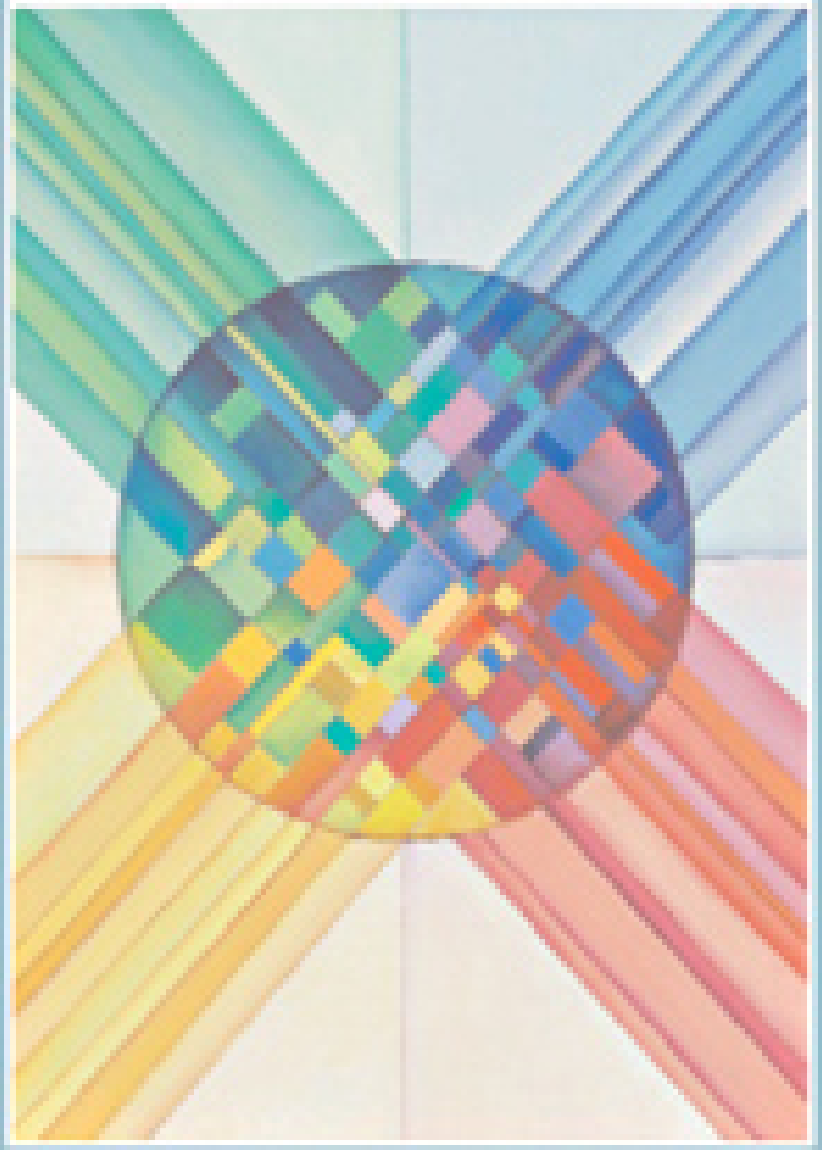
CAMBRIDGE STUDIES ON CHILD AND ADOLESCENT HEALTH



SOCIOEMOTIONAL DEVELOPMENT AND HEALTH FROM ADOLESCENCE TO ADULTHOOD

Edited by LEA PULKKINEN, JAAKKO KAPRIO, and RICHARD J. ROSE

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Socioemotional Development and Health From Adolescence to Adulthood

This book is based on two longitudinal studies of behavior development, both conducted in Finland, a living laboratory setting for longitudinal research. Much of the book reports results from a longitudinal study begun in Jyväskylä, Finland, in 1968, when its participants were schoolchildren. This study is complemented by two Finnish twin-family studies to yield insights into genetic and environmental sources of variation in early development and later outcomes. Findings from the two sets of longitudinal studies are presented, set within a theoretical framework of socioemotional development, and focused on predictors of health-related outcomes from childhood to early adulthood.

Lea Pulkkinen is Professor of Psychology at the University of Jyväskylä in Finland. She was the Director of the Program on Human Development and Its Risk Factors, approved as the Finnish Centre of Excellence from 1997 to 2005, and President of the International Society for the Study of Behavioural Development (ISSBD) from 1991 to 1996. She has conducted an ongoing longitudinal study since 1968 and has collaborated in the twin study since 1991. She has more than 350 original publications. She has served on a number of national committees and has contributed to the reform of the Finnish school system from the point of view of children's socioemotional development. She received the Finnish Science Award in 2001, the Aristotle Prize from the European Federation of Psychologists' Associations (EFPA), and the Distinguished Scientific Contributions to Child Development Award from the Society for Research in Child Development (SRCD) in the United States in 2005.

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Richard J. Rose is Professor of Psychology and Medical Genetics at Indiana University. He was a founding member of the Behavior Genetics Association and has served as its president. He has been the Principal Investigator on NIH grant awards for the two *FinnTwin* studies. He has been a Senior Fellow of the Fogarty International Foundation of NIH and has received a NATO Traveling Scholar Award and a Senior Research Fellowship from the NIH. His most recent research grant, awarded for continuation of *FinnTwin* research, was converted to a MERIT award.

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Preface

Early chapters of this jointly edited and multi-authored book review the history, design, and rationale of two ongoing longitudinal research programs conducted in Finland; subsequent chapters present a diverse set of empirical findings from the two sets of studies. Those results aim to offer an integrated perspective of continuities in behavior from childhood into adulthood via analyses of individual and familial predictors of adult outcomes, with emphasis placed on health-related longitudinal findings.

The first of the two research efforts began as a cross-sectional study of 8-year-old Finnish schoolchildren; designed and conducted by Pulkkinen as her doctoral dissertation and completed in 1969, the dissertation study evolved into the Jyväskylä Longitudinal Study of Personality and Social Development (JYLS). Now that the original study participants have aged into mid-life, their children are enrolled in ongoing study protocols. The first of the two *FinnTwin* studies, reflecting six years of earlier collaboration between Rose and Kaprio, began baseline data collection in 1990 as consecutive birth cohorts of participant twins reached age 16; a second, more ambitious *FinnTwin* study, for which Pulkkinen joined Rose and Kaprio as a co-investigator, began baseline assessment of twins at ages 11–12 in 1994. That study adapted assessments from the JYLS for use with twin children to yield genetically informative information on socio-emotional behavior in childhood as a complement to results obtained decades earlier on participants in the JYLS.

Over the years, the research collaboration of Pulkkinen, Kaprio, and Rose led them to frequent interactions in Finland, in Indiana, and at international meetings on different continents. Close friendships were forged. The common aims and shared assessments of the JYLS and *FinnTwin12* studies fostered parallel analyses of the two data sets. And graduate students at Indiana University, the University of Helsinki, and the University of Jyväskylä used data from the two projects for their dissertations; increasingly, these students began to interact with one another to form a second generation of research collaborators from Finland and the United States. These several forces led to the idea for this jointly edited book when Professor Klaus Hurrelmann, Chief Editor of the series "Cambridge Studies on Child and Adolescent Health" with Cambridge University Press, extended an invitation to Pulkkinen to edit a volume for this series. She, in turn, asked Kaprio and Rose, along with colleagues and doctoral students working on the two projects, to join her.

The origins of our research collaborations merit mention. Rose and Kaprio first met in 1977 at the Second International Congress on Twin Studies. In 1984, Rose first visited Helsinki, returning as a Senior Research Fellow of the Fogarty International Center of NIH for the calendar year 1986. During that year, detailed plans were developed for ascertaining cohorts of younger twins for new studies in developmental behavior genetics, and those plans were realized as *FinnTwin16* (*FT16*) began in 1990. Once *FT16* was under way, plans were formulated for a more ambitious longitudinal twin-family study, to begin with baseline assessments in mid-childhood, rather than mid-adolescence. But success for such a study required the addition of a Finnish co-investigator with expertise in assessment tools for children's development. Neither Rose nor Kaprio had met Pulkkinen. Neither had ever visited the University of Jyväskylä. But Rose had read of Pulkkinen's longitudinal study and of the peer nomination instrument she had developed for it. So in 1991, he traveled to Jyväskylä, in central Finland, introduced himself, and explored prospects for three-way collaboration; he was well received.

The collaboration has been a synergistic and mutually rewarding one. Our training and expertise complement one another: Pulkkinen is a developmental psychologist with expertise in longitudinal study to which she has dedicated her professional life; Kaprio, trained in

medicine and public health, is a genetic epidemiologist whose earlier interests focused on risk factors for coronary heart disease; Rose was trained as a clinical psychologist who specialized in behavior genetics just as that interdisciplinary field emerged. For reasons that this book will make clear, Finland is an ideal setting in which to conduct longitudinal and twin-family research. Arguably, the nearly four-decade duration and minimal attrition of the Jyväskylä Longitudinal Study of Personality and Social Development and the exhaustive ascertainment and very high participation rates obtained from twins and their parents in the two *FinnTwin* studies could not be achieved in any other setting.

The other multidisciplinary authors of the present book are some of the editors' collaborators and students who were invited to contribute to the book on the basis of their interests in socioemotional development and health. They represent diverse training backgrounds and form a rich network of relationships. Collaborating with Kaprio at the University of Helsinki in the *FinnTwin* projects are two scientists first trained in medicine: Kirsi Pietiläinen and Aila Rissanen; they are joined by Karri Silventoinen, a postdoctoral Fellow trained in demography, and Eero Lahelma, a medical sociologist. Pietiläinen and Silventoinen completed their doctoral studies under Kaprio's supervision at the University of Helsinki. Two contributors to this work, Danielle M. Dick and Brian Mustanski, completed their doctoral studies in psychology at Indiana University, with supervision by Rose, and both continue to collaborate with him in analyses of *FinnTwin* data. Some authors have completed their doctoral studies under the supervision of Pulkkinen at the University of Jyväskylä and are among her collaborators in the JYLS. These include Helena Hurme, Petri Juujärvi, Marja-Liisa Kinnunen (who was first trained in medicine), Katja Kokko, Marja Kokkonen, Riitta-Leena Metsäpelto, and Kaisa Aunola (shared supervision). Another, Elina Vierikko, worked with data from the twin study. Doctoral students in psychology at the University of Jyväskylä using the JYLS data for their dissertations are Päivi Fadjukoff, Anne Mäkikangas, Tuuli Pitkänen, and Johanna Rantanen; Satu Barman is using the twin data. Ulla Kinnunen, Ph.D., participated in the JYLS in 1979 while preparing her master's thesis. She and Taru Feldt, Ph.D., are specialists in work psychology and have been Pulkkinen's collaborators in the JYLS in

recent years. Mika Kivimäki, Ph.D., and his co-authors Marianne Virtanen, Marko Elovainio, and Jussi Vahtera, are specialists in health psychology; they have processed JYLS data in their comparative studies.

We gratefully acknowledge the continuing interest and participation of the subjects in our research programs; all have taken part for years, and some have done so over decades. Their interest and dedication make our research a source of continuing joy and satisfaction. We also wish to acknowledge the sources of research support that have made our studies possible: the Academy of Finland and the project "Human Development and Its Risk Factors" (Finnish Centre of Excellence Programme, 1997–1999, 2000–2005; Grant 44858), the USA National Institute on Alcohol Abuse and Alcoholism (Grants R01-AA09203, R01-AA08315, R37-AA12502, and K05-AA00145), the Academy of Finland (Grants 42044, 44069, and 100499), the University of Jyväskylä, the Finnish Foundation for Alcohol Studies, the Finnish Ministry of Health and Social Welfare, and the Yrjö Jahnsson Foundation. Anja Niininen, Secretary to Pulkkinen, earned our deep gratitude for her patient and skillful assistance throughout the editorial process.

June 2005

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Introduction

Richard J. Rose

TWO COMPLEMENTARY FINNISH RESEARCH STUDIES

This book celebrates two sets of ongoing longitudinal research studies conducted in Finland. In the 16 chapters that follow, the principal investigators of the Finnish longitudinal studies introduce their research designs, and 25 of their collaborators selectively review recent research results from these studies. Reports from the Jyväskylä Longitudinal Study of Personality and Social Development (JYLS), now in its 38th year and with accumulated observations on its participants from mid-childhood to mid-adulthood, make up much of the book. The JYLS reports are presented in the context of emerging theory and prospective data relating childhood assessments of socioemotional behavior to educational, occupational, and social success, and to physical and psychological health at later follow-up. The rich multi-occasion, multilevel longitudinal data of the JYLS are related to social, educational, and occupational outcomes, and to self-esteem, health, and well-being. Research publications from the Jyväskylä Longitudinal Study have importantly contributed to our conceptual understanding of the role of emotional and behavioral regulation and self-control in life-span development, and the reports contained in this volume update empirical results from the study and extend its conceptual contributions.

Reports from two longitudinal studies of families of young Finnish twins, now in their 15th year of data collection, make up the balance of

this volume. Each of the two *FinnTwin* studies sequentially enrolled twins over 60-month periods of baseline data collection to achieve age-matching across five consecutive twin birth cohorts; each was designed to address environmental as well as genetic influences on children's development. The younger *FinnTwin* study yoked classmate controls to selected twin pairs to distinguish school and neighborhood effects from those arising within families, and that study directly adapted school-based assessments first used in the JYLS for application to families of twin children. Accordingly, reports from the *FinnTwin* studies complement JYLS findings with genetically informed analyses of individual, familial, and extra-familial predictors of developmental outcomes from early adolescence into early adulthood. Applications of the *FinnTwin* studies to substance use, pubertal development, eating disorders, and gender differences in socioemotional behavior are reviewed in chapters that follow.

The JYLS and the *FinnTwin* studies illustrate the central features of a true longitudinal research design. Baseline assessments were completed on selected samples of children when all children in each studied sample were of the same age; the same subjects were then repeatedly assessed again and again across developmental periods from childhood onward. In their research design, both the JYLS and *FinnTwin* research share features of many similar studies completed, or ongoing, throughout the world. But JYLS and *FinnTwin* are uniquely conducted in Finland, each having selected its research subjects from members of Finnish families residing in that small country. So it is appropriate that this introduction offer a capsule portrait of Finland as a research setting for the kinds of longitudinal research here described. And it is appropriate, as well, to consider the unique strengths and challenges of longitudinal research designs, of twin study comparisons, and of longitudinal research that samples families of twins, in efforts to understand the causes and developmental consequences of individual differences in children's patterns of socioemotional behavior.

Accordingly, this introductory chapter addresses three sets of questions: *Why longitudinal research? Why twin-family research? Why Finland?*

Traditional research in developmental and health psychology relied on a cross-sectional research design, selecting a single subject

from each of a sample of unrelated families and making observations on each subject on a single occasion. In typical cross-sectional research, the studied sample of subjects varied in age, family history and family circumstance, and many other unmeasured (and perhaps unknown) between-family differences. For decades, such cross-sectional research designs and the correlational analysis of their data formed the evidential basis of developmental, personality, and health psychology. The designs featured in this volume – longitudinal study of the same individuals across decades of their lives, and the ambitious complication introduced by sampling twins rather than singleton subjects for longitudinal study – place many more demands on researchers' time and resources. Are they worth it? In what unique ways does longitudinal research address questions of socioemotional development and health? How does sampling twins and their families enrich that understanding? And what advantages does the country of Finland offer to those who pursue longitudinal and twin-family research?

WHY LONGITUDINAL RESEARCH?

Information Unique to Longitudinal Study

What unique information does a longitudinal study design add to traditional cross-sectional research? Two answers are immediate and instructive: Longitudinal study of a representative group of persons uniquely provides information on consistency and change in their social behavior, on the stability of their behavioral individuality across time and circumstance. It is the only research design that can inform us as to whether individual differences in children's social behavior – readily evident to the children's parents, teachers, and classmate peers – remain consistent across the children's life spans. How much of the individuality that we observe in children's early lives is preserved into their adolescence and adulthood? It is the stability of individual differences from age to age, the preservation of rank-ordered differences in salient dimensions of socioemotional behavior, that longitudinal research uniquely addresses.

In seeking to map the consistency of individual behavior patterns across time, longitudinal research parallels the psychology of

everyday life, the psychology each of us engages in as we monitor the behavior of our friends and neighbors, pleased when we anticipate their actions ("I knew you were going to say that!") and surprised when their behavior upsets our anticipations ("What's gotten into you today?"). For such reasons, tracking the trajectories of individual lives through longitudinal study has been called "the backbone for behavioral study" (Cairns & Cairns, 1994). And we learn something more, something crucial for prevention and intervention: Longitudinal study of behavioral differences observed in early childhood uniquely tests the predictive value of those behavioral differences for developmental outcomes in adolescence and adulthood – outcomes as diverse as education and employment, marriage and parenting, health habits and disease outcomes.

Are there important developmental consequences for children who exhibit frequent "explosive" behaviors during childhood? Do the frequent and intense temper tantrums of a child navigating his "terrible two's" predict social consequences significantly different from those of nonirritable age-mates when the two sets of children are compared decades later in life? In the question plainly asked by one longitudinal research team (Caspi, Elder, & Bem, 1987): "Do ill-tempered boys become ill-tempered men?" Nothing short of longitudinal research, conducted across many years, can address such questions, documenting whether profiles of childhood behaviors predict social outcomes decades later in the developmental unfolding of individual lives.

Longitudinal research assesses persons as well as discrete behaviors across situations and over time. In an important sense, every longitudinal study is a set of separate individual studies, the set of unfolding life stories of every individual participant under study. Longitudinal study of individual lives has confirmed the everyday observation that some persons are more stable over time and situation than are others; some children and adults are quite consistently predictable from their personality dispositions, but others less so. Some children are resilient to highly stressful environmental circumstance; others are highly vulnerable to it. And within each of us, some behavioral domains are more pliable and sensitive to environmental modification than others. Some behaviors exhibit greater age-to-age stability at certain developmental stages of life than at others, and greater

consistency and more pronounced preservation of ordered individual differences may be found for certain behaviors in one sex than the other at a given developmental stage.

In this brief introduction, we consider only the more general question: Does behavioral observation of children identify robust early precursors of adult outcomes? Do early personality dispositions significantly affect trajectories of the adult life course? Results from a number of celebrated longitudinal research studies that have spanned the lives of their research participants address such questions. To illustrate, and to create a context for exploring mechanisms for age-to-age continuity of behavior, a summary of just one set of analyses of one childhood behavior pattern in longitudinal data from one study will suffice.

An Illustration: The Berkeley Growth Study

The Berkeley Study began in 1928–29, when, for an 18-month period, every third newborn in the city of Berkeley, California, was enrolled in an observational study. The sample included 214 children, mostly from White, Protestant, native-born, middle-class families, and about 90% of these boys and girls were followed up into mid-adulthood. Results allow us to relate individual behavioral differences in childhood, revealed in structured assessments based on interviews with the children's mothers, with adult outcomes, assessed from two sets of interviews with the subjects themselves at ages 30 and 40.

As all parents of more than one child know, a salient dimension of behavioral variation in childhood is the frequency and intensity of temper tantrums. At annual intervals when the Berkeley study participants were ages 8, 9, and 10, their mothers were interviewed, and from the interviews a simple 5-point scaling was made of the severity of temper tantrums and their frequency (which across the studied children, ranged from one a month to several per day). From that scaling, 38% of all boys in the sample were classified as having had a history of childhood temper tantrums.

How did they turn out as adults? The question goes beyond asking whether ill-tempered boys grow up to become ill-tempered men; it is a question of whether and how they differ in transitioning into adult roles, in the education levels they achieved, in the employment

positions they held, in their patterns of job security and social stability, and in their histories of marriage and parenthood. Analyses of the Berkeley data (Caspi et al., 1987) confirm the significant association of an ill-tempered childhood with adult outcomes. Two decades later, ill-tempered boys were judged (from their interviews) to be more irritable and less controlled than their even-tempered peers in the sample. Their life histories revealed a progressive deterioration of their socioeconomic status, and their childhood tantrums were as predictive of their adult occupational status as was their fathers' social class. The downward drift in social status of men with a childhood history of tantrums was dramatic: More than half experienced downward mobility, nearly twice the proportion found among their even-tempered middle-class peers. Their job histories were erratic, and the association of childhood tantrums with job status remained significant after adjustment for the men's class origin, education, and adolescent IQ. Finally, more than half of these men had experienced divorce, twice the rate of their even-tempered peers.

And what of ill-tempered girls? From their childhood data, 29% of the girls in the Berkeley sample were identified with a history of childhood tantrums. And, as for men, that childhood history was associated with socially important adult outcomes. Traced through the occupational status of their husbands, a significant effect of childhood tantrums on the women's status was evident: "they fared less well than their even-tempered peers in the marriage market" (Caspi et al., 1987), and that association remained significant after controlling for their class origin, education, and adolescent IQ. And again like ill-tempered men, these women were more than twice as likely to have experienced divorce by mid-life. Perhaps most significantly, given role expectations for this cohort born in the 1920s, ill-tempered women became ill-tempered mothers. Both their husbands and their children perceived their parenting to be less adequate, less controlled, less even-tempered.

Mechanisms of Continuity

The evidence is that men and women with a history of temper tantrums in late childhood show significant continuities in their

explosive behavior patterns. Compared to their even-tempered peers, they experience significant problems in their adult life roles. But *why* should this be so? How can we understand continuity across time and situation in the expression of what is, quite clearly, maladaptive behavior? If behavior is maintained by its social consequences, as psychologists have long thought true, how explain the continued expression of ill-tempered action patterns across the life span? The question has prompted (if not required) developmental scientists to adopt a perspective of people as active agents who select their own environments, matching their dispositional behaviors to social situations that will foster their expression.

The metaphor that development is a passive process, a mechanical mirroring of one's experience, is rejected, replaced by the concept of a continuous, lifelong process of person-environment interaction. People select environments that offer opportunities for expression of their behavioral dispositions; the selected environments then reinforce, sustain, and enhance those initial dispositions. Over time, an ancient proverb is realized: "As a man grows older, he becomes more like himself." Early personality dispositions, evident in the temperamental dimensions of childhood behavior, get strengthened across development, because each of us selects experiences that provide opportunity for our dispositions to find expression and, in the environments we so select, behaviors we express receive reinforcement. This idea, with nuances in details of its description, emerged during the 1980s from different investigators.

Longitudinal researchers (Caspi, Elder, & Bem, 1987, 1988) suggested the idea of *cumulative continuity* to describe the process in which behaviors "channel" selection of environments in which those behaviors can be "sustained" by the "progressive accumulation of their own consequences." Among personality/social psychologists, research on the construct of *self-monitoring* (Snyder, 1983) led to a focus on "the influence of individuals on situations" and the processes by which "individuals plan and enact their behavioral choices in social contexts." And at the same time, behavior geneticists had distinguished different types of gene-environment interactions and correlations, suggesting that "genes direct the course of human experience," and advancing arguments that most behavioral differences between people arise from "genetically determined differences in

the experiences to which they are attracted" and from the different experiences their genetic differences "evoke from their environments" (Scarr & McCartney, 1983).

However described, this notion that our genetic differences shape differences in our experience is important to this Introduction because it ties the longitudinal research data of the JYLS, which abundantly document continuities of behavior from childhood to mid-adulthood, with analyses from the *FinnTwin* studies that document gene by environment interactions and correlations. In Chapter 2, we will revisit this notion that people create the environments in which they live their lives.

Externalizing Childhood Behavior and Its Consequences

Childhood temper tantrums are one aspect of aggression, a core feature of a pattern now conceptualized as externalizing behavior (Chapters 1 and 8). Age-to-age continuity of externalizing behavior has been demonstrated in many longitudinal studies in many different cultures, satisfying the acid test for longitudinal analyses. And that test is met, as well, in the predictive association between externalizing behavior patterns in early childhood and earlier onset of alcohol use in adolescence and its more rapid acceleration to alcohol abuse by early adulthood. Robust cross-cultural confirmations (in Sweden, Canada, New Zealand, Denmark, and the United States) document that a childhood history of externalizing behavior, identified in ratings by classroom teachers and classmate peers, distinguish those more likely to abuse alcohol by late adolescence; these longitudinal findings are fundamental evidence for a developmental genetic perspective of alcohol abuse (Rose, 1998). And that association was confirmed in Finnish culture, as well, in the longitudinal data from the Jyväskylä Longitudinal Study of Personality and Social Development (JYLS) (Pulkkinen & Pitkänen, 1994).

A Long-Term Longitudinal Study of Development, the JYLS

Those who have engaged themselves in longitudinal research have noted that, by its very nature, it leads to an inextricable overlapping of

the lives of the researchers with those of their subjects. Longitudinal research creates the powerful paradox in which the project investigators and their participants "travel together through space and time," a long-term endeavor that "demands as large a slice of the lives of the investigators as of the participants" (Cairns & Cairns, 1994). And so it is with Lea Pulkkinen and the JYLS study, jointly tracking the development of those first studied when they were 8-year-old students in a dozen second-grade classes in Central Finland. Of this remarkable study, I recently noted:

> It's quite a story. A behavioral scientist in a small, somewhat isolated nation completes a dissertation for her doctorate in psychology, obtaining behavioral ratings from teachers and peers on a cohort of 8-year-old school children in classrooms in and around the university town in which she trained. The life development of the participant subjects in the dissertation consumes her professional life, and, working mostly alone and with limited research support, she regularly restudies them as they, and she with them, move through life. (Rose, 2004)

The JYLS, like many other longitudinal studies, began as a cross-sectional investigation, planned as no more than a dissertation project, a one-time study. Only after initial baseline assessments were completed were plans made for a follow-up. And one follow-up led to another. Results of those follow-up assessments, from age 8 into mid-adulthood, are reported in chapters to follow in Parts III and IV. A key feature of the JYLS, underlying its importance today, was the inclusion of multi-informant measures, including those of classmate peers, at the age 8 baseline and again at first follow-up at age 14. These rich childhood assessments led to the conceptual theory that the JYLS data fostered, or perhaps, required (Chapter 1); now, nearly four decades later, the peer assessment instrument derived from the JYLS offers evidence that assessments by classmates carry information that is more predictive of some later outcomes than are the assessments from either children's teachers or their parents (Pagan et al., 2005). From its beginning, the JYLS has focused on the role of emotion regulation in behavior development, and that focus has ensured the relevance of the study's conceptual framework across nearly four decades of change in the zeitgeist of developmental psychology.

WHY TWIN RESEARCH?

The Rationale for Twin Studies

Consider now the second question posed for this essay: What unique information do samples of families of twins add to samples of singletons from unrelated families? Simply stated: *Why twin studies?* The central rationale for conducting research with samples of twins is to identify the genetic and environmental sources of interindividual differences in behavior, to estimate their magnitudes, and to assess correlations and interactions of genetic and environmental influences on behavioral variation. Twin studies thus address fundamental questions of developmental psychology: How and why do people differ in developmental outcomes? Why do children growing up together in the same household show both similarities and differences in their behavior development and adult outcome? How much do children resemble their parents? And why do children differ from the parents who raised them?

To address these kinds of questions, we must sample families rather than individuals, and, depending on the question of interest, we may study data from several different informative comparisons. We can compare persons who differ in their genetic relatedness but who grow up together sharing their experiences into late adolescence – for example, comparing pairs of identical twins who share all their genes identical-by-descent with fraternal twin pairs (and perhaps non-twin siblings) who share, on average, one-half of the segregating genes transmitted by their parents. Or we might focus on the effects of neighborhood and school experience in creating similarities among children, matching pairs of unrelated classmates to pairs of identical and fraternal twins in their classes to create double dyads in which the different dyads share none, half, or all their genes; some dyads, but not others, also share a family household; and each member of every double dyad has grown up in the same neighborhood, attends the same school, and studies in the same classroom. Or we might identify sets of married identical twins to assess the similarities of each to their spouse, and that of each twin to the spouse of the other twin, asking whether (and to what magnitude for which behaviors) genetic factors influence spouse selection. Or we might study

children born to identical co-twins, because these children are genetic half-siblings who are reared as cousins in separate households. Many different research designs have been developed for behavior genetic studies, but for what follows, the most relevant research design is the traditional comparison of child and adolescent twin pairs. Details of design and analyses of twin research are sketched in Chapter 2, detailed in Chapter 3, and illustrated in applications of twin research in Part II and Chapter 8.

For this introductory illustration, we again consider patterns of childhood aggressive, oppositional, and disruptive behavior, now asking what we can learn from a twin study comparison. These behaviors, assessed by parents, teachers, research observers, and the children themselves, were studied in a sample of 1,116 pairs of 5-year-old twins born in England and Wales (Arseneault et al., 2003). The sample was selected to enrich the prevalence of these behaviors by over-sampling families in which the twins' mothers first gave birth at 15 to 20 years of age. Easily and reliably measured, a mother's youthful age at first childbearing is a documented risk factor for her children's problem behavior – reflecting either differences in child-rearing environments offered by teenaged mothers to those provided by older mothers, or prenatal factors and genetic differences associated with teenaged pregnancy, or both. The enriched risk sampling scheme was successful: a substantial proportion of these 5-year-olds, more than in a random sample, exhibited disruptive behavior, and, at age 5, over 8% of them met diagnostic criteria for conduct disorder. Agreement across the four sets of assessments was high, suggesting that the children's antisocial actions were pervasive across settings, and not situation specific. This kind of antisocial behavior, pervasive across different settings and reliably identified by different informants, was strongly influenced by genetic factors, which were estimated to account for >80% of the variation in antisocial behavior across the children in the large sample; residual variation specific to one informant was influenced by underlying genetic differences between children, as well, although clearly less so.

The major findings from this recent study from Britain replicate earlier reports from the United States, the Netherlands, and Canada in which even younger twins, ages 19 to 36 months, were studied. The inference to be drawn is that children's genetic differences

significantly contribute to observed differences in the frequency and intensity of their aggressive, antisocial behavior across situations. Replicated evidence across different cultures and at different developmental stages of early childhood makes the inference a confident one.

Longitudinal Twin Research

Do genetic influences contribute to age-to-age continuity of aggressive behaviors in children? A longitudinal twin study can address that question. If aggressive behavior is studied in a sample of twins on two occasions, we can assess the contribution of genetic factors to the continuity of individual differences in aggression over time. Details of these kinds of longitudinal twin analyses are described in Chapter 3 and illustrated in Part II. Longitudinal twin data allow us to obtain the cross-twin, cross-occasion correlations, in which, for this example, a twin's measured aggression at baseline is correlated with that of his or her co-twin at follow-up (and vice versa); comparisons of the cross-twin, cross-occasion correlations from pairs of identical and fraternal twins yield an estimate of the genetic contribution to age-to-age continuity. In one such study, a sample of more than 1,000 Swedish twin pairs (Eley, Lichtenstein, & Moffitt, 2003) was assessed with parental ratings from mid-childhood (age 8–9) to mid-adolescence (age 13–14). The major findings were that aggressive antisocial behavior was influenced by both genes and shared environments in early adolescence, but its continuity from childhood to adolescence was largely mediated by the continuity of genetic influences across the two ages of assessment. Thus, the age-to-age consistency of aggressive antisocial behavior from childhood into adolescence is, in part, and perhaps in large part, to be understood by significant genetic influences on these behaviors throughout this developmental period and their continuous influence from ages 8–9 to 13–14.

Studying Twins to Identify Environmental Effects

These two studies, one of 5-year-old twins in Britain and the other a longitudinal study of Swedish twin children at ages 8–9 and again at 13–14, illustrate the traditional, basic purpose for conducting twin

studies: to document the influence of genetic factors, setting the stage for efforts to identify gene-behavior pathways. But twin studies serve purposes other than this primary one of estimating, and ultimately identifying, genetic effects on behavior. Sampling twin pairs, rather than unrelated singleton subjects, can be extremely helpful in identifying sources of environmental influences as well. We illustrate with several examples in Chapter 2, but, for this introduction, consider a study of twin pairs in which the two co-twins differ in some important way, such as their birth weight. Their study enables us to make tests *within families* of the associations observed in unrelated singleton subjects, *between families,* to rule out between-family differences (e.g., familial structure, status, and social class, a child's neighborhood and public school) to more incisively confirm causal relationships between a putative causal factor (in this case, birth weight) and a developmental outcome. The uncertain meaning of between-family associations is a pervasive problem for a developmental psychology based on naturalistic observation; observations reveal associations between variables of great interest, but how to interpret these associations? Twins offer an incisive tool for attempting to replicate between-family associations in within-family comparisons.

Replicating Between-Family Associations in Within-Family Comparisons

Does low birth weight increase a child's risk for later developmental problems? There is accumulating evidence that nonoptimal fetal growth, indexed by low birth weight among full term newborns, is predictive of increased likelihood of adult cardiovascular disease and other syndromes (Barker, 1995). And there is some evidence as well that low birth weight elevates risk for childhood behavioral problems (Botting, Powls, Cooke, & Marlow, 1997). These associations fostered the *fetal origins hypothesis* (Lamblak & Rosebloom, 2001) that reduced fetal development programs later disorder, because the fetus, adapting to reduced nutrients, alters its physiology and metabolism. If the hypothesis is correct, the association between reduced fetal growth and later disease or behavior problems arises from persistent metabolic adaptations to growth retardation during late gestation. *But the evidence*, of course, *is only an association*, and, as always, the

association of two variables might be due to effects of a third – in this case, any of many variables that correlate both with low birth weight and later risk for medical and behavioral problems, such as a mother's marital and socioeconomic status, her age, medical care, and living circumstances. Is low birth weight a direct *causal* risk factor for children's problem behavior, or is the association driven by common genetic and environmental risk factors that contribute *both* to reduced birth weight *and* later childhood behavioral problems?

Suppose we test the association *within families*, in weight-discordant twin siblings, rather than between families, among unrelated individuals (Dick, Johnson, Viken, & Rose, 2000). Sibling comparisons eliminate systematic between-family differences, and comparisons of genetically identical twin pairs, which in this case are co-twins extremely discordant for birth weight, compare siblings of a common pregnancy, matched for age and gender and controlling for all genetic differences as well. In one such test (von Os et al., 2001), 745 pairs of Belgian twins were followed longitudinally to age 10; their birth weights had been recorded immediately following delivery and standardized behavioral ratings were made of each pair of twins by their parents as they reached age 10. Results were unambiguous: lower birth weight was a continuous risk factor for problem behavior, and that association was confirmed in within-pair comparisons of weight-discordant co-twins. Greater within-pair weight differences were associated with greater within-pair discordance for problem behavior 10 years later. Most convincingly, the birth weight–problem behavior association remained significant in an analysis restricted to the 324 pairs of genetically identical twins in the Belgian sample. The within-family comparisons of weight-discordant co-twins illustrate a replication of a between-family association in within-sibling comparisons, suggesting that the association of low birth weight with childhood behavior problems is not due to a third variable confound (whether of genetic or familial-environmental origin).

Many analyses conducted on data from the ongoing *FinnTwin* studies have first considered the twins as individuals, to establish associations between variables, and then, having identified co-twins discordant for a variable of interest, perform within-family tests of the association among these discordant co-twins. Thus, the association

of elevated testosterone levels with early alcohol use was tested in 14-year-old boys from *FinnTwin12* (Eriksson, Kaprio, Pulkkinen, & Rose, 2005), first among all boys as individuals (with statistical correction for their twin relatedness), and then within co-twins who were most discordant for testosterone level. Similar tests made of the association between differences in age at menarche and patterns of early substance use among twin girls from the *FinnTwin* studies are reviewed in Chapter 5.

Finnish Twin Studies

Laboratory research studies of Finnish twin children were conducted nearly seven decades ago (Lehtovaara, 1938), and epidemiological research with families has a rich tradition in Finland, exemplified in the 30-year North Karelia Project on coronary heart disease. In common with other Nordic countries, Finland has, since the early 17th century, maintained nationwide registration of births, marriages, and deaths through parish church records. In 1956, the Finnish Foundation for Alcohol Studies appointed a research team to plan a twin study of genetic influences on alcohol use, and using nationwide registry records maintained by church parishes, the team identified all twin brothers born in Finland from 1920 to 1929. The resulting study, *Inheritance of Drinking Behavior* (Partanen, Bruun, & Markkanen, 1966) remains a classic contribution to the field. Finland established a computerized and centralized Population Register Centre (PRC) in 1973 to record demographic data on all Finnish citizens. And in 1974, the Finnish Twin Cohort Studies were established, initially composed of all same-sex twin pairs born before 1958 and with both co-twins alive in 1967 (Kaprio, Sarna, Koskenvuo, & Rantasalo, 1978). A baseline questionnaire sent to these twins in 1975 yielded remarkably high response rates (approximately 90%), and similarly remarkable response rates have characterized all subsequent research with Finnish twins. During the mid-1980s, birth cohorts of younger Finnish twins were identified from the PRC (details in Chapter 3), and from sets of those younger birth cohorts, the two longitudinal *FinnTwin* studies were developed. Measurement tools developed for the JYLS decades earlier were adapted for use with families of twins in the design and implementation of the second study, *FinnTwin12*.

The initial formation of the Finnish Twin Cohort Studies followed a 1973 meeting on international collaborative twin studies, and questionnaire content for research with Finnish twins was, from its beginning, designed to permit pooling of data with twin research efforts from other countries. Now, with the development of a major collaboration called *GenomEUtwin* and data from approximately 800,000 twins largely drawn from countries of the European Union, the benefits of a standardized questionnaire protocol across cultures and languages will be fully realized.

FINLAND AS A RESEARCH SETTING FOR LONGITUDINAL RESEARCH

Consider now the third question posed for this introductory chapter: *Why Finland?* What advantages, if any, are there in conducting longitudinal research and longitudinal twin-family studies in this small Nordic country? A summary sketch of Finland as a research setting will set the stage for considering that question (*Pocket World in Figures, 2005 Edition*; Facts about Finnish Social Welfare and Health Care 2005: http://www.stakes.info/files/pdf/Raportit/Facts_2005.pdf; Statistics Finland: www.stat.fi/index_en.html).

History, Geography, and Demography

Finland is a young nation, an independent republic only since 1917. For more than a century preceding its independence, Finland was an autonomous Grand Duchy within the Russian Empire, and for centuries earlier, it had been part of the Kingdom of Sweden. Finland has a parliamentary form of government, with a president elected for a 6-year term. The current president, Tarja Halonen, is the nation's first female leader. Finland has been a member of the European Union since 1995 and adopted the euro as its currency in 2002.

The country occupies a large area for its population of 5.2 million, an average density of 17 persons per sq. km. Finland has undergone a recent and rapid transition from an agrarian society, dependent on agriculture and forestry, to emerge as a world leader in design and high-tech industry. Nearly a quarter of its current exports are in electrical and optical equipment. The dramatic success of companies

such as Nokia, a rubber boot and tire manufacturer that transformed itself into a world leader in design and production of cellular phones, illustrates the rapidity with which change has occurred in Finnish industry and commerce. Finnish corporations are well received in international markets, widely perceived to be competitive, open, and free of corruption. A 2003 index ranked nations according to their perceived corruption by business people, academics, and risk analysts; that index ranked Finland the least corrupt of all countries in the world. On a measure of innovation (assessing human resources skills, market incentive structures, and interactions between business and scientific sectors) Finland ranked third, trailing only the United States and Taiwan. And on an index of information and communications technology, Finland ranked second only to Iceland, slightly exceeding its other Nordic neighbors, as well as the United States.

Of Finland's total area, 10%, including 188,000 lakes, is water; only 6% of the land is under cultivation, and forests cover nearly 70% of the entire country. Finns show great care and concern for their environment. On an environmental sustainability index, based on 20 indicators including environmental systems and stresses, human vulnerability to environmental risks, institutional capacities on environmental issues, and shared resources, Finland ranked first among the countries in the world. An index of healthy cities, evaluating criteria such as waste removal, air pollution, clean drinking water, infectious disease, and hospital availability, ranked Finland's capital, Helsinki, third behind only Calgary, Canada, and Honolulu, Hawaii, in a 2003 ranking.

The unique Finnish language shares its roots with Hungarian and Estonian. The country is officially bilingual: 92% of all Finns speak Finnish, some 7% Swedish, but nearly all Finns are multilingual, and English is very widely spoken. Finland has had very modest immigration and emigration, and the ethnic composition of the Finnish people is very homogenous.

Contemporary Finns have a high median age (39.4), ranking the country sixth among all nations of the world for the year 2000. The country's age distribution reflects a demographic pyramid similar to that of many other industrial countries in which middle-aged groups predominate. Children under the age of 14 make up nearly 20% of Finland's population, and the proportion of its population over age

80 is high, ranking it 16th among all countries in that statistic, reflecting the health care coverage freely provided all Finnish citizens and consequent longevity of the Finnish population.

Just over half of Finland's population is in the labor force, and nearly 80% of women aged 25 to 54 are employed outside the home. Most women are engaged in full-time employment, even if they have young children at home; part-time work with reduced working hours for mothers, common in other Nordic countries, is relatively rare in Finland. The working week averages just under 40 hours. Finland's global competitiveness is remarkable for its small population. A ranking based on the ability of a country to achieve sustained high rates of gross domestic product growth and considering over 250 different criteria such as the openness of the economy, the role of the government, the development of financial markets, and the quality of the infrastructure placed Finland eighth among all countries. The business environment of Finland is exceeded only by that of Canada and the Netherlands in criteria that reflect opportunities for, and barriers to, the conduct of business. Nonetheless, the unemployment rate is high: 9.1% of the labor force was unemployed in 2002. Finland underwent severe economic pressure following the collapse of the former Soviet Union, when unemployment mushroomed above 20%; recovery has been steady, but unemployment remains an issue, so much so that many of the social and health challenges faced by the nation are rooted in the chronic unemployment of a small minority of its population.

Contemporary Finland is characterized by small households, with a density of only 2.2 persons per dwelling. The registered marriage rate is low and divorce is relatively high, reflecting the freedom enjoyed by Nordic adults and the very modest role that religion plays in the ordinary lives of Finnish citizens. Few Finns are regular churchgoers, although perhaps 80% are baptized at birth in the Lutheran Church and are nominal members of it. A small minority of Finns holds very conservative religious attitudes, and, as in other cultures, such conservative religious attitudes underlie regional variation in patterns of alcohol use (Winter, Karvonen, & Rose, 2002).

The percentage of newborns to married or cohabiting couples has declined in the last 15 years, and for the most recent year available, 87% of newborns were from a couple either married or cohabiting.

More than half of Finnish households are single-family; most others reside in apartment blocks. Most Finns (80%) reside in urban areas, and one-fifth of them live in the capital Helsinki area.

Services of the Finnish Welfare State

The Finnish social protection system is based on its constitution, which guarantees basic economic, social, and educational rights to all people resident in the country. The system is structured along the Nordic welfare model, seeking to apply the principle of universality, the right of everyone to social protection, to all citizens, regardless of their residence, status, profession, or economic position. Understandably, such a social protection system requires a very strong public sector with tax funding based on legislated rights of residents to equal treatment and, by any standard, a relatively high level of benefit. Services and income security are guided by legislation and funded mainly by taxation. Funding for basic services is provided primarily by municipalities, the local governmental units that manage distribution of health and educational benefits. The cost of living is high, consistent with other Nordic cultures.

Life expectancy is also high, 75-plus for men and 82 for women. Of Finland's total gross domestic product, 7% is allocated for health services. Adjusted for population size, the availability of hospital beds and practicing physicians places Finland favorably among all nations, and the availability and quality of medical care is reflected in the low rate of infant mortality, for which Finland, with its Nordic neighbors, Iceland and Sweden, ranks in the top five of all world countries.

Organized child care is an integral feature of modern Finnish society. Over half of Finnish children ages 1 to 6 are in municipal daycare centers; adding in those who are in private daycare facilities, nearly 60% of Finnish children under age 6 are in daycare. As a result of recent reforms, nearly all current 6-year-olds receive an academic year of kindergarten education before entering public schooling at age 7. The benefits of Finland's child care and early schooling are evident in the competitiveness of Finnish schoolchildren when compared to other European nations at age 15.

Finnish children enter their neighborhood comprehensive public school during the year they reach age seven. And for a half-century,

all Finnish schoolchildren have received free daily lunch at their school. Compulsory education continues through grade nine, the age Finns turn 16. Most Finnish adolescents then continue in secondary schooling for an additional three years: Nearly 3 in 4 Finnish adults, age 25 to 64, have completed upper secondary or tertiary education. And 1 in 3 Finns, the highest percentage among all EU countries, has a university or other tertiary qualification. College degrees are more commonly earned by Finnish women than men; completion of vocational training is more common among Finnish men. Dropouts from comprehensive school are rare, and the quality of the nationwide comprehensive education system is high.

The excellence of Finland's compulsory public education system and its nationwide uniformity is evident in the first report from the *P*rogramme for *I*nternational *S*tudent *A*ssessment (PISA), a comprehensive and rigorous international effort to compare educational skills in 15-year-olds drawn from the member countries of the Organization for Economic Cooperation and Development (OECD). Results (www.pisa.oecd.org) of the first PISA assessment, conducted in 2000 and released in 2001, focused on reading comprehension; in a 2-hour paper/pencil exam, it assessed student skills in retrieving, understanding, and interpreting information read not only in test samples of continuous prose but contained also in information presented in lists, graphs, and diagrams. Finnish students, a sample of nearly 5,000, were compared to some quarter-million students from 31 other countries. Reading comprehension of Finnish adolescents, particularly girls, was significantly better than that of all the other participating countries (the mean for Finnish adolescents was nearly a half international standard deviation above the OECD mean). And remarkably, that superior performance was evident across all Finnish schools included in the PISA sample: In contrast to most OECD countries, *between-school variation among Finnish students was* very modest – only *one-third of the OECD average* – and correspondingly, neither measured socioeconomic indices of individual students nor a composite socioeconomic index derived for their schools contributed much to between-school variance in PISA scores for Finnish adolescents.

PISA results show that Finland's public education system achieves a superior international standard of student achievement, and that it does so nationwide with negligible between-school variation. A

high standard of service to all Finnish children, regardless of family structure, status, or residential location, is evident not only in public education but also in preschool child care, delivery of health care within the comprehensive public school system, and in social services offered their parents. The homogeneity of educational opportunity and health care delivery make Finland an outstanding venue for studies of familial and genetic influences on behavior development. And there's other good news for scientists planning longitudinal research in the country.

Historical and Cultural Features of Finnish Society

Finland is an extraordinary living laboratory for behavioral and genetic research. With its Nordic neighbors, it offers unusual advantages for longitudinal studies. The Population Register Centre contains data on all Finnish citizens, with each individual given a unique personal identifying number (PIN) that, unlike the Social Security numbers in the United States, is not meaningless or arbitrary. The PIN for newborn Finns incorporates their date of birth and an alphanumeric linkage to their biological mother. The Population Register Centre contains a current residential address for all Finnish citizens as well as richly informative data on family structure, births, deaths, marriages, and divorces. As a result, it is possible, with appropriate permission from central authorities, to identify all multiple births in any or all birth years, link them to their first-degree relatives, locate them, and track them over time. Effectively, no one is every truly lost to follow-up, because the residential address and linkage to health and institutional outcome measures are always available for every Finn.

Finland's history and culture add other research advantages. Historically, the country was a linguistic and geographic isolate. As a consequence, with limited emigration and immigration, Finland for a long period was a closed society, and genes that are relatively rare in other populations may be more prevalent within Finland. For such reasons, Finland offers unique resources for genetic research.

Finland's citizens are highly literate and well informed about scientific and medical research. Finns have a long history of voluntary participation in epidemiological and medical research requests.

Compliance rates that are essentially unmatched elsewhere are typical in Finnish studies. Finally, Finland has a rich history of longitudinal study of population-defined cohorts. The research that has been the life work of Lea Pulkkinen, and which forms a major portion of the research described in this book, is a prime example. Participation rates of individuals in this study have remained high from age 8 into mid-life. Finland also has a history of twin study research, and with its Nordic neighbors, formed a population-based twin register at a time (1975) when the value of such a register was not widely appreciated.

Finland, in common with other population isolates, may have special advantages in genetic mapping for complex traits (Peltonen, Palotie, & Lange, 2000). Population isolates offer a number of advantages in efforts to map disease genes as these countries show significantly less genetic diversity than people as a whole. By definition, population isolates start with a small group of founders. Many isolates experience bottlenecks – a marked reduction in population size, alternating with periods of rapid growth. Famine, war, environmental disruption, and infectious disease epidemics create such population bottlenecks.

The history of Finland demonstrates a demographic history typical of many isolates. A small number of original founders, subsequent isolation, rapid expansion, and major bottlenecks combine to allow genetic drift to form the gene pool. The vast majority of present-day Finns descended from two immigration waves occurring roughly 4,000 and 2,000 years ago. And the country has a long-established nationwide system of population records, an important resource for genetic studies. Using these population records, deceased Finns can be traced to common ancestors, especially in the sub-isolates of the late settlement region.

For such reasons, Finland's demographic history has led to a unique catalog of genetic disease. At least 30 mostly recessive diseases are highly enriched in Finland, while others common elsewhere are almost nonexistent. The advantages of an isolate population include a higher prevalence for some diseases, a more uniform genetic background, excellent genealogical records, less migration, and, as described for Finland, a more uniform environment. That said, the promise of genetic isolates for complex gene mapping studies of

behavioral outcomes remains uncertain (Varilo & Peltonen, 2004), but other characteristics of Finnish culture, including the Population Register Centre, more uniform delivery of health service and education, and high interest and participation by Finns in research, offer clear advantages in efforts to understand continuities in behavior development and the developmental interplay of nature and nurture. Some results of those efforts are described in the chapters to follow.

AN OVERVIEW OF THE BOOK

This book offers a progress report on research findings from the JYLS and, to a lesser extent, the two *FinnTwin* studies. More of the book is devoted to results from the JYLS because it has been ongoing for a very long period of time, and, because its participants have been tracked from childhood into mid-adulthood, it has a much richer and more diverse set of follow-up results to report. By design, the two *FinnTwin* studies age-standardized initial assessments across consecutive birth cohorts so that all twins from each cohort were tested at similar ages. Doing so required 5 years to enroll twin families at baseline, so follow-up is yet limited and the studies focus largely on adolescence. But the *FinnTwin* studies overlap the JYLS in many of their aims, in key aspects of their longitudinal design and their multigeneration sampling, in the breadth of outcomes studied, and in some of the core assessments made by multiple observers of participant children. Common elements of the two sets of studies are highlighted in research reports in Part II, where data from the JYLS are integrated with parallel data from the twin samples.

In Part I, two chapters describe the history and rationale of the JYLS and the *FinnTwin* studies, while a third offers an overview of genetic and environmental influences in behavior development. Written by the three editors of the book, this part sets the stage for the diverse set of findings from the two sets of studies reported in the three parts that follow.

The four chapters in Part II illustrate applications of longitudinal data from both the JYLS and the two *FinnTwin* studies in research focused on adolescence, growth and puberty, health habits and substance use, and self-rated health. Early maturation is related to earlier onset of substance use in analyses conducted both between- and

within-families, and body mass index and attained height in early adulthood are associated with both familial and individual predictors from parent and child. Interactions of genetic and environmental factors in the initiation and trajectories of adolescent smoking and drinking are documented, and age-related modulation of genetic influences on self-rated health is evident in analyses of longitudinal *FinnTwin* data from adolescence into early adulthood. Jointly, these chapters underscore some fundamental findings from longitudinal research: that both continuities and discontinuities emerge across development, that effects from genes and environments are not static but continuously correlate and interact in dynamic fashion, and that both individual and familial factors are relevant in predicting outcomes from childhood into early adulthood.

In Part III, the components of socioemotional behavior, as assessed in both the JYLS and *FinnTwin12* (*FT12*), are introduced. Data from *FT12* are used to explore gender differences in mean levels and sources of variance in the three components of socioemotional behavior, and evidence of substantial gender differences, consistent with research reports from other cultures, is found. Emotion regulation is analyzed as both a process and an outcome. Childhood behaviors are shown to be associated with symptom reports, accidents, and poor health habits, and these associations persist into adulthood. The impact of parenting processes and family atmosphere on children's socioemotional behavior is evaluated with data from the JYLS. Links between parents' negative job-related affect, the quality of their parenting, and the psychological well-being of the affected children are reviewed. Parents' knowledge of their children's whereabouts and activities, an index of the quality of parent-child relationships, robustly associates with children's positive development. And taking family relationships a step further, the final chapter in Part III evaluates the significant supportive role grandparents can play in children's development: JYLS data suggest that reciprocity in social support across three generations can foster children's positive development.

The final chapters, comprising Part IV, carry the longitudinal story of the JYLS into mid-adulthood, with analyses of paths from the participants' childhood developmental background to their physical and psychological well-being in adulthood. The processes of identity

formation and constructs of sense of coherence and personal control are related to individual histories of employment, education, parenting, and psychological distress. Early school success is associated with identity achievement, which, in turn, facilitates positive outcomes. An important strength of the JYLS, evident in assessments made at the initial baseline, is its focus on positive outcomes. Concern with positive development as much as with behavior problems made constructs such as sense of coherence and optimism highly relevant; data from the JYLS suggest that sense of coherence and optimism are rooted in child-centered parenting, that such parenting fosters school success and predicts psychological well-being into mid-life. In other analyses here presented, JYLS data are used to study causes of long-term unemployment and its sequential effects. Externalizing problem behaviors in childhood predict truncated education, and not surprisingly, limited education is a risk factor for unemployment and downward social mobility. The book's final chapter offers a critical discussion of models relating psychosocial factors and well-being. Longitudinal data from the JYLS show that a lower level of emotion regulation in childhood is associated, directly or indirectly, with lowered well-being in adulthood, a finding that addresses a central theme of this book and illustrates the power of the longitudinal research designs on which it is based.

PART I

LONGITUDINAL AND BEHAVIORAL GENETIC APPROACHES

The three chapters in Part I offer a framework for the conceptual and empirical data presentations from the JYLS and the *FinnTwin* studies that follow in Parts II, III, and IV. Chapter 1 by Pulkkinen offers an integrated introduction to the history, design, and conceptual framework of the Jyväskylä Longitudinal Study of Personality and Social Development. The JYLS is a long-term study that Pulkkinen began as her doctoral dissertation completed in 1969. Created as a model of individual differences in children's socioemotional behavior, the conceptual framework of the JYLS evolved into a more general perspective of individual differences in emotion regulation. And the more modest goals of investigating associations between children's emotion regulation and their adjustment expanded into a major longitudinal study that has tracked trajectories of education and occupation, family, health, and social integration from mid-childhood into mid-adulthood. A strength of the study is that its childhood assessments of compliant, constructive behavior and self-control permit tracking positive developmental outcomes into adulthood, and the Jyväskylä data show that predictive factors for positive outcomes accumulate over development, an interesting and important complement to the process of cumulative continuity sketched in the Introduction for negative, maladaptive behaviors.

Chapter 2 by Rose reviews basic principles of gene-environment (g–e) interaction and correlation. People select many of the environments in which they live their lives (g–e correlation), and age-to-age

continuities in behavior are understood, in part, as consequences of active person-situation correlations. People differentially react to standardized environments (g–e interaction), and individual differences in susceptibility to environmental stress importantly contribute to differences in developmental outcomes. Twin study designs help disentangle confounds that inevitably arise in nuclear families when parents rear the children to whom they transmitted their genes, as illustrated in studies of children of twin parents discordant for divorce. Dispositions, not destinies, are inherited. It is in the interplay of nature and nurture, in the interactions and correlations of genes and environments, that developmental pathways to social behavior and health can be understood.

Chapter 3 by Kaprio offers a basic introduction to the analyses of twin data, coupled with a description of the development of the two ongoing *FinnTwin* studies, into which some 5,400 families of Finnish twins are enrolled. These are true longitudinal studies, using a 5-year sequential enrollment to age-standardized baseline measures across consecutive twin birth cohorts; jointly, the two *FinnTwin* studies permit robust analyses of the changing influence of genetic and familial-environmental effects of behavior from early adolescence into early adulthood. Many analyses of these data start with an epidemiological study of all participant twins as individuals, followed by a more focused and intensive study of selected twin pairs who are discordant for the behaviors of particular interest – that is, one twin of a pair exhibits the behavior whereas the other does not. Kaprio illustrates this two-phase approach by first identifying risk factors for eating disorders in analyses of all twins as individuals and then reporting an intensive study of twin sisters discordant for anorexic and/or bulimic symptoms.

1

The Jyväskylä Longitudinal Study of Personality and Social Development (JYLS)

Lea Pulkkinen

The Jyväskylä Longitudinal Study of Personality and Social Development is an ongoing long-term study that began in 1968. From the very beginning, data have been collected within a framework of emotional and behavioral regulation. This chapter presents the framework model and its theoretical rationales. Data collection waves are described, first, from childhood to adolescence, and second, in adulthood. Results on continuity in socioemotional behavior and its developmental background, problem behavior and health, and positive development are presented so as not to overlap with results in the other chapters of this book.

INTRODUCTION

The title of the Jyväskylä Longitudinal Study of Personality and Social Development (JYLS) specifies the concepts of personality and social development. One way to make a distinction between personality and social development is to limit the questions of personality structure, traits, and identity to the personality domain, and those of social relationships, role achievements, and dimensions of interpersonal behavior, such as prosocial and antisocial behavior, to the social domain. Personality development concerns the process of individuation for a unique personality, whereas social development concerns the process of socialization into a society. As noted by Masten and Coatsworth (1995), "Human individuals, as living organisms, must

maintain coherence and organization as a unit, while they interact with the environment, including other individuals, and also function as part of larger systems" (p. 715).

The major goal of the JYLS, when it began in 1968 as my doctoral dissertation study (Pitkänen, 1969), was to detect and conceptualize inter- and intraindividual differences in behavior motivated by negative emotions, such as anger and fear. A basic assumption was that individual differences in emotionality and impulse control contribute to differences in the quality of social behavior. The term *socioemotional* refers to the integral role of emotions and emotion regulation in socialization.

This chapter presents the framework model for inter- and intraindividual differences in children's socioemotional behavior, the confirmation of the model by empirical findings, and the description of the sample and data waves of the JYLS to give a comprehensive picture of the different stages of this study. The JYLS was, as were many other older longitudinal studies, originally a cross-sectional study, but it transitioned into a longitudinal study in which the same individuals have been studied from early school age to early middle age. The idea of a longitudinal study was presented in the discussion section of my dissertation (Pitkänen, 1969, p. 190).

SOCIOEMOTIONAL BEHAVIOR IN CHILDHOOD

From Impulse Control to Emotional and Behavioral Regulation

My findings in the 1960s concerning interindividual differences in aggressive behavior (Pitkänen, 1969: Part I) had shown that a small proportion of children behave aggressively in thwarting (frustrating, opposing, or foiling) situations; that notion recently was confirmed by Broidy et al. (2003) and the study of the NICHD Early Child Care Research Network (2004) with large and diverse samples. Most children react in social encounters in ways other than aggression. Nonaggressive behaviors were little studied in the 1960s when prosocial behavior had not yet become a focus of study. For outlining various behavioral alternatives – nonaggressive and aggressive – in a thwarting situation and their interdependencies, I developed a circumplex impulse control model with two main dimensions (Pitkänen, 1969:

Part II; Pulkkinen, 1982). The dimensions covered social reactivity and cognitive control of emotional behavior, and defined controlled and uncontrolled expression of impulses and controlled and uncontrolled inhibition of impulses.

In the 1990s, when the study of emotion regulation began to flourish, I relabeled the model a model of emotional and behavioral regulation (hereafter EMO). It integrates the views on impulse control in a thwarting stimulus situation into a more general view of individual differences in the regulation of emotions (Pulkkinen, 1995). Interaction with other individuals, social competence, and adjustment are affected by the frequency and intensity of individuals' typical emotional responding (Eisenberg, Fabes, Guthrie, & Reiser, 2002). Here, *emotion* refers to a mostly negative emotional state subject to control, and *emotion regulation* to the redirection, control, and modification of this state, which enables an individual to function adaptively. Emotion regulation is often achieved through effortful control of attention and through cognitive processes that affect the interpretation of the situation, as stated by Eisenberg et al. (2002) and Rothbart and Putnam (2002). The same ideas were included in the development of the framework model of the JYLS (Pitkänen, 1969; Pulkkinen, 1995).

The EMO model explicates that both socially active and passive behavior may be emotionally regulated or dysregulated, and that both low and high control of emotions may be manifested in an active or passive way. Two bipolar processes – neutralization or intensification of emotion, and activation or suppression of behavior – are suggested in the model to produce both intra- and interindividual variations in behavior. Emotion regulation helps maintain internal arousal within a manageable, performance-optimizing range, whereas behavioral regulation helps adjust reactions to external circumstances. It may also help to modulate negative emotions – anger and fear – toward friendliness or calmness (Pulkkinen, 2004). As noted by Eisenberg et al. (2002), emotion regulation and emotion-related behavioral regulation are intimately related.

Behavioral Strategies

The model defines different behavioral strategies (Figure 1.1; Pitkänen, 1969; Pulkkinen, 1988a, 1995). They are not categorical

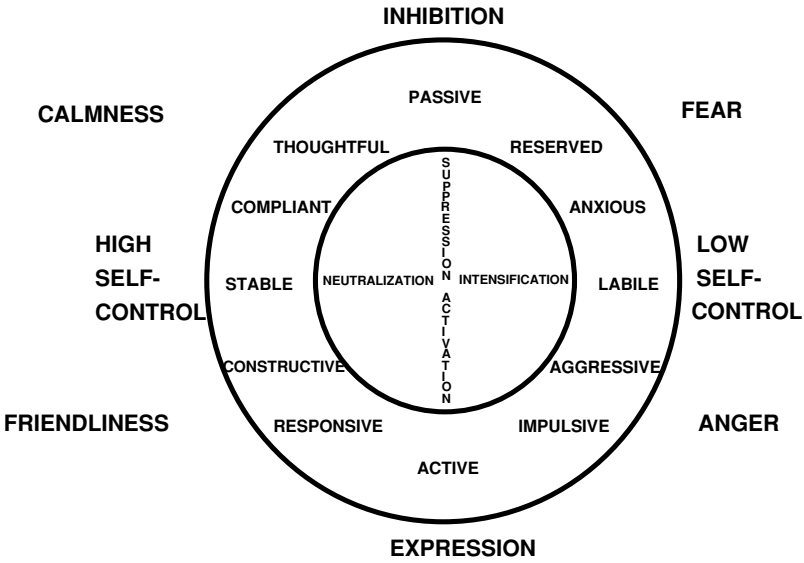

FIGURE 1.1. The model of emotional and behavioral regulation (EMO) (modified from Pulkkinen, 1995).

concepts per se but are the corners of the two-dimensional map. If both enhancing processes, the intensification of emotion and the activation of behavior, are aroused, the likelihood of an individual's reactivity to stimuli and emotional expression (uncontrolled expression of impulses) increases. It may be manifested in impulsive behavior or aggression that aims to eliminate a thwarting situation immediately by delivering noxious stimuli to another organism. This pattern is labeled Type A behavior. (Note: Type A used here does not refer to the Type A personality that is related to cardiovascular disease risk factors; Friedman & Rosenman, 1974).

A simultaneous neutralization of the emotional state and the activation of a behavior enables an individual to focus his or her attention on situational factors. Activation aroused by the stimulus situation is kept under cognitive control and displayed in neutral forms. Individuals act by taking into account the needs of the parties involved, evaluating the consequences of alternative behaviors, and regulating their behavior on that basis (controlled expression of impulses). This pattern is labeled Type B behavior, and it may be manifested in socially responsible, constructive behavior. Type A and Type B

behaviors have social reactivity in common, but they differ in the regulation of emotional behavior.

A simultaneous neutralization and suppression means that feelings of emotion are avoided and the behavioral-expressive aspect of emotion is suppressed. An individual tends to block awareness of his or her emotional state by cognitive appraisal of the situation (controlled inhibition of impulses). The appraisal process may even distort reality, in which case it can be called defensive. Avoidance may occur in a concrete withdrawal from the situation or in the mitigation of the emotional state. This pattern is labeled Type C behavior, and it may be manifested in thoughtful and compliant behavior. Type B and Type C behaviors have high self-control in common, and they share characteristics of spontaneous and compliant prosocial behavior, respectively (Eisenberg, Cameron, Tryon, & Dodez, 1981; Eisenberg, Pasternack, Cameron, & Tryon, 1984).

A simultaneous suppression of behavior and intensification of emotion means that an individual perceives the situation as emotionally exciting, but overt behavior is blocked (uncontrolled inhibition of impulses). Emotional activation is bound to the fear of the threatening stimulus and anxiety regarding one's inability to defend oneself. This pattern is labeled Type D behavior, and it may be manifested as anxious and reserved behavior.

The EMO model suggests a link between the two major types of dysfunction, externalizing and internalizing problem behaviors (Achenbach & Edelbrock, 1984), through low self-control of emotions. Type A is comparable to externalizing problem behaviors that are harmful and disruptive to others, and Type D is comparable to internalizing problem behaviors that refer to core disturbance in intropunitive emotions and moods indicated by depression and anxiety. According to the model in Figure 1.1, Type A and Type D behaviors have low self-control of emotions in common, which may explain the comorbidity of externalizing and internalizing problem behaviors in some individuals.

Developmental Perspectives

The two-dimensional model depicted inter- and intraindividual differences in a given situation. Beyond the model, however, hypotheses

were formed within a learning theoretical paradigm about the role of socialization experiences in the development of individual differences in self-control (Pitkänen, 1969; Pulkkinen, 1988a, 1995; Pulkkinen, Feldt, & Kokko, 2005). Uncontrolled expression of impulses (Type A) was expected to be related to a child's general temperamental activity and either parental indifference toward the child's way of expressing impulses (lack of guidance) or the direct or vicarious reinforcement of aggressive behavior. Type B, controlled expression of impulses, was seen as a result of a successful socialization due to the reinforcement of socially acceptable behavior and prosocial models. I also assumed that this pattern of behavior requires a certain level of cognitive capacity, and therefore its display was expected to become more likely with the child's maturation. Type C, controlled inhibition of impulses, was thought to be learned as a result of strong dependency on nonaggressive authority figures and the consequent need for approval. Aggressive behavior would compromise the satisfaction of the need. Type D, uncontrolled inhibition of impulses, was expected to be connected with lack of personal resources indicated by physical or cognitive weakness and low social skills, and with discouragement of active coping efforts.

A temperament theory presented by Rothbart and Derryberry (1981) helps to connect individual differences in emotional and behavioral regulation to the child's temperamental basis. It defines temperament as "constitutionally based individual differences in emotional, motor, and attentional reactivity and self-regulation" (Rothbart & Bates, 1998, p. 109). Reactivity, which is modulated by self-regulatory processes, can be measured in terms of the onset, duration, and intensity of affective reactions. By *constitutional*, they refer not only to heredity but also to maturation and experience, which means that temperament develops; it is influenced over time by heredity and experience (Rothbart & Putnam, 2002).

Although the two-dimensional model presented in Figure 1.1 was based on psychological processes involved in coping with aggression impulses, the application of the theoretical constructs were not expected to be limited to the derivatives of the aggression-inhibitory tendencies. Instead, an individual's way of controlling his or her negative emotions was expected to be more general and become habitual

in time to characterize his or her relationships with other people and life attitudes.

DEVELOPMENT THROUGH ADOLESCENCE

Data Collection in Childhood and Adolescence

The original sample of the JYLS consisted of 12 complete second-grade school classes, randomly selected for the study. Half of the classes were located in downtown Jyväskylä, a university and industrial town in Central Finland with about 80,000 inhabitants, and half in the suburban areas of Jyväskylä. The sample included 196 boys and 173 girls. Almost all participants (93.5%) were born in 1959, 3.8% in 1958, and 2.7% in 1960. All participants were native Finns; in the 1960s, Finland was very homogeneous in terms of ethnicity.

Childhood

The first data were collected when participants were 8 years old (in 1968) with the aim of understanding individual differences in children's social behavior. Parallel information about the children's social behavior was collected from teachers and peers. A 33-item multidimensional assessment inventory with its parallel versions for peer nomination and teacher rating was developed (Pitkänen, 1969; Pulkkinen, 1987) within the framework of the EMO model (Figure 1.1) and administered to the sample. The items were designed to measure aggressive, anxious, constructive, and compliant behaviors, and the theoretical framework dimensions of social activity versus passivity, and low versus high self-control of negative emotionality. For aggression, a distinction was made between reactive and proactive aggression, direct and indirect aggression, and physical, verbal, and facial aggression integrated with each other as depicted in the descriptive model of aggression (Pitkänen, 1969; Pulkkinen, 1987; Tremblay, 2000). It is proactive (also called offensive) aggression that is predictive of later problem behaviors (Pulkkinen 1987, 1996a).

Each pupil received a pad containing pages for each item including the forenames of the same-sex pupils in the class. The pupils were asked to cross out three to five names (excluding their own) of the classmates who best fit the behavior described. The items were

read aloud by a researcher (e.g., "Which of your classmates are able to sort things out by talking?" "Which of your classmates quarrels with other children even with a slight reason?"). The class teacher assessed each pupil in these items worded as a statement ("Quarrels with other children . . . ") on a semiabsolute scale from 0 (*the teacher has never observed the characteristic in question*) to 3 (*the characteristic in question is very prominent*). The behavior of the girls and boys was to be compared with that of girls and boys of the same age in general. In addition to the 33 variables also presented to the pupils, the teachers were asked to rate ensuing antisocial behavior, excessive withdrawal, lack of concentration, and good prognosis. Teachers also rated the pupils' school success by rank-ordering them. The ranks were coded on a 5-point scale in accordance with normal distribution. The parents' socioeconomic status was coded on the basis of the father's occupation (or mother's occupation, if she was a sole provider) on a 3-point scale: 1 = *blue-collar*, 2 = *lower white-collar*, and 3 = *higher white-collar* occupation.

In addition, two personality tests were administered to children at age 8. One of them was the Junior Eysenck Personality Inventory (Junior NESI; Eysenck & Eysenck, 1963) modified to comprise scales both for impulsive and social extraversion in addition to the neuroticism and lie scale. The reliabilities for the extraversion scales were low (Pitkänen, 1969) but good for neuroticism. Another scale was based on the work by Cattell and Coan (1959) and its standardization for Finland (Ylinentalo, 1965). The scale consisted of 12 subscales (9 items in each). The reliabilities were satisfactory for masculinity versus femininity, attitude toward school, dominance versus submissiveness, self-confidence versus inferiority feelings, altruism versus egoism, emotionality, restlessness, and dependency; they were lower for cooperativeness, sensitivity (vs. tough-mindedness), anxiety, and fearfulness. The correlations between personality inventories and behavioral assessments averaged across peers and teachers were very low. Only a few significant correlations for restlessness (up to .23) were obtained with variables for disobedience, lack of concentration, and physical aggression. Low correlations corresponded to the concurrent findings by Walker (1967) and Werdelin (1966) that there were only slight connections between self-ratings of children and other ratings. It is obviously difficult for children at age 8 to make valid

self-ratings. In further longitudinal analyses on socioemotional behavior, self-ratings have had a negligible value compared to teacher ratings and peer nominations that correlated significantly with each other and proved to have predictive power.

As a modification of the peer nomination measure, a 30-item Multidimensional Peer Nomination Inventory (MPNI), with its parallel Teacher and Parent Rating Forms (38 items), was developed for the twin study (*FinnTwin12*; see Chapter 8 of this volume) in the 1990s (Pulkkinen, Kaprio, & Rose, 1999). The Teacher and Parent Rating Forms of the MPNI were also used in the JYLS when the offspring of the participants were studied in 1997–1999 (see Chapters 10 and 11 of this volume). Peer nominations in *FinnTwin12* concerned both sexes: the pages of the pads on which the children made their choices included the first names of all classmates, divided by gender, and the pupils were asked to respond by crossing out names of up to three female and three male classmates who best fit the behavior described.

The MPNI and its parallel forms were enriched to cover a wide spectrum of externalizing and internalizing behaviors. The MPNI consists of scales for aggression, hyperactivity-impulsivity, and inattention that, on the basis of factor analysis, form a factor for Externalizing Problem Behaviors (Type A; Figure 1.1); anxiety and depression, forming a factor for Internalizing Problem Behaviors (Type D); and constructiveness, compliance, and social activity, forming a factor for Adaptive Behaviors (Types B and C combined; Pulkkinen et al., 1999; Pulkkinen, Vaalamo, et al., 2003). A factor analysis that included only items for adaptive behaviors resulted in two factors in accordance with the EMO model (Figure 1.1): one for more active constructive behavior and another one for more passive compliant behavior. However, in the context of problem behaviors they were combined into one factor due to the perceived common variance of adaptive behaviors as a contrast to problem behaviors. In spite of a positive correlation between constructive and compliant behavior, their predictive power is partly different, as shown below.

Early and Late Adolescence

In 1974, when the participants were 14 years old, 189 boys and 167 girls (96% of the original sample) were investigated in the follow-up study. They were traced using the archives of the local school

authority and schools, local records of the parents' addresses, and church and civil records on the moves of the families. The participants were then located in 78 school classes in several communities.

Data were gathered using peer nomination and teacher rating in every school class that contained at least one participant from the original sample. To reduce the workload of teachers and peers, the number of rating variables was reduced to eight categories of behavior formed on the basis of the results at age 8 (Pitkänen, 1969, p. 182; Pulkkinen, 1987, 1998). Each category was assessed by one item representing highly correlating indicators of the category (for aggression: "Who attacks without reason, teases others, says naughty things?"; for constructiveness: "Who tries to solve annoying situations reasonably, negotiates, conciliates, strives for justice?"; for anxiety: "Who is fearful, helpless in others' company, the target of teasing, unable to defend?"; and for compliance: "Who is peaceable, patient, compliant?"). The items were also formed for the two bipolar reference dimensions of the EMO model depicted in Figure 1.1. The pupils were asked to nominate three same-sex classmates who were best described by each item. The same variables (worded as statements) were used in the teacher rating. Because of the subject-teacher system, the teacher who knew the participant in question best was asked to assess his or her behavior in relation to 100 pupils he or she knew and to give a ranking score from 1 to 100. In addition, teachers filled out a 30-item questionnaire concerning the pupil's adjustment to school work, peer group, and society. Because of the change of schools and class structures that resulted from the move from elementary school with a class-teacher system to lower secondary school with a subject-teacher system, peer nominations and teacher ratings at ages 8 and 14 were independent.

A subsample of 43% of the participants (77 boys and 77 girls) and one of their parents were studied more intensively by interviewing them. For financial reasons, the interviews were limited to the participants who had belonged to any of six extreme groups of socio-emotional behavior formed at age 8 on the basis of factor scores (Pulkkinen, 1982). The parents of this sample ($n = 201$) were asked to agree to an interview of the child and either of the parents. An agreement was obtained from the parents of 154 participants (77 boys and 77 girls), 76.6%. They distributed to the extreme groups formed

at age 8 as follows: aggressive (10%), aggressive and anxious (7%), anxious (8%), constructive (12%), emotionally stable (11%), compliant (10%), and not extreme (42%). No differences existed between boys and girls in the distribution to these categories. The participants belonging to the subsample and one of their parents (most often the mother) were separately interviewed at age 14 (two hours each; semistructured interview) about family life, parenting, leisure activities, and school work. The interviews were coded quantitatively and qualitatively to cover the variation of responses.

In 1980, when the participants of this subsample were 20 years of age, 135 (68 men, 67 women) were interviewed again about their transition into late adolescence, current activities, and future plans. They were also presented with a self-control inventory, checklist, and self-rating form developed for this study by Pulkkinen (1982). Criminal records (governmental records of convictions and local police records of arrests) were investigated at age 20 (Pulkkinen, 1983a); thereafter, governmental records were investigated every 5 years. The age of criminal responsibility is 15 in Finland; offenses committed before age 15 are not registered.

Continuity in Socioemotional Behavior

Studies on differential stability of the Type A to D behaviors from age 8 to 14 have shown statistically significant stability (correlation coefficients from .20 to .47) in activity, passivity, low self-control, high self-control, aggressiveness, constructiveness, and compliance (Pulkkinen, 1998). For anxiety, the correlation was significant only for girls, and for high self-control, only for boys. This kind of continuity refers to homotypic continuity – continuity of similar behaviors or phenotypic attributes over time. Kagan (1971) distinguishes it from heterotypic continuity, which he refers to the situation in which a particular attribute is predictive of a phenotypically different but theoretically reasonably related attribute at a later age. Caspi (1998) uses the term *coherence* to refer to heterotypic continuity, that is, continuity of an inferred genotypic attribute underlying diverse phenotypic behaviors. The broadest view of continuity was presented by Rutter (1984). For him, the concept of continuity implies meaningful links over the course of development – not a lack of change. This

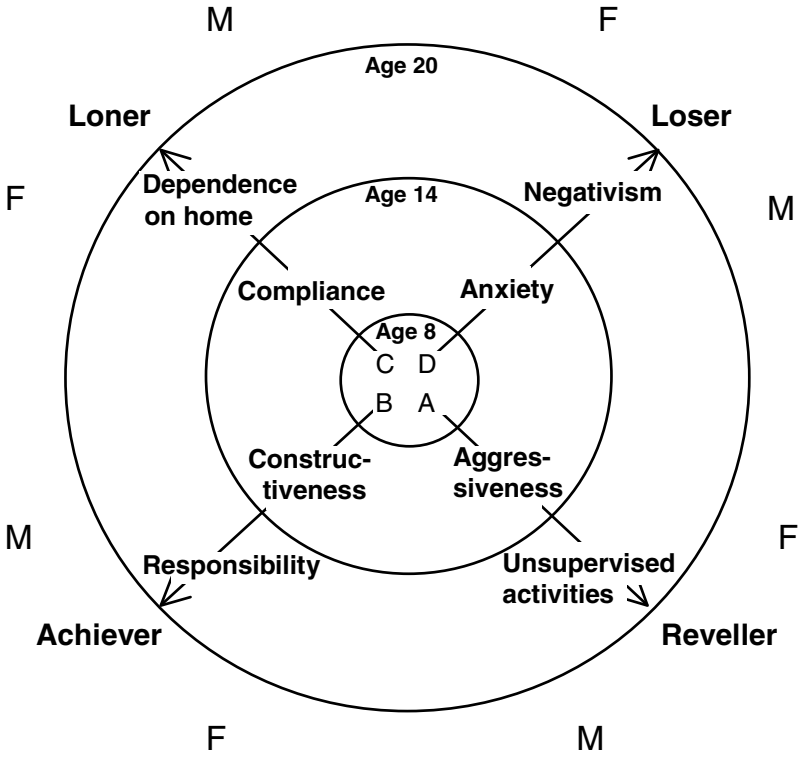

FIGURE 1.2. Development lines of socioemotional behavior from childhood to late adolescence (modified from Pulkkinen, 1983). *Note.* M = males, F = females.

view embraces cases in which the observed continuity of behavior is more – or merely – a reflection of environmental continuity.

In the JYLS, the EMO model (Figure 1.1) has been suggested to explain theoretical relatedness or meaningful links between socioemotional behavior in childhood and (mal)adaptive behavior in adulthood. Predictability of styles of life in late adolescence from the participants' behavior in childhood and early adolescence was examined by first conducting factor analyses of behavioral indicators separately when participants were 8, 14, and 20 (Pulkkinen, 1982). Then the correlations between the first two factors extracted at each age were calculated across the ages.

The results showed (Figure 1.2) that aggressive, low-controlled behavior (Type A) at age 8 predicted unsupervised activities at age

14 (called peer orientation in Pulkkinen, 1982), indicated by roaming in the streets, gathering together, aggressiveness, and seeking pleasure in cigarettes, alcohol, and heterosexual interaction at an early age. Both aggressiveness and unsupervised activities were related at age 20 to the style of life labeled Reveller in the study. It was indicated by pleasure seeking such as gathering with friends, drinking, and smoking, and by conflicts with the parents, weak frustration tolerance, and aggression.

Correspondingly, compliant behavior in childhood (Type C) predicted dependence on home, indicated by staying at home during free time, few contacts with age-mates, and refraining from pleasure in early adolescence. These characteristics were associated in late adolescence with the style of life called Loner, indicated by abstaining from drinking, internalizing norms, lack of friends and social contacts outside home, and dependence on parents.

Constructive, socially skilled behavior in childhood (Type B) preceded orientation toward responsibility in early adolescence. Besides socially constructive behavior, the latter involved responsible school attendance, club activities, and popularity. These characteristics were associated in late adolescence with the style of life called Achiever in the study (called Striver in Pulkkinen, 1982). In addition to their constructive behavior, Achievers were well adjusted, optimistic about the future, successful in studies, selective in their leisure activities, and aware of their societal obligations. This line of development reflected high self-control and strong orientation toward reality and its demands. On the contrary, anxious and socially helpless behavior in childhood (Type D) preceded generalized negativism: negative attitudes toward school work, poor adjustment to school, aggressiveness, unpopularity, and unsupervised leisure activities. These characteristics were associated in late adolescence with the style of life labeled Loser, indicated by negative and alienated attitudes, a lack of plans for the future, failure in studies, low self-confidence, and problems of adjustment.

The same developmental lines were found in males and females, but there were slight gender differences in the quality of the styles of life at age 20 (Figure 1.2; Pulkkinen, 1982). Male Revellers and female Achievers had social activity in common, and male Loners and female Losers had social passivity in common. On the contrary, male

Losers and female Revellers had low self-control in common, and male Achievers and female Loners had high self-control in common.

There were differences between the styles of life in regard to smoking and drinking (Pulkkinen, 1983b). Both male and female smoking were associated with the developmental line from aggressive behavior to the Reveller style of life and with that from anxious behavior to the Loser style of life. More specific connections were found for drinking. Male heavy drinking was associated with the developmental line from aggressive behavior to the Reveller style of life; also heavy female drinking was part of the life style of Reveller, although it was not associated with preceding female characteristics in childhood and early adolescence. The Loners at age 20 were least likely to be users of alcohol or smokers.

Differences existed also in delinquent behavior. Compared to nonoffenders, male participants who had committed several offenses by age 20 had received higher scores in peer-nominated aggression at age 8, participated in unsupervised activities at age 14, and displayed the Reveller style of life at age 20 (Pulkkinen, 1983a). Both male and female Achievers were most likely to be nonoffenders. Constructive behavior at age 8 differentiated female offenders from nonoffenders; the former had received higher scores in constructive behavior than offenders. On the contrary, obedient behavior at age 8 differentiated male nonoffenders from offenders; the former had received higher scores in compliance.

Developmental Background

The developmental lines depicted in Figure 1.2 were highly associated with parenting behavior that was labeled Child-centered versus Parent-centered parenting (Pulkkinen, 1982). The factor for child-centered parenting consisted of the parents' sustained interest in and control of the child's activities, trust, warmth, advice, and consideration of the child's opinions. In this atmosphere the child was respected as an individual and his or her development was supported. Child-centered parenting was related to the developmental line from constructive behavior to the style of life of Achiever, and with that from compliant behavior to the style of life of Loner. Parental restrictiveness was not associated with children's socioemotional development;

emotional atmosphere was more important, particularly as experienced by children.

Parent-centered parenting, as compared to child-centered parenting, involved dealing with the child in a more shortsighted way. The parents were less interested in the child's activities and opinions, more inconsistent, unjust, and dependent on their own moods, and spanked the child for misbehavior instead of giving him or her advice (Pulkkinen, 1982). Parent-centered parenting was associated with the developmental line from aggressive behavior to the Reveller style of life, and with that from anxious behavior to the Loser style of life.

There were also differences in the developmental lines reflecting life conditions (Pulkkinen, 1982). High socioeconomic status supported the child's development toward the style of life of Achiever, while low socioeconomic status was associated with the Loser style of life and its precedents. Socioeconomic status was not associated with the Reveller style of life and its precedents. Life conditions also differed in the stability of life. Many life changes, indicated by mother's employment, mother's young age, parents' lack of time for the child, frequent caretakers, lonely afternoons, frequent moves, and parental divorce, were related to anxious behavior in childhood, negativism in early adolescence, and the Reveller style of life in late adolescence. A difference in life conditions between the Achievers and Loners was that the Loners lived in more stable conditions with older parents than the Achievers.

The quality of parenting contributes to the child's socioemotional development, but there are also other factors in individuals' life circumstances that tend to accumulate in a positive or negative sense. Rönkä (1999) has shown that risk factors and problems of social functioning tend to interact, co-occur, and form chains. Problems relating to family and school are transformed into adult problems of social functioning through cyclical mechanisms that interact.

DEVELOPMENT THROUGH ADULTHOOD

During the course of the long-term longitudinal study, the original goal of the JYLS to investigate individual differences in socioemotional behavior has expanded to the study of individual life courses. *Life course* specifies the social role demands at different

stages, whereas *life span* specifies the temporal order of life stages. We have combined a life-span study of an individual's personality and social development with his or her life courses in the trajectories of education and work, family, health behavior and health, and social integration. These developmental lines were covered by data collected in adulthood (at ages 27, 33, 36, and 42).

Data Collection in Adulthood

Young Adulthood

In 1986, all participants of the original sample (then 27 years of age) were traced for a follow-up study. The participants' addresses were obtained through the Population Registration Centre (PRC); for those who had not updated their addresses in the PRC, their parents' addresses were obtained. Not all of these parents, however, knew their children's exact addresses, and therefore, many other ways (telephone directories, local records, police, friends) were used as informants to trace the participants. Data were gathered by a mailed Life Situation Questionnaire 1 (LSQ1), developed for this study by Pulkkinen, and a semistructured interview. The LSQ1 was completed by 166 men (85% of men) and 155 women (90% of women), and interviews were conducted with 150 men (77%) and 142 women (82%).

The LSQ1 consisted of 200 items concerning family, education, work, leisure, alcohol consumption, and smoking, as well as a series of questions on life satisfaction, values, life changes, personal control over development, trust in life, and future orientation, including optimism. The interview covered relationships with parents, spouse, and children, as well as friendships, antisocial behavior, emotional reactions, health and health habits, sources for the meaningfulness of life, and an Identity Status Interview (Marcia, 1966). The semistructured interviews were transcribed for each theme and coded quantitatively and qualitatively to cover the variation of responses. In the context of the interview, the participants were presented with two personality inventories standardized for Finland by Haapasalo (1990): the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975) and the Sensation Seeking Scale (Zuckerman, 1979).

When the original participants were 33 (in 1992), they were sent by mail a Big Five Personality Inventory – an authorized adaptation

of the NEO Personality Inventory (NEO PI; Costa & McCrae, 1985), in which about one quarter of the items are substitutes for the original American items (Pulver, Allik, Pulkkinen, & Hämäläinen, 1995). Also, participants' television viewing motives were measured via an inventory adapted from Rubin (1983; see Mustonen, 1997) and television program choices were measured on the basis of volume questions. The participants were given a list of the 10 most common network television program genres and were asked to indicate how often they watched particular programs. The mailed questionnaire was returned by 123 men (63% of men) and 126 women (73% of women).

Adulthood and Middle Adulthood

In 1995, when the participants were 36 years old, a mailed Life Situation Questionnaire 2 (LSQ2) was again completed by 161 men (84% of men of the available sample; two men had died) and 150 women (87% of women); interviews were held with 146 men (76%) and 137 women (79%) during which a set of inventories were presented. The latest data were collected in 2001, when the participants were 42 years old. The mailed Life Situation Questionnaire 3(LSQ3) was again completed, the participants were interviewed, and the inventories were administered. In addition, a medical checkup was made by a physician and a nurse. The interviews in all waves have been conducted by several (9 to 17) interviewers specifically trained for data collection in this study. According to the participant's choice, the interviews were conducted at the University of Jyväskylä, in the participant's home, or in some other place in the community where the participant lived.

In 1997–1999, the participants who had school-age children were invited to visit our laboratory for the study of regulation processes in children's behavior in cognitive, emotional, and social contexts. The goal was to test hypotheses drawn from the EMO model. The number of participating families was 109; 55 men and 54 women of the original sample. Each of these participants was termed as an index parent for whom the longitudinal data were available. His or her spouse (34 men, 42 women) also participated in the study as well as a school-age child (60 boys, 49 girls) whose age and gender matched the age and gender of the parent at the time of his or her

participation in the JYLS study in childhood. In addition, we were able to recruit a school-age sibling (15 boys, 24 girls) from 39 families.

The measures contained laboratory tests for the study of executive functioning, cognitive regulation, emotional regulation, and behavioral regulation. For the behavioral measure, data were collected from teachers using the Teacher Form of the Multidimensional Peer Nomination Inventory (MPNI). Family interaction was observed in the laboratory setting, and the spouse's personality and parental characteristics were measured.

By the age of 42, 5 men and 1 woman had died, and 5 men and 15 women had withdrawn completely from the study. Consequently, the available sample size in 2001 was 7% smaller than the original sample: 186 men and 157 women. Of these, at least some information was obtained from 151 men (81% of the available sample) and 134 women (85%). The rest either were not reached (20 men, 13 women) or had declined participation in this wave of data collection (15 men, 10 women). The LSQ3 was completed by 147 men (79% of the available sample) and 132 women (84%); 123 men (66%) and 120 women (76%) were interviewed. The medical checkup was made with 121 men (65%) and 120 women (76%), and 104 men (56%) and 112 women (71%) took part in medical laboratory tests.

The LSQ2 and LSQ3 were similar to the LSQ1 administered when participants were 27. The interviews when they were 36 and 42 were similar in style, and more structured than the interview at age 27. The interview included the Identity Status Interview (Marcia, 1966) at both ages (36 and 42); a self-report delinquency scale (modified from Junger-Tas, Terlouw, & Klein, 1994) at age 36, and, at age 42, the Life History Calendar (Caspi et al., 1996), which was intended to produce information about the participants' residence, family (marital relationships and children), educational and work history, and other life events annually from ages 15 to 42. Furthermore, the interviews included discussion about important domains and branching points in people's lives, marital relationships, employment and unemployment, and working conditions.

During the interview sessions at ages 36 and 42, the participants were presented with several self-administered questionnaires that often were shortened versions of the original ones: Affective Experience Scale (Feldman, 1995), Emotion Regulation Scale (Mayer &

Stevens, 1994), Self-Esteem Scale (Rosenberg, 1965), Scales of Psychological Well-Being (Ryff, 1989), Depression Scale of General Behavior Inventory (Depue, 1987), the Self-Report Attachment Style Prototypes (Bartholomew & Horowitz, 1991), the Aggression Questionnaire (Buss & Perry, 1992), the 12-item General Health Questionnaire (Goldberg, 1972), Child Rearing Practices Questionnaire composed by Pulkkinen (Metsäpelto & Pulkkinen, 2003), Strategic Attribution Questionnaire (Nurmi, Salmela-Aro, & Haavisto, 1995), Karolinska Scales of Personality (af Klinteberg, Schalling, & Magnusson, 1990), the CAGE questionnaire for alcoholism (Ewing, 1984), and the brief Michigan Alcoholism Screening Test (Selzer, 1971; Kristenson & Trell, 1982). At age 42, additional questionnaires included the 13-item Orientation to Life Questionnaire for measuring Sense of Coherence (Antonovsky, 1987), the Big Five Personality Inventory (Costa & McCrae, 1985; Pulver et al., 1995), Emotional Intelligence Scale (Schütte et al., 1998), Generativity and Integrity Scales (Ryff & Heincke, 1983), Social Well-Being Scale (Keyes, 1998), Dyadic Adjustment Scale (Spanier, 1976), Work-Home Interference (Geurts, 2000), a Brief Measure of Social Support (Sarason, Sarason, Shearin, & Pierce, 1987), Ambivalence (Lüscher, Pajung-Bilger, Lettke, Böhmer, & Rasner, 2000), and the Adult Temperament Questionnaire (Derryberry & Rothbart, 1988).

The medical examination was conducted by a physician and a nurse. It lasted 1.5 hours and contained an interview about medication, diseases, injuries, hospitalization, physical symptoms, family history, and self-rated health. The participants filled in a symptom checklist (Aro, 1988) during the interview. In addition, blood pressure, heart rate, height, weight, and waist and hip circumference were measured, and a dementia screening test was administered.

The laboratory tests yielded information about total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglycerides, blood sugar, plasma levels of total glycosylated hemoglobin (GhbAlc), complete blood count (hemoglobin, leucocytes, thrombocyte platelets), liver function, thyroid gland function, dehydroepiandrosterone-sulfate (DHEAs), sensitive C-reactive protein, free testosterone of serum, genes, and 12-hour urine norepinephrine and epinephrine. Most of the blood samples were analyzed in the clinical laboratory of the Hospital of Central Finland,

but urine samples and a frozen blood sample for the measurement of DHEAs were sent to the clinical laboratories of other hospitals. The blood samples for gene analyses were sent to the Department of Molecular Medicine of the Finnish National Public Health Institute for DNA extraction. In addition, registered information about hospitalization and the participants' health in childhood were collected.

Attrition and Representativeness of the Sample

In the JYLS, data from childhood to adulthood, that is, from age 8 to at least one of the three adult ages – 27, 36, or 42– are available for 94% of the sample. Two-thirds of the original sample (66.9%) have participated in all major waves: at ages 8, 14, 27, 36, and 42. No initial attrition existed, because all pupils in the 12 second-grade classes randomly selected for the study participated in it. At that time, the permission of the school authorities was sufficient for data collection at school. In adulthood, an informed consent has been requested from the participants in connection with a mailed questionnaire. For data collection at age 42, the ethics committee of the Central Finland Health Care District examined and accepted the research design and procedure. To protect the confidentiality and privacy of the participants, no identification data have been entered in the database.

In order to detect a possible selection bias, the sample studied at age 42 ($N = 285$, 185 men and 134 women) was compared with those who did not participate ($n = 84$), divided into two groups: refused at age 42 or earlier ($n = 45$) and could not be contacted ($n = 33$) (Pulkkinen, Fyrsten et al., 2003). The groups were compared in the ratings made by teachers and peers at age 8 and 14. No differences at the $p < .01$ level were found between the groups. Nor were there differences in school success at ages 8 and 14.

In addition, the participants at age 42 ($N = 285$) were compared with the nonparticipants ($n = 84$) regarding smoking, use of drugs, and drinking, as measured at an earlier age. No differences were found. We have also observed that all participants who were criminal recidivists had participated in at least one of the measurement points in adulthood, except for one woman. The only significant finding for attrition was that among the individuals who had died by age 42 (five men and one woman) and among the four additional deaths since 2001 (one man and three women), seven participants had been

heavy drinkers or alcoholics and died of accidents or intoxication, three women of cancer.

At age 42, two-thirds of the participants lived in Central Finland and 17% in the Helsinki region. Nine participants (3.2%) lived abroad. The great majority (72%) belonged to the Lutheran church, typical of Finland. The sample turned out to be representative of the age cohort born in 1959 when data on marital status, number of children, socioeconomic status (for males), and unemployment provided by Statistics Finland were used as criteria at ages 36 and 42 (Pulkkinen, Fyrsten et al., 2003). Most participants (60.2%; 57.7% in the age cohort group) were married at age 42; 19% of the participants were cohabiting. The average number of children was 1.85 (1.87 in the age cohort group). Almost one-third (30.2%) of the participants had experienced a divorce by age 42. This figure was not comparable to the annual numbers of divorces provided by Statistics Finland because those figures are not given separately for each cohort or by the years when marriages are contracted, but it is close to the estimates made for this age cohort. The divorce rate has increased in Finland since the 1980s, and it is estimated that half the marriages contracted in 2001 will end in divorce (Statistical Yearbook of Finland, 2002, p. 134).

The male participants had lower education levels than did the women in both the age cohort group and the sample. Men did not differ from their age cohort group (approximately 14 years of education or less in 70% of the cohort, 75% of the sample), but female participants had more years of education than women in their age cohort group ($\sim$ 14 years or less in 59% of the cohort, 38% of the sample). Differences in the number of years of education between the female sample and the corresponding age cohort group, $\chi^2\,(5) = 31.5$, $p < .001$ were located in higher secondary (44% of the cohort, 26% of the sample) and lower tertiary education (26% of the cohort, 42% of the sample). Differences in higher tertiary education (master's degree or more) were in same direction but smaller: 10% of women in the age cohort group and 15.1% in the sample (9.5% of men in both the age cohort group and the sample) had higher tertiary education.

Correspondingly, female participants were less often in blue-collar occupations (20% of the cohort, 11% of the sample) than men (42% of the cohort, 47% of the sample). A gender difference also existed

in lower white-collar occupations that, on the other hand, were more typical of women (51% of the cohort, 59% of the sample) than of men (20% of the cohort, 16% of the sample). A gender difference did not exist in the higher white-collar occupations among the age cohort group (about 21% for both sexes) or in our sample (23% for both sexes). The rate of private entrepreneurs was slightly lower in the sample (10% of men and 7% of women) than in the age cohort group (16% of men and 13% of women). The occupational status of the male sample did not differ from that of the age cohort group, but in females there was a marginal difference, $\chi^2\,(3) = 9.9, p < .05$, because of more women working in blue-collar occupations and as enterpreneurs in the age cohort group than in the sample; in the sample, women more typically were in lower white-collar occupations.

The unemployment rate in the sample (6.0% of women and 10.9% of men) corresponded to the rate in the age cohort group (8.2% of women and 8.6% of men). The rate of unemployment varied in the sample across years in the same way as in the whole age cohort group. The unemployment rate rose from 3% in 1986 to 18% in 1995 in both the sample and the age cohort group due to a serious economic recession in Finland in the first half of the 1990s.

Problem Behavior and Health

Adult information about different trajectories and life domains, such as health and positive development, were studied in relation to child behavior within the framework of the EMO model (Figure 1.1). The results showed that childhood aggression (Type A) and, more generally, weak self-control are risk factors for health (Pulkkinen, 1995). The most generalized predictor of accidents and impairment assessed at age 27 was noncompliance in childhood, indicated by disobedience toward the teacher and aggression. Conduct problems at age 14 had a mediating effect on the relation between aggression and impairment; aggressive children who developed the pattern of conduct problems by age 14, indicated by truancy, punishments at school, and substance use, were at a higher risk for impairment in accidents by age 27. In adulthood, heavy drinking increased the risk of accidents. Childhood aggression was positively associated with heavy drinking in men at age 27, whereas social anxiety in childhood was negatively associated

with it (Pulkkinen & Pitkänen, 1994). In females, childhood anxiety was related to problem drinking in young adulthood.

At age 27, six clusters for health were extracted from self-reported health data: Healthy, Worried, Medicators, Stressed, Risky (for men, Operated for women), and Injured (Pulkkinen, 1990). Male and female Injureds had been in accidents. Male Injureds had been considered by classmates to be the most aggressive and disobedient toward the teacher. Among females, Medicators were the most aggressive at age 8 and 14. Medicators used medicine regularly and estimated their health to be weak. Behavioral characteristics that manifest strong self-control were found in Worrieds at both age 8 and age 14. They had had the best school achievements, but at age 27 they had feelings of being unwell and stressed. Male and female Healthys, who had always been well, were the least aggressive at age 8 and 14, and also in other respects they showed good adjustment to school. The results from the twin data (*FinnTwin12*) confirm these findings: various pains (back pain, stomachache, headache) are most often reported by preadolescent boys and girls who have both behavioral and emotional problems, such as aggression and anxiety (Vaalamo, Pulkkinen, Kinnunen, Kaprio, & Rose, 2002).

Health consequences of health-related behaviors such as substance use accumulate gradually and become more visible at a later age. It has been shown with the JYLS data that the early age of onset of drinking increases the risk for heavy drinking and alcoholism by age 42 (Pitkänen, Lyyra, & Pulkkinen, 2005) and metabolic syndrome risk (Kinnunen & Pulkkinen, 2002). For the latter, the direct relationship disappeared when alcohol consumption at ages 27 and 36 was added to the model. The early age of onset of drinking explained heavy drinking in adulthood, which explained metabolic syndrome, that is, a cluster of risk factors for cardiovascular diseases, consisting of insulin resistance, abdominal obesity, hypertension, dyslipidemia, and microalbuminuria.

Aggression in childhood is associated with aggression in adulthood (Kokko & Pulkkinen, 2005). Boys' aggressive behavior already at age 8 is related to aggressiveness at ages 36 and 42, but girls' aggressive behavior becomes predictive of adult aggressiveness only at age 14. Childhood aggression can be found in the developmental background of many kinds of adult social functioning problems. For

instance, in the JYLS, divorced 36-year-old women and men had been rated in childhood by their teachers as being more aggressive than their married counterparts (Kinnunen & Pulkkinen, 2003).

An association between childhood aggression and later antisocial behavior has been obtained in many studies (e.g., Farrington, 1991) and also in the JYLS: Highly aggressive individuals at age 8 had been arrested more often by age 27 than medium- or low-aggressive individuals (Pulkkinen & Pitkänen, 1993). More detailed analyses showed, however, that if the most aggressive individuals (above the 75th percentile) were excluded from correlative analyses, the correlation with criminality turned out to be insignificant (Pulkkinen, 1998). The accumulation of behavior problems over the school years increased the risk of crime by age 27, compared to childhood aggressiveness without the presence of other problems (Hämäläinen & Pulkkinen, 1996). The most predictive of antisocial behavior was a severe multiproblem cluster in childhood including problems in concentration, school achievements, and peer relations (Magnusson & Bergman, 1990). This finding was replicated with the JYLS data by Pulkkinen (1992) and with Canadian data by Pulkkinen and Tremblay (1992). Also, criminal convictions are highly concentrated. A small proportion of male offenders (4% to 5%) account for half of all offenses committed by the participants of studies conducted in Finland (Pulkkinen, 1988b) and in England (Farrington, 1988).

The accumulation of problem behaviors, such as aggression in childhood and maladjustment to school in early adolescence, also accounted for long-term unemployment by age 36 directly and indirectly through lack of occupational alternatives and problem drinking (Kokko & Pulkkinen, 2000). In another study (Rönkä, Kinnunen, & Pulkkinen, 2000), we formed a risk index for development that included the child's weak self-control and home adversities and found that developmental risk factors were related to problems of social functioning in adulthood, indicated by poor financial standing, unemployment, poor social relationships, poor intimate relationships, drinking problems, and criminality. The interpretation was that there are two strands through which childhood risks are transformed into adulthood and accumulated over time: environmental continuities (outer strand) and self-related cognitions, such as sense

of failure (the inner strand). The outer strand is more typical of men, and the inner strand is more typical of women.

Positive Development

A specific feature of the JYLS is the possibility for investigating continuity in positive development from childhood to adulthood because data on high self-control were collected in childhood. Our results have shown that individuals who exhibited higher self-control and more constructive or compliant behavior in childhood were more likely to be popular and successful at school, have more years of education, and have a more stable working career in adulthood; for women only, there is also higher marital satisfaction (Pulkkinen, 1998, 2001). A path analysis (Pulkkinen, Ohranen, & Tolvanen, 1999) has revealed that constructive behavior in childhood is associated with extraversion in adulthood and is a resource factor for female career orientation, whereas both compliant and constructive behaviors are associated with agreeableness in adulthood and are resource factors for male career orientation.

Resource factors for positive development tend to accumulate. In a structural equation modeling (SEM) analysis (Pulkkinen, Nygren, & Kokko, 2002), latent factors for high self-control, school success, and family circumstances, indicated by good relationships between family members and child-centered parenting, explained a latent factor for social functioning, indicated by socialization, stable career line, and controlled drinking. The developmental background did not directly explain psychological functioning, such as self-esteem and satisfaction with life.

Continuity in developmental lines has also been found when the JYLS data have been analyzed in a person-oriented way. Profile analyses by Laursen, Pulkkinen, and Adams (2002) revealed that a high-agreeable childhood type, defined by high compliance and self-control and low aggression, tended to develop a high-agreeable adulthood type, defined by high agreeableness and socialization and low impulsivity. In childhood and adolescence, these individuals had fewer disobedience and concentration problems, and in adulthood more career stability and fewer adjustment problems than their low-agreeable counterparts.

The participants were grouped using a clustering technique at age 27 on the basis of their personality characteristics (e.g., extraversion), social behavior (e.g., cultural interests), and life orientation (e.g., optimism), and three major clusters were extracted (Pulkkinen, 1996b): adapted (Resilients for males; Traditionals for females), nonconventional (Introverted for males; Individuated for females), and conflicted (Undercontrolled for males; Brittles for females). The clusters differed in a similar way in childhood and adulthood when the EMO model was used as a framework (Pulkkinen et al., 2005). The conflicted individuals were higher in aggression (Undercontrolled) and anxiety (Brittles), both in childhood and adulthood (from age 36 to 42), than, particularly, the adapted individuals. In adulthood, the Brittles were lowest in self-esteem, identity achievement, psychological well-being, and sense of coherence, and highest in depression. Differences in psychological functioning between the Undercontrolled and Introverted men leveled off in adulthood. The adapted individuals (Resilients and Traditionals) were highest in adult psychological functioning.

SUMMARY

This chapter introduced the basic goals and framework model of the Jyväskylä Longitudinal Study of Personality and Social Development, its data waves from age 8 to age 42, and its results on continuity in interindividual differences over 34 years. The next data wave is being planned for the year 2009 when the participants become 50 years old. The results obtained have confirmed the relevance of the model of emotional and behavioral regulation and the behavioral types, defined by the dimensions for high versus low self-control of negative emotions and high versus low social activity, for the description of inter- and intraindividual differences.

Low self-control, indicated by aggression and anxiety in childhood, is a risk factor for further development, whereas high self-control, indicated by constructive and compliant behavior, is a resource factor for development. Gender differences in these factors concern the positive impact of social activity on female development and that of high self-control on male development. Conversely, social passivity, particularly when it is anxiety-bound, is a risk factor for

female development, and social activity, when it is aggression-bound, is a risk factor for male development.

The results presented in this chapter were selected from the wide array of research areas studied with the JYLS data. Emphasis was given to the EMO model and earlier findings, which concern childhood and adolescence. More recent findings and other theoretical frameworks are presented in additional chapters of this book.

2

Genetic and Environmental Influences on Social Behavior and Health

Richard J. Rose

INTRODUCTION

Genes and experience jointly contribute to individual differences in social behavior, lifestyle, and disease risk. Once controversial, that statement is now accepted throughout the behavioral sciences. Evidence from decades of research in behavioral and psychiatric genetics (McGue & Bouchard, 1998; Martin, Boomsma, & Machin, 1997; Plomin, DeFries, Craig, & McGuffin, 2003; Rose, 1995; Rutter & Silberg, 2002) has fostered an integrated perspective in developmental science, a perspective that acknowledges the interplay of nature and nurture from prenatal life, through the acquisition and development of behaviors in infancy, to individual differences in cognitive decline and well-being in senescence.

Few if any dimensions of social behavior and health are insulated from some genetic influence, however indirect, but the timing, magnitude, and nature of genetic influences differ across health and social behaviors, and genetic effects are modulated by complex interactions of age, gender, environmental exposure, family circumstance, and family history of disease. It is equally true that no dimension of health and social behavior is independent of variation in one's cumulative experience, but identifying environmental effects, assessing their magnitude, and articulating their pathways of causal influence are invariably confounded with correlated genetic differences between families and individuals. For that reason, incisive

appraisal of environmental factors and disease risk require research designs that control, to the degree possible, between-family genetic confounds.

Contemporary analyses of the differences within and between human twins, analyses first suggested by Sir Francis Galton 125 years ago, offer fundamental data with which to address the causes of familial and individual variation in behavioral development and behavioral disorder. Twin research elucidates environmental factors as much as it identifies genetic influences, and twin research underscores the importance and ubiquity of gene-environment interactions and correlations in development. This chapter offers an overview of a twin research perspective on social and health behaviors.

Begin with a basic question: What is the relationship between genes and overt behavior? Clearly, behavior as we observe and assess it is not inherited. We can but speculate about the long and complex route from spiral molecules of DNA and the synthesis of proteins to organized behavior patterns amenable to ratings and self-report. And gene interactions and the interactions and correlations between genes and environmental factors immensely complicate gene-behavior relationships. What we inherit cannot be behavioral outcomes but, rather, predispositions that influence our sensitivity to, and selection of, environments in processes that bias our behavior development. The predispositions take several forms but for our purposes, two very general principles are important. The first, *differential susceptibility*, describes the interaction of each individual's unique genetic makeup (genotype) with that individual's unique history of accumulated environmental experience. The second principle, *selective exposure*, refers to the correlations of a person's genotype with that person's experience.

DIFFERENTIAL SUSCEPTIBILITY

It is a truism of health psychology that people differ in the magnitude and duration of reaction to standardized stress or the imposition of a uniform change in diet or exercise output. Individual differences in response to standardized stress are conditioned by reactive genetic dispositions, a replicated finding from dozens of research protocols. A study of twin children's skin sensitivity to antigens, including dander

of cat and dog, ragweed, mold, and house dust (Hopp, Bewtra, Watt, Nair, & Townley, 1984), illustrates this. The diameter of skin reactions to intradermal antigens was measured in each twin, with both twins in each pair tested on the same day in a standardized manner. The average difference in intradermal skin test responses among monozygotic (MZ or genetically identical) co-twins was half that found for the fraternal (DZ or dizygotic) twin pairs, who are half as alike. Correlations were 0.82 for MZ twins and 0.46 for DZ twins, suggesting that approximately 70% of the individual differences in skin sensitivity are due to underlying genetic variation. MZ/DZ correlations for an inhalation challenge, an index of bronchial responsiveness, were 0.67/0.34, matching the 2:1 ratio in genetic similarity between the two kinds of twins. Clearly, sensitivity to antigens is conditioned by genetic variation, a simple illustration of the well-documented general finding that reaction to stress challenge is familial and largely heritable.

If individual sensitivity to the environment is significantly influenced by genetic differences, MZ co-twins will respond in very similar ways to uniform environmental challenge. An illustration is found in research by Claude Bouchard and colleagues who recruited MZ twin pairs for several rigorously controlled laboratory manipulations. In one study (Bouchard et al., 1990), 12 pairs of young adult male MZ twins were overfed 1000 kcal per day 6 days each week over a 100-day period; each subject was overfed a total excess of 84,000 kcal (52% carbohydrate, 31% fat). The 24 men were housed in a college dormitory under careful 24 hours a day, 7 days a week supervision of their food intake and exercise. Although all participants were given "exactly the same" treatment, weight gains between unrelated twins ranged threefold, from 4.3 to 13.3 kg, with most of that variation between pairs. Within-pair variation was but a fraction (about one-third) of that between pairs. For the amount of gain specific to abdominal visceral fat, the similarity of twin brothers was such that between-pair variation was six times that observed within pairs – evidence of near-identical response of identical genotypes. Similar results from another environmental challenge were obtained in a study of changes in maximal oxygen uptake (VO_2) following a 20-week standardized endurance training program (Bouchard, Pérusse, & LeBlanc, 1990). Again, very large individual differences

in response were observed in twins from 10 MZ pairs, with training gains in VO_2 max ranging from near zero to 40%, and, again, there was seven to eight times more variation between genotypes than within them. Clearly, some genotypes are more reactive to specific environmental challenges than are others. Genes and environments interact.

A broader view of individual differences in reactivity assumes these differences to be nonspecific. Research suggests that some children are much more vulnerable (and others better buffered and more resilient) to adverse events and environmental "noise" of many kinds and across stages of development. Are some individuals inherently more vulnerable to environmental noise so that their developmental trajectories are more likely altered by cumulative effects of environmental stress? One research approach to that question uses *fluctuating asymmetry* (FA) of paired morphological structures to index impaired developmental buffering. Defined as nondirectional, random, stress-induced deviations in symmetry occurring during early development of bilateral symmetrical traits, FA is associated with susceptibilities to behavior disorder (Kowner, 2001; Reilly & Gottesman, 2001). Palmar *a-b* ridge count, illustrated in Figure 2.1, is a measure of the size of the second interdigital area of the palm; it has been studied because of its formation *in utero*, its stability post-birth, and evidence that *a-b* asymmetry (the nondirectional difference between left and right palms) is elevated among first-degree relatives of familial cleft lip/palate cases (Woolf & Gianas, 1976), suggesting reduced buffering in these families that resulted in the developmental malformation in affected family members and elevated *a-b* asymmetry in their unaffected relatives. If *a-b* asymmetry does index sensitivity to environmental noise, MZ twin pairs in which one or both co-twins exhibit it should show larger intra-pair differences in their behavior. That result, with MZ co-twins from asymmetric pairs significantly less similar across diverse scales of a standard questionnaire measure of adult personality, has been reported (Rose, Reed, & Bogle, 1987) and robustly replicated (Bogle, Reed, & Rose, 1994), encouraging efforts to relate asymmetry to developmental instability in longitudinal studies of non-twin children (Rose, 2005).

In sum, individual differences in reactivity are familial and heritable. Confronted with uniform stress, people differ in reaction

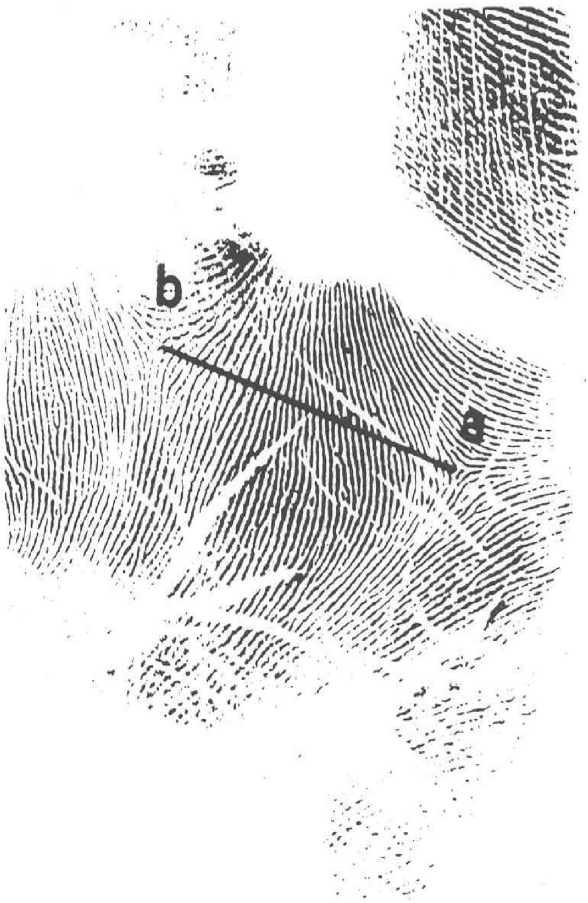

FIGURE 2.1. An illustration of the second interdigital area of the palm with *a–b* ridge count of 41.

to it. Different genotypes do not uniformly react to the same environmental demands, a phenomenon generally described as gene-environment interaction. A broadened view of interaction extends the variable plasticity of specific behavior-environment interactions to individuals who differ in vulnerability to nonspecific stress. Differential reactivity is a major pathway by which genetic variation modulates effects of stress in maintaining health and in the genesis of physical and behavioral disorder.

SELECTIVE EXPOSURE

Evocative Gene-Environment Correlations

If it is a truism of health psychology that we do not uniformly react to similar stress, it is a truism of social psychology that the situations we encounter do not just "happen" to us. In part, this is due to an evocative process, as our genetic variations influence the stimulus-cue value we offer to the social community and, accordingly, the experiences to which we are exposed. Differences in gender, age, appearance, physiological function, pubertal timing, and behavioral predispositions expose different persons to different patterns of experience. To the degree that such differences represent underlying variation that originates with the genotype, we speak of gene-environment (g-e) correlations, the behavioral consequence of selective exposure and differential learning history unique to each of us. A familiar and well-researched example is the association of maturational timing with developmental outcomes. Genes significantly influence the rate at which adolescents move through changes of puberty; in turn, pubertal timing is related to personality correlates, peer networks, the assumption of social roles, and early substance use (Chapter 5).

Proactive Gene-Environment Correlations

But g-e correlations also arise through active processes of selection, as we seek opportunities to develop and display the dispositional characteristics that define our own individuality. We selectively seek situations that will reinforce our dispositions. This is an obvious, everyday observation to social psychologists: "Physicians, clerics, entrepreneurs, and rock stars began by making choices that reflected their personal preferences and capacities" (Ross & Nisbett, 1991, p. 154). Subsequently, the initial choices provided situational contexts that allowed (and, in some sense, "compelled") them to further develop and display their dispositional differences. And the process then continues: We are selectively exposed to environments created by others who, anticipating continuity in our behavior over time, adjust the social settings within which they interact with us. So, "the

Reverend Fletcher" not only avoids orgies and opium dens, but his social audiences adjust to his presence, so "both the guest list and the evening's entertainment tend to be somewhat more refined" whenever he is invited (Ross & Nisbett, 1991, p. 155).

In sum, people not only make situational choices but their dispositional tendencies also transform the situations to which they are exposed. Proactive differences in social selection illustrate transactional pathways by which genetic variation contributes to differences in lifestyle and stress exposure. Differences in lifestyle do not just "happen": we actively choose most situations to which we are exposed, and we alter many situations we encounter.

Heritability of "Environmental" Measures

Twin studies have directly asked whether genetic differences between people contribute to the differences they report in their life histories, and the studies find affirmative answers to the question. One focus of such research has assessed genetic contributions to individual differences in measures previously interpreted as "environmental," including measures of social support and stressful life events. Two reports from samples of twin sisters in the Virginia Twin Registry illustrate. In one, a conventional inventory of social support was administered twice, about 5 years apart, to adult twin sisters (Kendler, 1997). The longitudinal retesting allowed correction for errors of measurement, yielding estimated heritabilities of the stable component of social support that ranged from 43% to 75%. These results suggest that social support is not an environmental given: it results from active efforts to "develop and sustain reciprocally supportive relationships" (Kendler, 1997, p. 1398). A parallel analysis of individual variation in exposure to stressful life events (SLEs) was made in data from twin sisters interviewed on two occasions, separated by a year or more (Foley, Neale, & Kendler, 1996). None of the life events measured was influenced solely by experiences unique to one sister and unshared with her twin sisters: variation in liability to all SLEs was found to be, in part, familial. And the stable individual differences in experiencing stressful life events were attributed to the sisters' common experience (e.g., sisters sharing the same social network) and to their shared genes. The pathways between genes and life events must be

highly indirect: Genes surely do not code for life events, but heritable characteristics of people do influence their "selection of, reaction to, and interaction with" their environments (Foley et al., 1996, p. 1250).

Friendship Selections of 12-Year-Old Twins

A direct test of genetic influence on social selection processes was made by asking twins in the *FinnTwin12* study, as the final item of a 33-item peer nomination exercise conducted in class (Pulkkinen et al., 1999), to nominate two classmates for the question: "Who are your best friends?" Several results (Rose, 2002) are noteworthy here. First, networks of best classmate friends of MZ co-twins are much more likely to include common classmates than those made by DZ co-twins. And second, twins choose as their best friends classmates who are similar to themselves (as shown in ratings made by their classmate peers), and accordingly, the nominated best friends of MZ co-twins are behaviorally more alike than those of DZ co-twins. That result was interpreted as reflecting a process of assortative pairing, analogous to the assortative mating found in adult spousal selection. We like those who are like ourselves, and, not surprisingly, MZ co-twins choose as their friends classmates who exhibit significant behavioral resemblance to one another. The important inference is that peer networks, which are often of great influence in adolescent development, result in part from active selection processes.

Genetic Effects on Behavior: Twin Parents and Their Families

Of many possible twin study reports that show genetic effects on behavior, a study of families of MZ twin parents is described here, because this design is cited later for another application. Families of adult MZ twin parents yield multiple parent-offspring relationships for genetic and environmental analysis, as illustrated in Figure 2.2. Children in each of the nuclear families derive half their genes from their twin parent, and those genes are identical with genes of the parent's twin sister or brother, the children's twin aunt or twin uncle. The children and twin aunt or uncle live in different households, so their relationship somewhat parallels that between adopted children

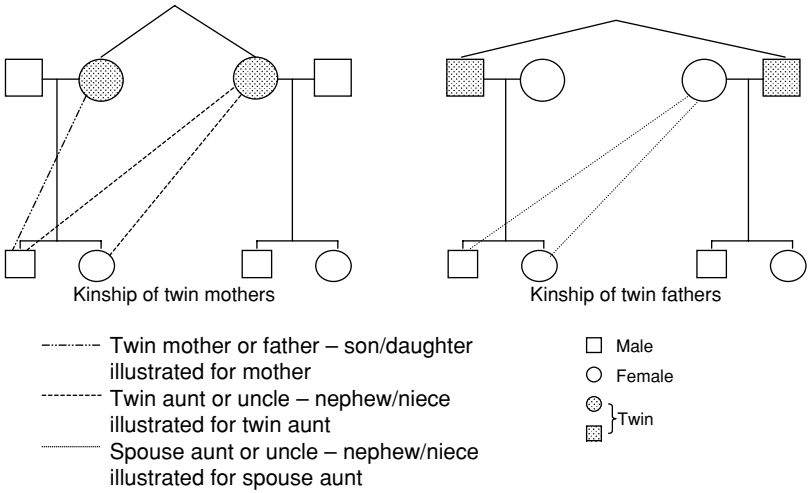

FIGURE 2.2. Parent-child relationships found in families of monozygotic twin parents. *Note* A. The children of identical twin mothers are maternal half-siblings, reared as cousins in separate households; they genetically relate to their twin aunt as closely as they do to their own mother. *Note* B. In the absence of assortative mating, children in a paternal half-sibship share neither common genes nor a common household environment with their spousal aunt. But these children do relate to their twin uncle as closely as they do to their own father.

and their biological parents. But this is a parallel to adoption studies with important advantages: There is no disruption of family milieu, for the children are reared by their own biological parents in their own homes. In adoption studies, biological fathers are rarely available for study, but here, the relationship between nephews or nieces to their twin uncle parallels that of foster children to their biological father. Children of MZ twin parents genetically relate to one another as half siblings; socially, they are reared as cousins in separate households. And, in contrast to conventional half-sibships created through death, divorce, or illegitimacy, MZ half-sibships are of the same age and size.

A measure of nonverbal intelligence, the Block Design test from the Wechsler batteries, was administered to 550 members of 65 MZ twin kinships (Rose, Harris, Christian, & Nance, 1979). To guide interpretation of the results, fingerprint ridge counts of the study population were included in the analyses. Total ridge count, fixed by the 12th week after conception and essentially unaffected by

postnatal environmental influences, is a well-established example of a familial/genetic trait. Across the different family relationships, the magnitude of resemblance found for the two measures directly related to the proportion of shared genes. Children resembled their parents no more than they did the twin parent's co-twin with whom they equally shared half their genes, but not a household environment, and the children showed no similarities to the spousal uncle or aunt to whom they are genetically unrelated. Correlations for the MZ twin parents (genetic correlation of 1.0), the full siblings within each family (0.5), the genetic half-siblings nested within kinships of twins (0.25), and that between twins and their spouses (0.0) paralleled genetic overlap. For neither trait was familial resemblance found in the absence of shared genes: There was no evidence of either environmental covariance or assortative mating. The parallel pattern of heritability estimates for the two traits, illustrated in Figure 2.3, shows close agreement across the multiple relationships within these kinships; the figure also emphasizes the much lower magnitude of genetic influence on this measure of nonverbal intelligence than that found for fingerprint ridge counts. Compared to morphological traits, complex behavior typically shows this pattern of reduced heritability, clearly assigning a significant role to nongenetic influences.

In the same sample of MZ twin families, measures of verbal intelligence yielded very different results. Twins' vocabulary scores correlated significantly with those of their spouse *and* equally highly with the spouse of their co-twin, and the correlation between the paired spouses of the twins was significant, as well, although the twins' spouses of course share neither genes nor household environments (Nance, Corey, Rose, & Eaves, 1981). The implication is obvious: We may not examine fingerprints or assess block design skills of a prospective spouse, but we do engage him or her in conversation, and "if to love is to listen," it is no surprise that we assortatively mate on verbal skills. Additionally, significant maternal effects were found for the vocabulary subtest of the Wechsler Scales (Rose et al., 1980): Correlations for vocabulary scores were significantly higher among children born to MZ twin sisters (maternal half-siblings) than among children of MZ twin fathers (paternal half-sibs, children whose mothers are genetically unrelated). The results could reflect prenatal or postnatal effects, or both, as the source of maternal influence. Identical

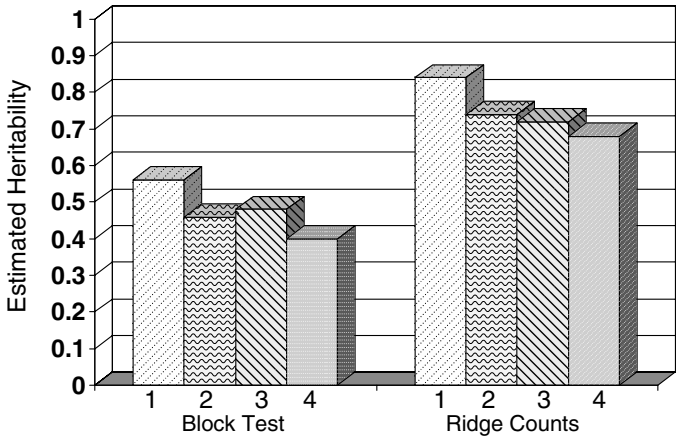

FIGURE 2.3. Heritability estimates obtained for total fingerprint ridge counts and scores on the Block Design subtest in members of families of monozygotic twin parents.

twin sisters may provide more similar patterns of child-rearing than do unrelated wives of twin brothers. Or the greater resemblance of maternal half-siblings may reflect reduced variability of intra-uterine environments of identical twin mothers.

DOCUMENTING ENVIRONMENTAL EFFECTS ON BEHAVIOR

Invariably, a twin study that documents genetic effects on behavior simultaneously shows that genetic variance accounts for much less than the total variation observed, so twin study data routinely reveal that environmental influences account for significant variation in the behavior observed between individuals. Ironically perhaps, it is sometimes suggested that the best evidence for environmental effects comes from twin research efforts to establish genetic effects.

Nonshared Environmental Effects

A common observation offers compelling evidence of effects from nonshared experience: Behavioral correlations of adolescent MZ twin

pairs sharing their lives do not reach unity. Intra-pair differences among adult MZ co-twins are common, and discordance for major outcomes (e.g., diabetes, schizophrenia) characterizes about half of all pairs. For MZ pairs living together, the only systematic source of influence to make them different derives from environmental effects experienced by one twin but not the other. That suggests one approach to identifying such effects: Correlate intra-pair differences in specific behaviors of MZ twin pairs with measured differences in some specific aspect of their experience. An analysis based on adolescent MZ twin pairs from a major study called NEAD (Nonshared Environment and Adolescent Development) illustrates (Pike, Reiss, Hetherington, & Plomin, 1996). Each twin and both of the twins' parents separately reported on negativity in the child-parental relationship of each twin, and each twin's behavioral adjustment was rated from self-report, videotaped observations, and parental ratings. The intra-pair differences in parenting measures of negativity correlated significantly (magnitude $\sim$ 0.30) with intra-pair differences in antisocial behavior. While many twin pairs' differences in the parenting assessments approach zero, suggesting their treatment from parents is highly similar, other pairs seemingly experience quite different parenting environments, and these different environments associate with differential outcomes in MZ co-twins. While interesting and important, the direction of causation in these associations is open to interpretation. Differences in parental treatment may have caused differences in twins' outcomes, but it is equally plausible that twin's behavioral differences caused differences in parenting. And, as always, a third variable may have caused both.

The NEAD study did not select MZ twin pairs who were discordant for parental treatment, but one could do so. The introductory chapter described efforts to confirm between-family associations in within-family comparisons of MZ co-twins discordant for the variable of interest. Selecting MZ twins discordant for specific experience can document long-term effects of specific environmental exposure. For example, analyses of *FinnTwin16* data compared follow-up status of twin pairs extremely discordant for adolescent alcohol exposure. From all tested twins, contrasts were made of that subset of pairs in which one twin was in the upper quintile of the distribution of reported alcohol problems in late adolescence, while that twin's

co-twin was in the lowest quintile. The sample contrasts MZ pairs in which one twin initiated drinking in early adolescence with a rapid trajectory to frequent intoxication and multiple alcohol problems at age 18.5, but the co-twin reports much lower alcohol exposure and few or no alcohol-related problems. Although few in number, such pairs are very informative. Among these drinking-discordant pairs, many significant differences are found at ages 23 to 27 for general health, number of sexual partners, and greater likelihood of unemployment and financial problems, as well as continued intra-pair differences in substance use patterns (personal communication). Associations of discordant outcomes with discordant experience in MZ co-twins confirm the causal role of nonshared environments in behavioral development.

Shared Environmental Effects

Influential monographs (Cohen, 1999; Harris, 1998; Rowe, 1994) have suggested that beyond transmitting their genes, parents have limited influence on their children's outcomes. One version of the "Do parents really matter?" argument is that peers, not parents, are the major source of environmental influence and that, accordingly, the more relevant environment is found in schools and neighborhoods, not in households. A more general argument is that environmental effects on behavior are almost entirely of the nonshared sort, and that experiences shared by siblings while growing up together have negligible effects on their resemblance. Both arguments are overstated and misleading (Rose, 1995; Rutter, Pickles, Murray, & Eaves, 2001). Conventional twin studies and those of adopted siblings, genetically unrelated but reared together, yield compelling evidence of shared environmental effects for some behaviors at some ages (e.g., intellectual abilities in childhood, substance use, sexual experience, and antisocial behaviors in adolescence). Sibling similarity too great to attribute entirely to shared genes is evident in observational assessments made by neutral (unrelated) observers (e.g., Lewin, Hops, Davis, & Dishion, 1993). And, here as elsewhere, study of MZ twins is particularly instructive. The duration of cohabitation of MZ twins prior to their separation and the frequency of their contact subsequent to their separation correlate with pairwise resemblance for many behaviors: co-twins who cohabit longer and those who maintain

more frequent contact are more alike (Rose & Kaprio, 1988; Rose, Kaprio, Williams, Viken, Obremski, 1990). In behaviors subject to significant effects from reciprocal interactions of siblings (delinquency, substance use, early sexual experience), shared influences account for substantial variance (Rowe & Gulley, 1992; Hunt & Rowe, 2003).

Gene-Environment Interaction

Of numerous examples of g-e interaction in recent twin-family research, a twin study that documents an interaction of genetic vulnerabilities with physical maltreatment (severe, nonnormative discipline) is chosen for illustration. The data, from more than 1,100 pairs of 5-year-old British twins and their families, come from the E-risk Study, a twin sample enriched for prevalence of childhood conduct disorder (CD) by over-sampling twins born to young mothers (as described in the Introduction; Arsenault et al., 2003). The analysis of interest here (Jaffee et al., 2005) was set in the context of three established observations: (a) maltreatment places children at elevated risk for conduct problems, but (b) not all maltreated children develop conduct problems, and (c) children's conduct problems are moderately to highly heritable. Jointly, these observations raise the question, Is the likelihood of conduct problems, given maltreatment, modulated by genetic risk? Maltreatment was assessed via maternal report; the children's risk for conduct problems was estimated as a function of their co-twin's status for conduct disorder and the zygosity (MZ or DZ?) of each twin pair. Each twin entered the analysis twice, first as the target twin, whose genetic risk was estimated from the CD status of the co-twin, and second as the co-twin. The target twin's genetic risk was highest if the co-twin was diagnosed with conduct disorder and the pair was MZ; lower for a DZ twin whose co-twin was diagnosed with CD; lower yet for a DZ twin whose co-twin did not have a diagnosis of CD, and lowest for an MZ twin whose co-twin did not meet diagnostic criteria for CD. Results showed that predicted risk of a CD diagnosis varied as a joint function of genetic risk and physical maltreatment. Maltreated children at the lowest level of genetic risk (targeted twins whose MZ co-twin was not diagnosed with CD) had but a 2% increase in risk of CD over those not maltreated; at the highest genetic risk level (among targeted twins whose MZ co-twin was conduct disordered) that risk increased 12-fold, to 24%.

This impressive evidence of gene-environment interaction led the investigators to infer that some genotypes may increase sensitivity to environmental adversity and "certain genotypes may promote resistance to trauma" (Jaffee et al., 2005). The notion that certain genotypes may enhance a child's buffering capacity in the face of adverse rearing while others render children more vulnerable is one that invites much more study with analytic tools from both quantitative and molecular genetics.

And gene-environment interaction may be ubiquitous. Some evidence from the *FinnTwin* studies suggests that parenting behaviors, which have very modest influence as main effects on children's behavior, have very substantial influence as moderators of their children's genetic dispositions (Dick et al., 2005). Rearing environments may have profound influence on children's outcomes not evident as simple and direct effects but via complex interactive pathways that moderate, attenuate, and enhance children's dispositional differences.

PARENTING AND CHILDREN'S OUTCOMES

Correctly evaluating causal connections between parents' behaviors and their children's behavioral outcomes is a complex but critically important challenge. Necessarily, research methods rely primarily on correlational analyses of observations from between-family data. Given that, how should we interpret the many statistically significant associations of family structure and status, home environments, and parental characteristics with behavioral outcomes of children in these families? As with the between-family associations discussed in the introductory chapter, parent-child correlations may reflect the effects of third variables that concurrently influence both parent and child behavior and parent-child relationships. Systematic sources of between-family differences, including differences in parents' education and income, and their social status, their religious attitudes and practices, the family's residential neighborhood and the children's school, the community's cohesion and stability (and many others) demonstrably exert third-variable influences of this kind, correlating with both differences in parenting and differences in children's social and educational development.

Confounding of Genetic and Environmental Effects in Nuclear Families

Worse, there is, in nuclear families, inevitable confounding of the genetic and environmental effects parents have on their children. Parents transmit their genes to their children and concurrently create the family environment in which the children are reared. Genes that influence the parents' behavior and the family environment they create are transmitted to the children to affect the children's behavior. Associations of parenting behaviors and child outcomes, too easily attributed to environmental origins, may be a consequence of genetic factors that influence both (Rutter et al., 2001). Because parents provide the environment for their children *and* transmit their genes to them, the children's environmental and genetic factors are correlated. Under such conditions, spurious associations of parental and child behaviors occur; in the example we consider, associations of parental divorce with offspring outcomes, parental divorce may represent the genetic risk for the outcome itself (D'Onofrio et al., 2003).

Developmental Risks for Children of Divorced Parents

A number of twin-family research designs offer promise in identifying underlying mechanisms for observed correlations between familial/parental measures and children's outcomes (Rutter et al., 2001). To illustrate, we consider the association of parental divorce with emotional and behavioral problems in children affected by it. There is little question of the reality of this association. Nor is the importance of understanding its meaning in question. We ask what insights may be gained by studying the children of twins who are discordant for divorce.

Consider first, the nature of the association to be explained. Negative outcomes observed in children of divorced parents include the two most studied: elevated risk of depression and own divorce. But there are many others, including both behavioral and attitudinal differences compared to controls: less commitment to marriage, a higher frequency of nonmarital relationships, greater likelihood of cohabiting and not marrying (Cherlin, Kiernan, & Chase-Lansdale, 1995), lower educational attainment, and a pattern of life-course trajectories

(O'Connor, Thorpe, Dunn, & Goldberg, 1999) that include a developmentally earlier departure from the parental home, earlier formation of cohabiting or marriage relationships, earlier parenthood, and greater risk of premarital pregnancy.

Thus, children's outcomes associated with parents' divorce are diverse. Effects of divorce on affected children are neither immediate nor direct, and the developmental risks following parental divorce are intercorrelated. Parental divorce seems to set into motion a life course pattern of developmental acceleration of adult transitioning: an earlier departure from the rearing home and earlier parenthood. Parental divorce may act as a trigger that precipitates an unfolding life course pattern (O'Connor et al., 1999).

Such findings suggest that the association of parental divorce with offspring outcomes may, in part or whole, be accounted for by a passive gene-environment correlation or by environmental selection characteristics. Perhaps divorced parents differ from nondivorced parents, and these differences underlie both the marital disruption and the later adjustment problems of their offspring. Perhaps family and parental characteristics that are due, in large part, to genetic influences precede marital separation, contribute to it, and account for postdivorce behavioral problems in the offspring.

Genetic Factors in "Risk" for Divorce and Its Consequences

Data on divorce risks among ever-married Minnesota twins (McGue & Lykken, 1992) support such ideas. In these data, odds ratios of divorce among more than 1,500 adult same-sex twin pairs were calculated from the divorce status of the parents of the twin and parents of that twin's spouse, and the divorce status of each twin's co-twin. The major findings were that "risk" of divorce increased about 10% (a bit less than twofold) if either the twins' parents or the parents of the twin's spouse had divorced; similarly, there was a less than twofold increase in risk for a twin whose DZ co-twin had divorced, but, in contrast, nearly a 6-fold increased risk for the co-twin of an ever-divorced MZ twin. These results, and others, show that divorce is strongly familial, and genetic factors play a role in its familial transmission – presumably via indirect paths of inherited personality characteristics. And one implication of these data is

clear: The developmental outcomes observed in offspring following parental divorce may be due to genetic factors.

A direct test of this inference can be made with data on adopted children who experience divorce of their adoptive parents. In the absence of selective placement, there can be no passive gene environment correlation in adopted families, for the children receive their genes from one set of parents but are reared by another. With data from the Colorado Adoption Study, O'Connor, Caspi, DeFries, and Plomin (2003) assessed difficulties in 12-year-old adopted offspring of divorced adoptive parents; results suggested that associations between divorce and children's behavioral, emotional, and social adjustment may not be entirely environmental in origin, but the analyses were constrained by small samples and limited information on the adopted children's genetic risks.

Children of Divorce-Discordant Twin Parents

An alternative design with the promise of more power is the study of children of divorce-discordant MZ twin parents, the parallel to an adoption design described and illustrated earlier in this chapter. As with direct comparisons of discordant MZ twins, comparisons of children of discordant MZ twin parents yield an estimate of a within twin-family effect that is free from between-family confounds. Assume the twin mothers illustrated in the left side of Figure 2.2 are discordant for divorce: Children in the family of the divorced twin mother inherit her genes *and* experience parental separation, its precursors, and its consequences; children of the other twin mother, although at equivalent genetic risk, are not exposed to the social consequences of parental separation. If the association between parental divorce and child outcome is environmental, these children will exhibit fewer behavioral problems than their maternal half-siblings, the children whose twin mother has divorced. If, conversely, the association of divorce with child outcomes is genetic in origin, outcomes for children in the two families will not differ, for they share the same maternal genes. Equivalent rates of behavioral problems among children of discordant MZ twin parents would show that parental divorce does not have a specific influence on children's outcome. A detailed presentation of the children of twins design in

elucidating causal relations between parent characteristics and child outcomes (D'Onofrio et al., 2003) compares expectations for children of discordant DZ twin parents and develops an analytic model that yields parameter estimates of the role of passive gene-environment correlations; the model is illustrated with data that examined the association of smoking during pregnancy with child birth weight.

Subsequently, this "children of twins" design was applied to the association of parental divorce with children's behavioral outcomes (D'Onofrio et al., in press a). With data from a large sample of families of Australian twins, more than 2,500 children (average age 25 years) of twin parents were studied. Most children were from intact families, but 17.3% had experienced separation of their parents before age 16 and an additional 6% after age 16. Comparisons made of the children of twin parents included their substance use and behavioral problems, with results clearly suggesting that environmental processes specifically associated with parents' marital instability account for the higher levels of psychopathology observed in offspring of divorced parents. A parallel analysis of the same data set (D'Onofrio et al., in press b) for other outcomes yielded results consistent with a causal role of parental divorce in elevated risk of educational problems, depressed mood, emotional difficulties, and earlier initiation of sexual intercourse in early-adult offspring. In contrast, increased likelihood of cohabitation and earlier initiation of drug use were explained by selection factors that included genetic confounds. Results of these two sets of analyses effectively illustrate the potential of twin-family research designs to address enduring issues in the developmental processes of central concern to the Jyväskylä Longitudinal Study and the *FinnTwin* studies.

CONCLUSIONS

This review of genetic and environmental factors in social behavior and health began, and ends, by noting that both genes and experiences are inevitably involved in behavior development and life outcomes. Many of the chapters that follow underscore this point. It may be important to conclude by repeating earlier admonitions (Rose, 1995) on the nature and limits of genetic effects. We seek opportunities to develop and display our inherited dispositional characteristics.

Behavioral differences that define our individuality are not direct consequences of genetic variance; they result from proactive and interactive processes of lifestyle selection. With rare exceptions of some single-gene disorders, genes do not mandate life outcomes. We inherit dispositions, not destinies. Life outcomes are consequences of lifetimes of behavioral choices. The choices are initially guided by our dispositional tendencies, and the tendencies find expression and social reinforcement within environmental opportunities we have actively created. The interaction and correlation of genes and environments are at the core of all developmental study.

3

Social Behaviors and Health in Twins

The FinnTwin *Studies*

Jaakko Kaprio

INTRODUCTION

Family twin, and adoption studies have provided evidence for cultural and biological inheritance in human behavior and health (Boomsma, Busjahn, & Peltonen, 2002). Because currently known genes account for only a fraction of the estimated genetic variance of most traits, more knowledge of the dynamics of gene action and of specific environmental conditions is needed. Twin and twin-family studies with multiple measurements over time can permit a more detailed assessment of the development aspects of behavior, growth, and health, and how the relative roles of genes and environment unfold over time.

After more than a decade of research with the older Finnish twin cohort, which consists of twins born before 1958 (Kaprio & Koskenvuo, 2002), our research group realized in the mid-1980s that development of younger twin cohorts for prospective studies would be of great utility. Studies of children, adolescents, and young adults are needed for such studies of the development of behaviors that are relevant for maintaining health.

In Finland, two longitudinal studies of adolescent twins and their families, each with about 2,700 participating families, form a complementary, ongoing study base: *FinnTwin16*, initiated in 1991 (twins born 1974–1979) and *FinnTwin12*, initiated in 1994 (twins born 1983–1987). The fourth wave of data collection in *FinnTwin16* was

completed in 2003, and the third wave in *FinnTwin12* was completed in 2005. The primary focus in these studies at present is on behavioral traits and growth, and their change over time. Later, as the cohorts age, studies on the relationship of behavior with diseases and disorders relevant to public health will become increasingly possible. This chapter provides updated information on the status of these two cohorts as reviewed in 2002 (Kaprio, Pulkkinen, & Rose, 2002).

These cohorts are used to analyze gene by environment interaction in well-characterized subsets of the cohort, assessing health-related behaviors such as smoking, alcohol use, and physical inactivity, and to examine genetic and environmental determinants of change and stability of growth and behavioral risk factors using multivariate, quantitative genetic models. Genetic and environmental effects on traits vary over the life span and across different environmental conditions. Only longitudinal studies in genetically informative data sets permit the study of such effects.

STUDY COHORTS

In 1986, all twin pairs (including parents of twins) born in Finland during 1958–1986 were identified, with a total of 21,958 twin pairs (estimated 6,114 monozygotic, 7,922 same-sexed dizygotic, and 7,922 pairs of opposite sex) (Kaprio, Koskenvuo, & Rose, 1990; Kaprio et al., 2002). Multiple births were identified through the use of family member links added in the early 1970s for all persons in the Population Register Centre. Thus, persons born on the same day to the same mother were considered multiples. In August 1998, twins born in 1987 ($N = 597$ pairs) were added to the database.

FinnTwin16 Study

The *FinnTwin16* study is a longitudinal study of five consecutive birth cohorts (1975–1979) of Finnish twins, their siblings, and parents. Baseline data collection was initiated in 1991 and completed in January 1996. Pairwise response rates exceed 88%, yielding baseline data on 2,733 twin pairs. Parents and older sibs have also participated in the questionnaire studies, yielding data on substantial numbers of extended twin families.

The baseline assessment of all twin pairs, made within 60 days of their 16th birthdays, includes a survey of health habits and attitudes, a symptom checklist, MMPI personality scales, and relationships with parents, peers, and co-twin. All respondent twins were surveyed again at age 17, again on a monthly basis, with the measures of health habits and health-relevant attitudes, symptom reports, and social relationships. From 1993 onward the third survey was carried out based on four annual mailings, two in autumn and two in spring, timed to ensure that respondents were on average 18.5 years old. The response rate was 95% and this data collection was completed by August 1998.

Starting in the autumn of 2000, we semi-annually contacted the annual birth cohorts, such that twins born in 1975 were contacted then, those born in 1976 and 1977 in spring and autumn of 2001, respectively, and during 2002, twins born in 1978 and 1979 were contacted in the spring and autumn to complete the fourth wave of data collection. The last questionnaires were returned in 2003. Of those who had participated at baseline, we could reach in 2000–2002 a total of 5,594 subjects (2,689 men, 2,905 women) and questionnaires were returned by 4,929 (2,239 men, 2,690 women), yielding a response rate of 88.1% (83% for men, 93% for women). These numbers included 173 questionnaires, out of 196 mailed, returned by twins born in the last three months of 1974, who have been pilot subjects for testing questionnaires at all phases.

In the last wave of data collection we also contacted twins who had not replied at baseline to request their participation and to give them the possibility of declining further participation. Of those who had not participated at baseline, either because they had not chosen to participate or we could not reach them, 307 out of 602 subjects responded (51%). Their questionnaire included items on zygosity not otherwise asked of those who had responded earlier, but the questionnaire was otherwise identical.

The goal of the study is to carry out analyses of genetic and environmental contributions to consistency and change in health-related behaviors during late adolescence and early adulthood. These are periods of significant change in adolescents' and young adults' health habits and in their relationships to peers and parents. In addition, the representative sampling of male, female, and opposite sex twins

in this study is used to evaluate gender modulation of longitudinal effects and gender modulation of the genetic and environmental relationships among health habits, attitudes, and personality.

FinnTwin12 Study

Another five-year birth cohort study, the *FinnTwin12* study, was started in September 1994 to examine genetic and environmental determinants of precursors of health-related behaviors, with particular focus on use and abuse of alcohol, in initially 11–12-year-old twins. Major funding was obtained from the U.S. National Institutes of Health. This research is cast within the perspective of developmental genetic epidemiology, asking whether precursors of risk behaviors are evident to parents, teachers, and classroom peers as early as age 12.

The study has a two-stage sampling design. The larger, first-stage study is an epidemiological investigation of five consecutive and complete birth cohorts of Finnish twin children, including questionnaire assessments of both twins and parents at baseline, starting with a family questionnaire (returned by 2,724 families, 87% participation rate) that was mailed late in the year before the twins reached age 12, with follow-up of all twins at age 14, and again at age 17½ years. For the epidemiological study of Stage-1, we excluded families in which one or both co-twins were deceased or living outside Finland, families in which both co-twins lived apart from both biological parents, and families in which the CPR contained no residential address for a twin.

Five separate questionnaires were mailed at baseline to each twin family: a family questionnaire, usually completed by the twins' mothers, which when returned, was immediately followed by a postal mailing of individual questionnaires to both parents and the two co-twins. Parents not resident with their twins were also contacted. The family questionnaire requested basic information on the twins' gestation and delivery and early development, their zygosity, and the specific school in which they were then enrolled. The baseline questionnaire assessment of the twins' parents includes an 11-item diagnostic screen for alcohol-related problems, enabling us to identify twin children at elevated risk of substance abuse. The twins'

questionnaire included items on self-reported height and weight; time spent with twin and friends, time spent on different activities and hobbies, relationship with parents, atmosphere and caring at home; life satisfaction and pubertal development. At age 12, several months after the baseline questionnaires had been returned, we also sought a rating from parents and classroom teachers of all twins in the epidemiological sample, using a Multidimensional Peer Nomination Inventory (MPNI) (Pulkkinen, Kaprio et al., 1999; Chapter 1). Ratings were completed by 93% of teachers and 92% of parents of the entire Stage-1 twin sample.

Most of the items asked of the twins at age 11–12 were repeated when they were 14. In addition, items on frequency of use of alcohol and intoxication, use by peers of alcohol, own smoking status and peer smoking, alcohol expectancies, self-esteem, and peer use of drugs were included. The age 14 follow-up assessment of all twins, by postal questionnaire, was completed with a participation rate of 88%; 4,740 questionnaires were returned out of 5,362 mailed. The response rates were 87% for boys and 90% for girls.

A second follow-up questionnaire, when participants were 17½, was initiated in autumn of 2000 and was completed in the spring of 2005. Each cohort was mailed questionnaires in either March or April, or September–October closest to the time when they were 17.5 years old. Again, many items are repeated, with additional age-specific items on health behaviors. We also ask for mobile phone and Internet use, as these new means of social interaction are common among today's youth. In all, 4,236 questionnaires were returned out of 4,594 mailed, a response rate of 92.2% for those already participating in earlier questionnaires.

This epidemiological first stage of our *FinnTwin12* study thus includes some 5,600 twins, and 5,000 of their biological parents, and, as expected from population-based ascertainment, the twins form equal proportions of brother-brother, sister-sister, and brother-sister pairs, permitting robust testing of gender modulation of genetic and environmental risks in the development of health behaviors, and appraisal of the magnitude and persistence of effects of variation in pubertal timing.

Nested within this epidemiological, population-based study is the second stage of *FinnTwin12*, an intensive assessment of a subsample

of twin families. Most of the subsample is selected at random, but this random sample is then enriched with twins at elevated familial risk for alcoholism. For inclusion in the intensively studied subsample of Stage-2, we further required that (one or both of) the twins' parents returned the family questionnaire and gave us written permission to initiate school contact, that the family questionnaire contained no new information about the twins (e.g., studying abroad, living at home but severely handicapped) that made them ineligible for inclusion in the study; we then further required that both twins and at least one parent be Finnish-speaking because it was cost-prohibitive to train interviewers to conduct structured psychiatric interviews in Swedish as well as Finnish. (As about 6% of the Finnish population speak Swedish as their mother tongue, all questionnaires were made in both languages.) We have previously assessed the nonresponders at each stage and found no evidence for selection for family type (both vs. single parents), parental age, area of residence, or type or sex of twin (Kaprio et al., 2002).

Of families for whom permission was obtained for school contact, 1,035 were selected for intensive (Stage-2) study. About half are families in which the twins are assumed to be at elevated risk for alcohol problems, given the elevated scores on the Malmö-modified Michigan Alcoholism Screening Test (Mm-MAST) (Silventoinen et al., in press), self-reported by one or both of their biological parents at baseline. We created an 11-item lifetime version of the Mm-MAST, adding two additional items to increase the predictive validity of the Mm-MAST as a screen for *DSM-III-R/IV* diagnoses of alcohol abuse and dependency. We have also found that the Mm-MAST is an effective screen for alcohol problems assessed by interview. Interviews of the parents in these families, using the Semi-Structured Assessment for Genetics of Alcoholism (SSAGA) instrument (Bucholz et al., 1994) have been completed, with a total of 1,864 interviews completed (participation rate approximately 90%).

In-school assessments of the twins, including peer nominations and individual behavioral testing, have been completed for all five cohorts. In this study, both co-twins were in the same class for nearly 90% of the twin pairs. The twins of the present study were in 1,002 classes, with a mean class size of 25 students. The twins had 23,200 classmates of the same age; 11,297 girls and 11,903 boys, for whom

peer nominations were also obtained. These provide an extraordinary resource for comparing the different aspects of the behaviors of twins and singletons in an exceptionally large and representative study population (Pulkkinen, Vaalamo et al., 2003), and we have shown that there are at most only minor differences in behavior of twins and singletons. This indicates that twinship is often an advantage and among preadolescent twins does not seem to be a disadvantage compared to same-aged singletons.

The adolescent SSAGA interviews are complete, yielding 1,854 completed interviews (90%). The twins' interviews (with the adolescent version of children's SSAGA, C-SSAGA-A, which provides diagnoses and symptom counts of several psychiatric disorders, including alcohol abuse and dependence, drug abuse and dependence, conduct disorder, oppositional disorder, depression, anxiety, suicidal behavior, anorexia, and bulimia) are highly standardized for the adolescent twins' age, given the very dynamic nature of alcohol use and risk-associated behaviors in mid-adolescence; accordingly, we completed 90% of adolescent interviews within 6 months of the participants' 14th birthday. We found no systematic source of bias in the small subset of parents and twins whom we have not been able to interview. Adolescent interviews are conducted face-to-face using custom software and a notebook PC to enter the twins' responses online. In addition, neuropsychological tests (Trails, Mazes, California Stroop) are conducted, and for 1986 and 1987, saliva samples for hormonal assays (cortisol, testosterone) were collected (Eriksson et al., 2005).

We have examined associations of testosterone (T) and alcohol use in adolescent twin brothers, conducting both between- and within-family analyses. In analyses of twins as individuals, higher T levels, adjusted for time and season of sampling, characterized boys reporting ever drinking, more frequent intoxication, high density drinking, more alcohol symptoms, and diagnosed alcohol dependency on interview. Adjusting for pubertal development, only associations with symptom count and diagnosis remained significant. The association with frequent intoxication was replicated among drinking-discordant twin brothers, effectively ruling out between-family confounds, but that association was not significant after adjustment for pubertal development (Eriksson et al., 2005).

The *FinnTwin12* dataset represents a very rich longitudinal design, with a genetically informative component (twins and parents), with assessments of twins' behavior based on self, co-twin, peer, parent, and teacher reports. We plan continuing assessments of both the total epidemiological sample and the more intensively studied subsample as the twins age.

IN-DEPTH STUDIES OF SUBSAMPLES

There are many analyses in progress based on these cohorts and the data that have been collected. In the following we briefly, and not exhaustively, describe major subsample studies not otherwise described in the chapters of this book.

Consequences of Adolescent Alcohol Use

From the *FinnTwin16* database, we have invited for further study twin pairs concordant and discordant for their alcohol use developmental trajectory. Starting in the spring of 2002, we are studying pairs using a structured psychiatric interview, blood tests, neuropsychological testing, and electroencephalogram/event-related potentials measures. We studied 302 pairs in this NIH-funded study. The clinical phase started in January 2002 and data collection was completed by summer of 2005.

Eating Disorders

In the fourth wave of the *FinnTwin16* sample, eating disorders and related body image items were included. Among the first analyses to be reported, various eating and body size-related factors and psychosomatic symptoms were significantly associated with two Eating Disorder Inventory (EDI) scales (high body dissatisfaction and drive for thinness) in both genders (Keski-Rahkonen et al., 2005). In women, early puberty onset, early initiation of sexual activity, and multiple sex partners were statistically significant risk factors of body dissatisfaction. In gender-specific univariate twin models, the heritability of body dissatisfaction was 59.4% (95% confidence interval [CI] = 53.2 − 64.7%) and that for drive for thinness 51.0% (95% CI = 43.7 − 57.5%).

No genetic effects were present for men, indicating that there are very distinct gender differences in the heritability patterns of body dissatisfaction and drive for thinness in young adults (Keski-Rahkonen et al., 2005).

As a part of the *FinnTwin16* study, Anna Keski-Rahkonen has been leading a study of the epidemiology and genetics of eating disorders. She identified 177 women with a lifetime diagnosis of eating disorders from the fourth wave of population-based Finnish cohorts of twins born in 1975–79 ($N = 2545$). The fourth wave questionnaire assessed current height and weight, ideal weight, minimum and maximum weight at current height, purging and weight loss behaviors, three subscales of the EDI (Body Dissatisfaction, Drive for Thinness, Bulimia), and the following questions: "Have you ever had anorexia?" and "Have you ever had bulimia?" with possible responses "Yes," "No," and "Not sure." An invitation to participate in the second stage of screening, the telephone interviews, was extended to screen-positive women ($N = 292$), that is, to women who fulfilled the following screening criteria: they responded "Yes" or "Not sure" to these questions, or exhibited current (within past 3 months) purging behaviors, or reported a current body mass index (BMI) smaller than 17.6, or had an EDI-Bulimia subscale score higher than 5, or reported a lifetime minimum BMI lower than 17.6 combined with either EDI-Body Dissatisfaction score higher than 10 or EDI-Drive for Thinness score higher than 5. In addition, 146 screen-negative female co-twins and 210 randomly selected screen-negative female controls were invited to participate, with an overall completion rate of 84.7% out of 648 women. Only 12 individuals (1.9%) refused to be interviewed. The rest could not be reached due to changes in cell phone numbers, addresses, and last names, or could not be included due to difficulties in scheduling an interview.

From the interviews, we obtained broadly and narrowly defined current and lifetime diagnoses of anorexia, bulimia, binge-eating disorder, major depression, and obsessive-compulsive disorder, narrow meaning *DSM-IV* criteria and broad including clinically significant but subthreshold symptoms. The interviewers were clinicians who had worked in a tertiary eating disorder unit in Helsinki, Finland, and had received detailed training in conducting the short Structured Clinical Interview for *DSM-IV* (SCID) interview. Interrater agreement was good (mean 0.9, range 0.7–1.0).

From this study sample, we are currently analyzing prevalences, incidences, and outcomes of eating disorders. Preliminarily, 55 women fulfilled the criteria of a lifetime *DSM-IV* diagnosis of anorexia nervosa (AN). At the time of the interview, 69.1% of them reported a full recovery from all ED symptoms, 10.9% had either remitted recently (less than 1 y) or were vague about their current symptoms, and 20.0% were currently ill. A lifetime *DSM-IV* bulimia nervosa (BN) diagnosis was established in 59 women: 55.9% were fully recovered, 20.3% were recently recovered or vague about their current symptoms, and 23.7% were currently ill. More than one-third of individuals with *DSM-IV* AN and almost two-thirds of individuals with *DSM-IV* BN had never received an ED diagnosis from a health professional. Formal treatment was rare.

We invited all participants of the prior eating disorders epidemiological screening study with current anorexic or bulimic symptoms to participate in an in-depth neuroimaging study. This Eating Disorder Neuroimaging (EDNEURO) ($N = 67$) study focused on individuals with current anorexic and bulimic symptoms, their co-twins (one co-twin refused to participate), and healthy control twin pairs. Among the participants, there were only three twin pairs discordant for anorexia nervosa; the rest of pairs with current anorexia nervosa either declined to participate or were medically too unstable to complete the study. Fourteen twin pairs were discordant for bulimia nervosa (6 MZ, 4 same-sex DZ, 4 opposite-sex DZ) and 3 twin pairs (2 MZ, 1 same-sex DZ) were concordant for bulimia. We also assessed 14 control twin pairs where neither twin had an eating disorder. The EDNEURO protocol consisted of the following: psychiatric assessment, Single Photon Emission Computed Tomography (SPECT) and functional Magnetic Resonance Imaging (fMRI) neuroimaging, exercise spiroergometry, anthropometric and dual-energy X-ray absorptiometry (DEXA) measures of body composition, a brief neuropsychological test, a tasting protocol, and blood tests.

Obesity

MZ and DZ pairs concordant and discordant for obesity identified on the basis of the fourth survey are targeted for detailed metabolic and imaging studies; while these are still ongoing, some results have

already been published (Gertow et al., 2004; Kannisto et al., 2004; Pietiläinen et al., 2005; Pietiläinen et al., 2004). Other analyses of body composition in relation to dietary factors are being initiated as part of the DiOGenes project (www.diogenes-eu.org).

Physical Fitness

Finally we have initiated a study of MZ pairs discordant for physical fitness based on the *FinnTwin16* sample. While studies in athletes and untrained subjects suggest that exercise training induces adaptations in cardiac structure and function, the role of genetic variation on the results has largely been ignored in these studies (Hannukainen et al., 2005). To investigate the effects of long-term volitionally increased physical activity on electrocardiographical and echocardiographical parameters, 12 male monozygotic twin pairs discordant for physical activity and fitness were recruited. All subjects completed a VO_2max test, electrocardiography and echocardiography studies. Results show that the volitionally increased physical activity that led to 18% increase in cardiorespiratory fitness induces greater changes in electro- than echocardiographical parameters (Hannukainen et al., 2005). Results from Positron Emission Tomography (PET) imaging and other examinations are still under analysis.

A BRIEF OVERVIEW OF THE ANALYSIS OF TWIN DATA

This section briefly describes the general principles of genetic data analysis for variance components, which is a first step in the exploration of the genetic architecture of a trait or disease. That is, the goal is to establish whether familial – in particular, genetic – factors are of relevance for the trait, and to what degree genetic variation accounts for the total variance of a trait (Thomas, 2004).

The total variance in a behavior, trait, or liability to disease can be divided into additive genetic (A), nonadditive genetic (D), common environmental (C), and unique environmental (E) variance (Boomsma et al., 2002; Lynch & Walsh, 1998). Additive genetic effects occur when the effects of each gene are adding up to affect the phenotype, whereas nonadditive (dominance) genetic effects denote interactions between the alleles of genes, which produce deviations

between the expected, additive genotypic value and actual genotypic value in the heterozygote. The additive and nonadditive effects add up over all the genes contributing to the phenotype. Interactions between genes (also known as epistatic effects) are seen as nonadditive genetic effects.

Environmental variance can be divided into shared (also called sometimes common) and unique components. Shared or common environmental effects denote all those aspects of the environment that lead family members, including co-twins, to be similar. In contrast, unique environmental factors affect only one member of the family. The estimate of unique environmental variance contains error variance, because random measurement error also decreases correlations between family members. Following from this definition, the same aspect of the environment can serve as a common or unique environmental factor depending on its influence on family members. For example, parental behavior may either influence all children similarly, acting as a common environmental factor, or it may be experienced differently by each sib, thus acting as a unique environmental factor.

The twin method is based on differences between the two types of twins: monozygotic (MZ) twins, who are genetically identical, and dizygotic (DZ) twins, who share on average 50% of their segregating genes, like any other siblings. The comparison of trait similarity between the co-twins of the two types, measured using the correlations between the co-twins, provides first pass information on the genetic and environmental contribution to the phenotypic variation of that behavior. An MZ twin correlation double the DZ twin correlation indicates additive genetic effects, whereas genetic dominance will reduce the DZ twin correlation to below half of the MZ twin correlation. DZ correlations more than one-half the MZ correlation provide evidence for shared environmental effects (Posthuma et al., 2003). While comparing MZ and DZ correlations provides useful initial guides to the partitioning variance, evaluation of different genetic models is best done by formal statistical models. Using Mx (Neale & Cardon, 1992; Neale, 1994), a tailor-made program for genetically informative data or other structural equation modeling programs, alternative models can be compared in which different components of variance are specified, and goodness of fit statistics

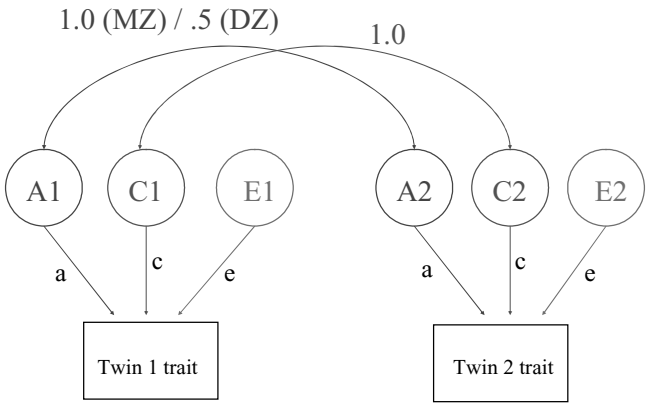

FIGURE 3.1. A path model for the univariate classic twin model to estimate the relative contributions of additive genetic effects (A), shared environment (C), and unique environment (E).

assess how well the various models fit the data. Scripts for different designs and models are available at the Genomeutwin Mx-script library (www.psy.vu.nl/mxbib/) in addition to the Mx-homepage (www.vcu.edu/mx/).

Figure 3.1 illustrates a path model for the univariate classic twin model to estimate the relative contributions of additive genetic effects (A), shared environment (C), and unique environment (E). A, C, and E are latent variables that regress on the measured trait in the twins (1 and 2), the value of the path (a, c, e) from the latent variable to the phenotype being regression coefficients. Thus, under an ACE model, the MZ covariance is expected to be equivalent to $a^2 + c^2$, while the DZ covariance is $\frac{1}{2}a^2 + c^2$. The fit of this model can be compared to submodels AE, CE, and E, in which the relevant paths are set to zero, and the change in model fit is assessed. Examples of univariate analyses are provided in Chapters 5 and 7.

Figure 3.2 illustrates the expansion of the basic twin model to a multivariate analysis, in this case a bivariate analysis exploring the relationship between two variables. This can be used to decompose the phenotypic correlations between traits 1 and 2 into proportions accounted for by genetic and environmental factors. Thus, the degree of relatedness of the genetic factors influencing trait 1 with the genetic factors influencing trait 2 can be estimated as the genetic correlation

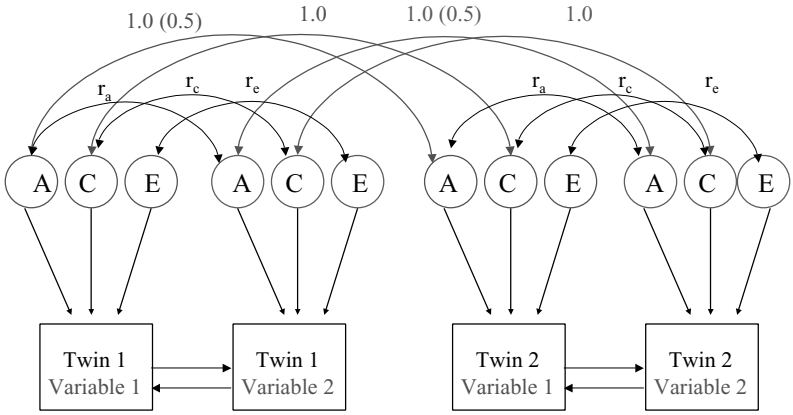

FIGURE 3.2. The expansion of the basic twin model to a multivariate analysis, in this case a bivariate analysis exploring the relationship between two variables.

(r_a) between the latent genetic variables of traits 1 and 2, respectively. Correspondingly, the model can estimate the correlation (r_c) between the shared environmental effects on the two traits, and the correlation (r_e) between the unique environmental effects on the two traits. Such a model with twin data is useful to assess to what degree two traits share the same genetic (or familial) background, and it can be extended to many traits to explore in more detail the quantitative genetic architecture of the traits. Alternatively, the variables from a bivariate or multivariate model may represent multiple measurements of the same trait over time in a longitudinal study. Then, the nature of the stability of the trait over time can be explored as illustrated by the analyses of weight and body size in Chapter 4, and of substance use in Chapter 6.

The models can be more complex, incorporating data on parents (Keski-Rahkonen, Viken, Kaprio, Rissanen, & Rose, 2004), other sibs, and other family members. With data on parents, the transmission of the family environment (i.e., cultural transmission) (Cavalli-Sforza & Feldman, 1981; Fulker, 1988) as well as assortative mating can be estimated. The contribution of shared social environment ("social homogamy") and direct spouse selection ("phenotypic assortment") can be estimated from data on twins and their spouses, principally by assessing the relative similarity of the spouses of MZ pairs with

the similarity of spouses of DZ pairs (Reynolds, Baker, & Pedersen, 1996; Silventoinen, Kaprio et al., 2003).

For longitudinal data on twins and families, growth models of various kinds can also be fit; these differ from the multivariate models outlined above in requiring only a small number of parameters to describe covariation across many occasions of measurement (Neale & Mcardle, 2000). Other useful models for the analysis of twin data are those exploring the nature of sex differences, as the correlatedness of same-sex DZ and opposite-sex DZ pairs can be used in what are known as sex-limitation models. These ask whether sex differences are accounted for by different genes acting in males and females, or different environments of males and females as illustrated in Chapter 8. Recently models to describe and estimate gene-environment interactions have been developed further (Purcell, 2002) and are illustrated by some analyses described in Chapter 6.

The genetic identicalness of MZ pairs may change over time as epigenetic and various environmental effects modify gene expression in the twins, even though their genomic DNA remains unchanged, except for possible somatic mutations (Gottesman & Hanson, 2005; Wong, Gottesman, & Petronis, 2005; Martin et al., 1997).

PROSPECTS FOR TWIN RESEARCH IN THE POST-GENOMIC ERA

As mentioned above, one of our goals is to evaluate and detect gene-environment interactions in behavioral development using a longitudinal twin-family design. The longitudinal aspect of studies with repeated measurements can be analyzed as if it were a study of individuals, predicting behaviors and health status at a later time from baseline or early follow-up. The data can also be used to evaluate the genetic contribution to interindividual variability of traits, and to the stability or change of a trait over time. The inclusion of parental data permits evaluation of assortative mating effects and generational transmission through the use of twin-family models (Neale & Cardon, 1992).

A challenge for analysis will be to combine all aspects of these designs and integrate measured genotypic and specific environmental measures, to provide an integrated picture of the development of the traits of interest with models that are realistic and can take into

account the complexity of the data. The development of better models makes it feasible to delineate effects of the environment within genetically informative designs, be they twin or family designs, and so analyses describe ever more complex gene-environment interactions. Finally as DNA is collected and advances in genetics further our ability to identify genes influencing complex traits and diseases, the next challenge facing researchers is to characterize the risk associated with specific genetic variants to better understand how these susceptibility genes are involved in the pathways leading to illness (Dick, Rose, & Kaprio, in press).

PART II

ADOLESCENT HEALTH-RELATED BEHAVIOR AND ADULT HEALTH

This section illustrates the use of longitudinal data in the study of growth and puberty, health behaviors, and self-rated health. Research results presented in Part II are based on JYLS data (Chapters 4 & 6) and *FinnTwin12* and *FinnTwin16* data (Chapters 4, 5, 6, 7). For the twin data, information from the parents is also used.

Chapter 4 by Kinnunen, Pietiläinen, and Rissanen examines the determinants of growth and the critical periods in the development of obesity from birth through childhood and adolescence to adulthood. In twin families, size of twins at birth is tracked to late adolescence and early adulthood but the tracking of height was more substantial than the tracking of relative weight. Length at birth and parents' height were the main predictors of final height and birth weight, whereas parents' body mass index (BMI) and mother's smoking during pregnancy were the most significant determinants of early adult BMI. In the JYLS sample, childhood BMI was a better predictor of adult obesity than size at birth. Young adults, especially the males, were at high risk of gaining weight in both study samples.

Chapter 5 by Dick and Mustanski documents the major contribution of genes to variation and familial aggregation of puberty assessed either as age at menarche or using measures such as the Pubertal Developmental Scale. However, several environmental factors importantly influence individual timing, and one is father absence; girls whose fathers are absent from the home experience puberty at an earlier age in our twin data. Data from the Finnish twin studies

also suggest a significant relationship between early maturation and increased substance use in both girls and boys, and this is found also in within-family analyses. These findings underscore the need for continued research to elucidate how individual specific risk factors, such as pubertal timing, act and interact with familial and other environmental factors to impact developmental outcomes.

Chapter 6 by Dick, Barman, and Pitkänen examines factors that contribute to the initiation and continuation of patterns of substance use. While environmental factors, of which several are studied in more detail in the chapter, appear to be particularly relevant for the initiation of smoking and drinking, once initiated, patterns of substance use among adolescents are under significant genetic influence. For drinking frequency, there are substantial increases in the importance of genetic factors with age, while the magnitude of genetic influence on smoking remains relatively stable in adolescence. Importantly, the relative impact of genetic and environmental factors is significantly moderated by environmental context. There are thus complex interactions of genetic and environmental influences that contribute to the initiation and progression of substance use.

Chapter 7 by Silventoinen, Lahelma, and Kaprio first reviews the knowledge base about self-rated health and the advantages and limitations of this health indicator. Analyses of family and individual-based socioeconomic factors predicting self-rated health from adolescence to early adulthood in the *FinnTwin16* study are presented. Genetic factors are shown to play a role in self-rated health, but change during aging. Policy implications of the results are discussed.

4

Body Size and Overweight From Birth to Adulthood

Marja-Liisa Kinnunen, Kirsi Pietiläinen, and Aila Rissanen

INTRODUCTION

Obesity has increased dramatically over the past decades worldwide in both sexes, all age groups, all ethnicities, and all educational levels. The International Obesity Task Force estimates that over one billion people around the world are now overweight; that is, they have a body mass index (BMI) of 25 kg/m² or more. Obesity is fast approaching tobacco as the top underlying preventable cause of death.

Most notably, obesity has increased in the young. In the United States (Jolliffe, 2004) and in many European countries such as Finland (Kautiainen, Rimpelä, Vikat, & Virtanen, 2002), the prevalence of overweight in children and adolescents has doubled in the past two decades. From a public health perspective, one of the most significant concerns is that many of the overweight children grow up to be overweight or obese adults. In addition to the adverse effects on health, the social stigma related to obesity is substantial and already present at an early age for these children, underscoring the importance of preventive strategies for avoiding obesity and maintaining a healthy weight across all ages. Accordingly, longitudinal research is necessary to identify the determinants of growth and the critical periods in the development of obesity from birth through childhood and adolescence to adulthood. The *FinnTwin16 (FT16*) and the Jyväskylä

Longitudinal Study of Personality and Social Development (JYLS) studies provide an opportunity to investigate these questions. In both samples, BMI was used as a measure of obesity and it was calculated by dividing weight in kilograms by the square of height in meters (kg/m^2).

In the *FT16* cohort, the participants' parents provided information about twins' body size at birth and the twins themselves were asked about their weight and height at ages 16, 17, 18.5, and 23–27 years. Both birth and 16-year baseline data were available from 2,188 twin pairs: 702 same-sex monozygotic (MZ) pairs, 724 same-sex dizygotic (DZ) pairs, and 762 opposite-sex DZ pairs. Follow-up data at 23–27 years was available for 1,990 pairs: 658 MZ, 664 same-sex DZ, and 668 opposite-sex DZ pairs. Information was available on both parents' height in 1,708 families, on both parents' BMI in 1,684 families, and on both twins at birth and at 16 years (Pietiläinen et al., 2001). Parental body size and socioeconomic status were recalled from the parents when the twins were 16 years old.

In the JYLS sample, information on birth weight was obtained from child welfare clinics ($n = 193$; 100 boys and 93 girls), and on height and weight at ages 7 ($n = 201$; 103 boys and 98 girls) and 14 ($n = 184$; 89 boys and 95 girls) from school health services. The participants ($n = 214$; 106 men and 108 women) were examined at age 42, when weight and height were measured with participants barefoot and in light clothing to calculate BMI at age 42. BMI at age 26 was calculated from self-reported weight at age 36 ("How much did you weight 10 years ago?") and from height measurement at age 42. BMI at age 36 was based on self-reported weight at that age ("How much do you weigh now?") and on height measurement at age 42.

The cutoffs for overweight in childhood were based on the international reference values (Cole, Bellizzi, Flegal, & Dietz, 2000). At age 7 in the JYLS, boys with a BMI over 17.92 kg/m^2 and girls with a BMI over 17.75 kg/m^2 were defined as overweight. At age 14, the cutoff values were 23.29 for boys and 23.94 for girls. In the *FT16*, the cutoff values were 23.90 and 24.37 at 16 years; and 24.46 and 24.70 at 17 years in boys and girls, respectively. In both studies, overweight adults (both men and women) were those who had a BMI equal to or higher than 25.0.

BODY SIZE AT DIFFERENT AGES

Twins are usually born approximately 3 weeks earlier and are nearly one kilogram lighter than singletons at birth. This was the case for the *FT16* twins compared to the JYLS singletons. In both studies, boys were significantly larger than girls at birth. In the *FT16*, the boys averaged 2,750 g, 47.6 cm, 12.0 kg/m² and the girls 2,627 g, 46.9 cm, 11.8 kg/m² at birth. In the JYLS, the newborn boys weighed 3,667 g and the girls 3,404 g.

MZ twins tend to weigh approximately 100 g less at birth than DZ twins (Loos, Derom, Vlietinck, & Derom, 1998), a pattern that was found in the *FT16* sample (Pietiläinen et al., 2001) as well. This size difference at birth is probably responsible for the finding that MZ females in the *FT16* remained approximately one cm shorter (165.3 cm) in final height at 23–27 years than same-sex DZ females (166.3 cm) (Silventoinen et al., 2003). MZ females weighed 60.5 kg and had a mean BMI of 22.1 kg/m² whereas in DZ females, the corresponding values were 62.2 kg and 22.5 kg/m² (Schousboe et al., 2003). MZ and same-sex DZ males had comparable heights, weights, and BMIs at all ages after 16 years. At 23–27 years, their mean heights were 179.3 and 179.5 cm, mean weights 76.7 and 76.9 kg, and mean BMIs 23.3 and 23.4 kg/m². In the JYLS, mean weight at age 7 was 22.3 kg in females and 23.6 kg in males, mean height was 121.6 cm in females and 122.7 cm in males, and mean BMI was 15.0 in females and 15.7 in males. At age 14, mean weight had risen to 49.9 kg in females and to 50.9 kg in males, mean height was 160.4 cm in females and 163.2 cm in males, and mean BMI was 19.2 in females and 19.0 in males. At age 42, mean weight was 68.3 kg in females and 86.1 kg in males, mean height was 164.8 cm in females and 178.8 cm in males, whereas mean BMI was 24.8 in females and 26.9 in males.

Previous studies suggest that young adulthood represents a critical time for weight gain (Lahti-Koski, Vartiainen, Mannisto, & Pietinen, 2000; Lissner, Johansson, Qvist, Rossner, & Wolk, 2000). This was confirmed in both the *FT16* and the JYLS (Figure 4.1). Less than 10% of the participants in both samples were overweight before the age of 18, but after they reached adult ages, the prevalence of overweight in the sample increased enormously. The largest proportionate changes occurred in males, among whom the number who were overweight

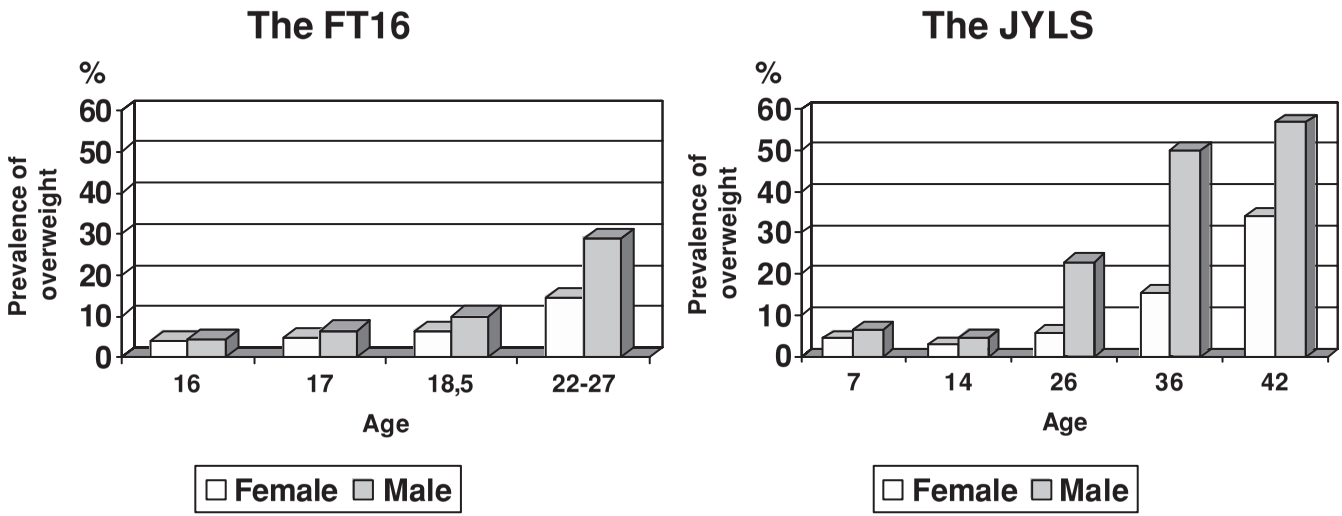

FIGURE 4.1. Prevalence of overweight in the *FT16* and the JYLS.

increased from 5% at age 14 to 33% at age 26 in the JYLS and from 10% at age 18 to 29% at age 23–27 in the *FT16*. Young adult females were less overweight than the males: The prevalence of overweight was 9.5% at age 26 in the JYLS and 15% at age 23–27 in the *FT16*. The sex difference in the JYLS sample might partly be because weight at age 26 was based on self-reports 10 years later. Females rather than males might have reported their weight lower than it actually had been. Overweight kept on increasing and the sex difference remained over the life course: As many as 74% of males and 50% of females were overweight at age 42 in the JYLS.

Tracking of Body Size from Birth to Adulthood

In the *FT16* individuals, body size was shown to track from birth to late adolescence (Pietiläinen et al., 2001). One finding – that the MZ females who were smaller at birth than DZ females remained shorter in adulthood – suggests that smallness tends to persist. Furthermore, the correlation between birth length and 16-year height was .39 in males and .36 in females, and the correlation between weight at birth and BMI at 16 years was about .10 in both sexes. In the JYLS, the correlations between weight at birth and BMI at 14 years were even smaller, namely, .05 in males and .02 in females. In *FT16*, a univariate regression analysis revealed that every 100 g increase in birth weight increased adolescent height 0.4 cm and every cm increase in birth length resulted in a 0.9 cm increase in height at 16. For each kg increase in birth weight, BMI at 16 years increased 0.5 kg/m^2. The effect of cm increase in birth length to adolescent BMI was negligible (0.04 kg/m^2).

To enable comparisons of height and weight units, the data were converted to age- and sex-specific Z-scores (Cole, Freeman, & Preece, 1998). Regressions on Z-scores revealed that height at 16 years was much more dependent on size at birth than was BMI at 16 years. Each unit increase in the Z-scores for weight or length at birth resulted in an approximately 0.20 unit increase in adolescent height whereas one unit increase in birth weight gave rise to about 0.08 and one unit increase in birth length about 0.04 units in BMI at 16 years. Thus, although both weight and height tracked, the tracking of height was more pronounced than that of BMI.

TABLE 4.1. *BMI Means, Standard Deviations (SD), and Correlations Between Different Ages in the JYLS. Correlations for female participants are above and for male participants below the diagonal.*

		1.	2.	3.	4.	5.	Mean (*SD*)
1.	BMI 7		0.68**	0.51**	0.44**	0.39**	15.0 (1.38)
2.	BMI 14	0.53**		0.52**	0.37**	0.45**	19.2 (2.34)
3.	BMI 26	0.58**	0.53**		0.74**	0.67**	21.5 (2.45)
4.	BMI 36	0.45**	0.35**	0.68**		0.80**	23.3 (3.65)
5.	BMI 42	0.41**	0.47**	0.65**	0.89**		24.8 (4.11)
Mean (*SD*)		15.7 (1.52)[a]	19.0 (2.37)	24.3 (3.43)[a]	25.9 (3.38)[a]	26.9 (4.26)[a]	

[a] differs from females at $p < .01$

** $p < .01$

TABLE 4.2. *Multinomial logistic regression analyses on the risk of belonging to trajectories of Overweight or Obese compared to trajectory of Normal Weight.*

Variables	Trajectory of Overweight ß	Trajectory of Obese ß
Sex (f = 1, m = 2)	1.88***	2.54***
Childhood BMI		
BMI at age 7	0.64**	0.81**
BMI at age 14	0.24	0.37*

*** $p < .001$. ** $p < .01$. * $p < .05$

Although the tracking of BMI was weaker, it could be seen in the JYLS. Correlations between BMI in different ages showed that the BMI tended to be rather stable during the life course (Table 4.1). In order to investigate the tracking of BMI more closely in the JYLS, different developmental trajectories for adulthood BMI were constructed and childhood BMIs were investigated as predictors of these trajectories using multinomial logistic regression analysis. The trajectories were estimated using a censored normal model in a Statistical Analysis System (SAS) for estimating group-based trajectories (SAS-TRAJ) (Nagin, 1999). More details about trajectory analysis are given in Chapter 15.

For data on participants from ages 26 to 42, a three-trajectory model of BMI was found to fit best. The fit was assessed based on the Bayesian Information Criterion (BIC) index (see Chapter 15). The trajectories were labeled Normal Weight, Overweight, and Obese (Figure 4.2). All three trajectories were linearly ascending and differed from each other only in terms of the level in body mass and of the angle of ascent: The Normal weight trajectory ascended least and the Obese trajectory ascended most. The trajectory of Normal Weight, which accounted for 46.7% of the participants ($n = 100$, 32 men and 68 women), was composed of individuals who remained at normal weight although they showed a slight weight gain during the follow-up. Participants in the trajectory of Overweight (43.0%; $n = 92$, 57 men and 35 women) were normal weight at baseline but became overweight. Finally, 10.3% of the participants ($n = 22$, 17 men and 5 women) who fell into the trajectory of Obese were already

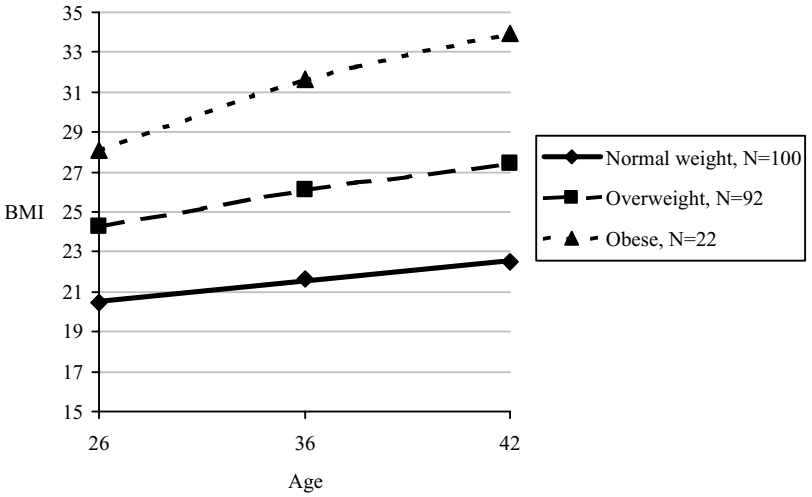

FIGURE 4.2. Trajectories of BMI in adulthood in the JYLS.

overweight in the beginning and gained weight to become obese. All probabilities of individuals' group membership on a given trajectory were over 0.90, which implies that the grouping had been successful.

Statistically significant probabilities of belonging to the trajectories in question were predicted by sex and childhood BMI. (Table 4.2). Men and those who weighed more than the others at age 7 fell more often into the trajectories of Overweight and of Obese compared to the trajectory of Normal Weight. Additionally, 14-year-olds who weighed most were more likely to follow the trajectory of Obese than the trajectory of Normal weight.

Smallness at birth and overweight in adulthood are related to the same constellation of chronic diseases (Barker, Eriksson, Forsen, & Osmond, 2002). Body size at birth and growth and health in childhood are, thus, important determinants of adult weight-related health. Socioeconomic status may be another important confounder: People who have better education are expected to be both leaner and healthier (Everson, Maty, Lynch, & Kaplan, 2002). In the JYLS sample, participants' educational attainment was inversely associated with adult blood pressure after researchers adjusted for sex and childhood blood pressure (Kivimäki et al., 2004). However, after further adjustment with adult BMI, the socioeconomic status was no longer significantly related to blood pressure. Birth weight was not associated with adult blood pressure in these models.

TABLE 4.3. *Multivariate Regression Analysis on Body Size at 16 Years in Relation to Prenatal and Parental Characteristics in Twin Individuals. N = 3222. Nonsignificant explanatory variables (twins' zygosity, mother's and father's occupation, mother's age, and the number of parents in the same household) are not shown.*

Variables	**Height at 16 y** β	**BMI at 16 y** β
Twin's		
Birth length	0.147^{***}	-0.185^{**}
Birth weight	0.008	0.089^{***}
Gestational age	-0.067^{***}	−0.035
Order of twin birth	−0.001	-0.006^{*}
Sex (m = 1, f = 2)	-0.057^{***}	-0.010^{*}
Mother's		
Height	0.389^{***}	−0.049
BMI	0.006	0.136^{***}
Smoking in pregnancy	−0.002	0.019^{***}
Father's		
Height	0.306^{***}	−0.005
BMI	0.009	0.155^{***}
All measures R^2	0.63^{***}	0.10^{***}

*** $p < .001$. ** $p < .01$. * $p < .05$

GENETIC AND ENVIRONMENTAL EFFECTS ON THE TRACKING

Findings from previous studies suggest that fatness during adolescence is related to parental fatness but not to fatness at birth (Frisancho, 2000). In the *FT16*, both parental body size and participant birth size were associated with participant size at age 16, but for height, the predictive value of parental and prenatal characteristics was much higher (63%) than for BMI (10%) (Table 4.3). The individuals who were tall at 16 years had been long at birth and had tall mothers and fathers. Heaviness (BMI) in adolescence was related to shortness at birth, large birth weight, and high maternal and paternal BMI. In addition, males were taller and heavier than females, and the co-twins born first were heavier than those born second. Mother's smoking in pregnancy resulted in a larger BMI at 16 years for participants independent of the other variables in the model.

Although smoking mothers tended to have smaller babies, they had heavier adolescents. These relationships were clear from confounding of gestational age, maternal and paternal BMI and height,

and socioeconomic status. Also, in other studies, exposure to smoking *in utero* has been associated with higher incidence of obesity in childhood (Williams & Poulton, 1999) and as adults (Power & Jefferis, 2002). In addition to its effects on obesity, smoking during pregnancy is harmful, for example, because it has been related to higher blood pressure in offspring (Williams & Poulton, 1999). Being small at birth but obese and hypertensive in adulthood would seem a particularly unfavorable combination. Therefore, in the developed societies where poor fetal nutrition is rare, maternal smoking would be the largest single preventable environmental factor likely to threaten fetal health as well as subsequent health of the individual. From the early ages, parental overweight is a very important risk factor for the development and persistence of overweight in the offspring.

Based on family data alone, no one can deduce whether the increased likelihood for obesity in the offspring of obese parents is due to genetic inheritance or the transmission of obesity-promoting environments. However, the incorporation of genetically informative twin models allows us to separate these factors. In the *FT16*, the genetic and environmental architecture of participants' body size changed from birth to adulthood (Pietiläinen, Kaprio, Räsänen, Rissanen, & Rose, 2002). The body size at birth was significantly influenced by fetal environmental factors. In males and females, shared environmental factors (C) accounted for 40% to 60% of the variation in length and 20% to 40% in relative weight at birth; unique environmental factors (E), 30% and 40%; and genetic factors (A), 10% to 40% and 20% to 50% of the variation in length and relative weight at birth, respectively. The importance of genetic factors increased after birth and the interindividual variation in adolescent and adult body size (both height and BMI) was mostly (80% to 90%) explained by genetic factors. The rest was explained by environmental factors. In height, about two-thirds of the remaining environmental effects were shared and one-third were unique for each co-twin. In adolescent or adult BMI, there was no evidence of shared environmental effects. Rather, all environmental effects were unique to the individuals.

The tracking of body size is due to genetic or environmental persistence across growth and development. The consistency or changes in the genetic or environmental determinants can be quantified in a longitudinal twin design by the use of Cholesky models, factor

models, or growth models to estimate correlations between genetic (or environmental) effects at different time points. About 20% to 50% of the covariation between participants' length at birth and height at 16 could be assigned to genetic factors, 40% to 60% to shared environmental factors, and 10% to 20% to unique environmental factors. The shared environmental factors were stable from birth to late adolescence (a shared environmental correlation $r_c = 0.75$), but unique environmental factors and genetic factors were more age-specific, as evidenced by the lower correlations between the E effects ($r_e = 0.25$–0.50) and A effects ($r_a = 0.30$–0.35).

Compared with the tracking of body height, the tracking of relative weight from birth to late adolescence was only modest. Most (70% to 90%) of this covariation was explained by genetic factors, with the remaining 10% to 30% being attributable to unique environmental factors. Neither genetic nor environmental factors stayed stable throughout the growth (r_a, $r_e = 0.10$–0.20), suggesting that new sets of genes were turned on at different growth phases and that age-specific environmental effects contributed to weight gain at each period.

Studying MZ twins offers additional information about environmental stability. If one member of an MZ pair is larger than the other at birth and this difference persists, it is evidence of enduring fetal environmental factors. Namely, intrapair differences in MZ twins are caused by differences in environments and not by differences in segregating genes. We can't exclude the possibility, however, that the rare MZ intrapair differences found are caused in part by epigenetic mechanisms (differences in gene function without a change in the DNA sequence), but the epigenetic regulation of body size is currently incompletely understood. Therefore, in the present analyses, the assumption was that all intrapair differences between MZ cotwins are caused by unique environments. Based on data from the *FT16*, fetal environmental factors had a smaller contribution to the tracking of BMI than to the tracking of height (Pietiläinen et al., 2002). One kg difference in birth weight between the members of an MZ pair resulted in a 2.4 cm and 0.3 kg/m² difference in BMI at 16 years. One cm difference in birth length resulted in a 0.5 cm height difference at 16 years but did not affect BMI (0.03 kg/m²). Because the MZ intrapair differences persist, this is an evidence of long-lasting effects of the fetal environment. However, while birth weight and length predicted

the growth in height, their effects on BMI were much smaller. This suggests that the development of obesity is mostly explained by factors other than size at birth, and underscores the importance of weight in childhood (Eriksson, Forsen, Osmond, & Barker, 2003). This conclusion was also confirmed in the JYLS study where birth weight did not predict the development of adult BMI when sex and childhood BMI were taken into account.

CONCLUSIONS

In summary, data from longitudinal twin studies in Finland have been advantageous in determining the growth trajectories from birth to early adulthood and in defining the genetic and environmental architecture responsible for height and weight development. Size at birth was shown to track to late adolescence and early adulthood, but the tracking of height is more substantial than the tracking of relative weight. Length at birth and parents' height were the main predictors of final height, and birth weight, parents' BMI, and mother's smoking during pregnancy were the most significant determinants of early adult BMI. Variation in size at birth was mostly explained by fetal environmental factors whereas most of the variation of adolescent and adult body size was attributable to genes. Shared environmental effects for height showed considerable carryover effects from birth to early adulthood, whereas the genetic and unique environmental effects were more age-specific. In BMI, both genetic and environmental effects were changing rather than staying stable during growth.

Childhood BMI was a better predictor of adult obesity than size at birth in JYLS. Participants' BMI showed a significant tracking from age 7 to age 42, and the stability of BMI increased with age. Young adults, especially the males, were at high risk of gaining weight. This finding was very pronounced and consistent in both the study samples. Young adults across the BMI range gained weight, but those already overweight gained the most. Ten percent of the JYLS participants belonged to the most severe trajectory of being overweight at 26 and becoming obese at 42. As many as 43% of the initially normal weight participants at 26 became overweight at 42, and less than 50% stayed normal weight through young adult life. It is worth noting

that the participants of the JYLS were 7-year-olds in 1966 and since then body mass of Finnish schoolchildren and number of overweight children have increased a lot (Kautiainen et al., 2002). Thus, more and more children are at risk of becoming overweight and obese adults in the future.

These analyses illustrate the genetic and environmental complexity of body size. Although the heritability is high in both height and BMI, the development of obesity is strongly dependent on environmental factors. Our genes have not changed during the past two decades when the obesity epidemic has evolved; accordingly, the major culprit in the increased prevalence of obesity is an environment that promotes excessive food intake and discourages physical activity (Hill, Wyatt, Reed, & Peters, 2003). In the current environment with freely available, good-tasting, energy-dense food and minor needs for energy expenditure, keeping slim seems to require conscious efforts and inventiveness from individuals. Teaching the skills early in life for maintaining a sensible weight may prove necessary if people are to resist unnecessary and unhealthful weight gain brought about by the mismatch between our ancient genes and the modern environmental infrastructure (Hill et al., 2003). Families and schools are important foci for preventive efforts for children and adolescents. In addition, public health efforts should be put forward to make the environment more conducive to physical activity and to increase the availability and lower the price of healthy foods. Health care systems should be prepared to identify and treat the people at risk for obesity and weight-related problems at early ages.

5

Pubertal Development and Health-Related Behavior

Danielle M. Dick and Brian S. Mustanski

INTRODUCTION

Puberty is a major biological and psychosocial milestone. It is a stage of intense physical development accompanied by substantial increases in circulating hormone levels leading to reproductive capability. Not all adolescents experience the transition to puberty at the same age, and differential pubertal timing among adolescents appears to have important implications for psychological and behavioral outcomes, making this an important area of study for integrative biopsychosocial models of development. There is also evidence that variation in pubertal timing may have different effects in boys and girls. In girls, early maturation relative to same-age peers appears to be a risk factor for many negative outcomes (Stattin & Magnusson, 1990). It is associated with increased family conflict that persists beyond the temporary perturbation in familial relations also experienced by on-time and late maturing girls.

Early developing girls are more likely to engage in a variety of problem behaviors, including precocious sexual behavior, alcohol use, and smoking, among others. They are more likely to report multiple emotional problems, including higher levels of distress, psychosomatic symptoms, adjustment problems, and greater dissatisfaction with weight and body image. Accordingly, early developers may be at increased risk for psychopathology, including depression, anxiety, and eating disorders. Finally, there is some evidence that early

maturing girls are less likely to achieve academic success in adolescence or to pursue education and professional careers.

The effect of pubertal development on behavioral outcome in males has not been studied nearly as extensively as in females. The reasons are likely twofold. Maturation can be more easily measured in females, in whom age at menarche serves as a salient indicator of pubertal development, while no single, reliable indicator exists for boys. Second, early research consistently found a relationship between early maturation and social/emotional advantage for boys (Alsaker, 1995). Early maturing boys have been shown to feel more attractive and to be more satisfied with their bodies. Some studies have also reported that early maturing boys are more popular and self-confident. Other studies have reported early maturation to be related to substance use (Wiesner & Ittel, 2002) and off-time maturation to be related to engagement in delinquent behavior (Williams & Dunlop, 1999). Thus the relationship between pubertal timing and social/behavioral outcome seems to be more complex among boys, with early timing being related both to social/emotional advantage and to substance use, and off-time development related to delinquent behaviors.

Most existent data on antecedents and sequelae of pubertal development have been derived solely from studies of singletons. These data cannot identify the complex interactive processes by which genetic and environmental influences jointly create behavioral differences. Because pubertal development and its causes and correlates are influenced by factors that are both individual and familial, both genetic and environmental, it is critical to use genetically informative data to disentangle those factors in order to draw conclusions regarding the antecedents and consequences of pubertal development. Research on pubertal timing has also been limited by the use of community- and school-based samples. Such samples are often quite homogeneous, and thus, may not fully display the role of variables such as rural/urban differences and social class. Furthermore, these samples have often been created to study early to mid-adolescence, but rarely are these individuals followed beyond the ages of 14 or 15. *FinnTwin12 (FT12)* and *FinnTwin16 (FT16)*, with their broad-based, longitudinal assessments of health-related behavior across adolescence and into young adulthood, have provided a unique

opportunity to study many of the issues central to understanding factors that influence pubertal development, and to examine the impact of variation in pubertal development on adolescent outcome.

MEASURING PUBERTAL DEVELOPMENT

In *FT16*, adolescents were first assessed at age 16; thus, most adolescents had already completed the most dramatic period of pubertal change. Accordingly, pubertal development was assessed (in years and months) at baseline by asking females to self-report on the age at which they began menstruating, and males to self-report on the age at which their voices changed. Age at menarche (AAM) is the most studied marker of pubertal development in girls, because, in addition to its salience as a transitional, biological event, it brings personal, familial, and societal changes (Graber, Brooks-Gunn, & Warren, 1995). Past research has found that women report age at menarche accurately and reliably, even decades later (Brooks-Gunn, Warren, Rosso, & Gargiulo, 1987). Additionally, high retest stability of self-reported AAM ($r \sim 0.96$) has been found among 16-year-old non-twin Finnish girls, age-matched to the twins whose data we report and who were administered the identical questionnaire item (Kaprio et al., 1995). AAM was approximately normally distributed for the 1,894 girls included in between-family analyses: 11.1% of the sample reported AAM when they were younger than 12, 29.0% at age 12, 36.5% at age 13, and 23.4% at age 14 or older. Mean AAM for all girls was 12.80 years, with a standard deviation of 1.13. Girls who reported AAM at age 11 or younger were considered early maturers. Girls who reported AAM at age 12 or 13 were considered on time, and girls who reported AAM at age 14 or older were considered late maturers (Dick, Rose, Viken, & Kaprio, 2000).

More limited data exist on the use of age at voice change as an index of pubertal timing in males. Voice change was approximately normally distributed in our sample, with responses ranging from 8 to 16 years old. The mean age at voice change was 13.75 years ($SD = 1.01$); 11.0% of the sample reported voice change at 12 or younger, 29.4% at age 13, 37.3% at age 14, and 22.3% at 15 or older.

Using a single index of pubertal development is not ideal, as puberty is defined by multiple physical changes, and reliance on

any one indicator necessarily ignores the complexity of pubertal processes and their associations with behavioral outcomes. However, single measures of pubertal development are prevalent in the literature, in part because of a number of issues that complicate research assessment of pubertal development. School officials and parents are reluctant to allow pubertal studies in school settings. Student embarrassment is another complicating factor. More sophisticated methods of rating pubertal development, such as the Tanner stages that document the progression of secondary sexual characteristics, are designed to be used by trained raters, such as nurses or physicians, and are based on actual visual assessment of the developing physiology. Such an assessment may be unacceptable for most school-based studies, and it is not feasible in large, population-based studies. A number of more theoretically agreeable alternatives have been tried, such as using photographs or schematic drawings of unclothed adolescents for ratings, but these, too, have met with resistance (Brooks-Gunn et al., 1987).

In response to the need for an integrative, noninvasive assessment of pubertal processes, Petersen and colleagues developed a measure they called the Pubertal Development Scale (PDS), to be used in interview or questionnaire format (Petersen, Tobin-Richards, & Boxer, 1983). The PDS is a 5-item scale that assesses five changes entailed in pubertal development. In both girls and boys, growth spurt in height, changes in body hair, and skin changes are assessed. Two additional items are sex-specific: girls report on their breast development and age at menarche, and boys report on their beard growth and voice change. Development on each item is rated on a 4-point scale (1 = *no development*, 2 = *development has just begun*, 3 = *development is definitely under way*, and 4 = *development is complete*), with the exception of menarche (which is rated dichotomously as pre- or post-menarcheal, and scored 1 and 4, respectively). The PDS exhibits adequate reliability (median alpha coefficient =.77; Petersen, Crockett, Richards, & Boxer, 1988) and validity, as assessed by comparison with physician rating (mean correlation between physician rating and total PDS score =.71; Brooks-Gunn et al., 1987). In order to encompass broader based assessments of pubertal development, when the *FT12* project was initiated, all individuals were administered the PDS in self-report questionnaire format at ages 12 and 14. PDS scores in the *FT12* sample

were approximately normally distributed for boys and girls at age 14, although they were somewhat positively skewed at age 12 when fewer children had commenced pubertal changes.

CAUSES OF VARIATION IN PUBERTAL DEVELOPMENT

Genetic Influences

The differential developmental and behavioral outcomes among adolescents who differ in pubertal timing underscore the need to study factors that influence pubertal development. A significant body of literature documents a strong role for genetic factors in determining AAM: replicated twin studies find substantially higher correlations in AAM for MZ twins than DZ twins (Golden, 1981; Treloar & Martin, 1990) and mother-daughter and sister-sister correlations in AAM also provide evidence of heritability (Kaprio et al., 1995).

Using data from *FT16*, we have tested genetic and environmental components of variance for AAM through univariate twin analyses using the program Mx (Neale, Boker, Xie, & Maes, 1999) using the general principles outlined in Chapter 3. The best-fitting model in our data was the AE model, in which 78% of the variance in AAM was attributed to additive genetic factors and 22% of the variance was attributed to unique environmental effects. These results closely agree with analyses from other twin cohorts (Treloar & Martin, 1990).

Using data on PDS scores in both males and females in *FT12*, we have undertaken more extensive analyses of genetic and environmental influences on pubertal development (Mustanski, Viken, Kaprio, Pulkkinen, & Rose, 2004). Multi-item assessments allow a more complete measurement of the pubertal process and allow cross-sex comparisons. Attempts at comparing the magnitude of genetic and environmental influences between the sexes, as well as the degree to which similar influences are important, are complicated by the fact that different physiological changes occur in each sex; in girls these include breast growth and menarche, whereas changes in boys include deepening of the voice along with facial hair and penile and testicular growth. Biometric modeling of these changes requires modeling of a latent "pubertal development" variable that allows direct comparison between the sexes, in the context of these distinct,

sex-specific indicators. Modeling of a latent variable also allows for the partitioning of variance into that which is common to all items and that which is item-specific.

We found that most of the variance in the latent pubertal development variable, and in the residual variation of the specific items, was explained by additive genetic influences (A), with small unique environmental effects (E). This suggests that genes largely influence individual differences in overall timing and in the timing of specific pubertal characteristics. We estimated the heritability of the latent pubertal factor at 89%. These results are consistent with our analyses of AAM in females in *FT16*, and the heritability estimate is in the same range as other physiological traits such as body mass index (Pietiläinen et al., 1999). Although the magnitude of genetic and environmental influences did not differ in males and females, our results did suggest that at least some of the genetic influences on the timing of pubertal development in males and females differ.

Supporting this finding is evidence from another study, which determined that the effect of a mutation in the gene for the luteinizing hormone receptor was sex-limited; it causes precocious puberty only in males (Laue et al., 1995). An important exception to the AE pattern of effect on the individual pubertal items was that C effects were found among females for menarche and growth spurt. This is particularly interesting because the majority of research on sociocultural influences on pubertal timing has used AAM as the dependent variable. It is also of interest that when prospective reports of AAM were used in the *FT12* project, we found significant evidence of C, which had not been detected previously using retrospective reports of AAM.

Father Absence

Although genes clearly contribute to variation and familial aggregation of AAM, several environmental factors importantly influence individual timing. Father absence has received increasing attention, and several studies have found that girls whose fathers are absent from the home experience puberty at an earlier age (Moffitt, Caspi, Belsky, & Silva, 1992). In *FT16*, the AAM of girls from families in which the father was absent was significantly lower (12.6 years) than

that of girls from intact families consisting of the biological mother and father (12.8 years). This difference was not seen among girls from families in which the mother was absent.

The fact that we find a trend toward earlier puberty only among families in which the father is absent and not among families in which the mother is absent suggests that precocious puberty is not due to the stress of being raised in a single parent household, but is somehow specific to father absence. These results were replicated and extended with data from the *FT12* sample. Here PDS scores were compared across homes where the biological father was present, homes where the stepfather was present, and homes in which no father was present at age 14. Both boys and girls in father-present homes show less development across every dimension measured by the PDS, and in 4 of 5 items for boys, and in 3 of 5 items for girls, the differences achieve statistical significance. No consistent differences were found between PDS scores in stepfather present and no-father present homes, suggesting that the effect is due to the absence of the biological father rather than the presence of an unrelated older male.

These results support and extend previous findings of accelerated pubertal timing among girls raised in the absence of a father. Several theories have been proposed to account for this relationship. Belsky and colleagues (Belsky, Steinberg, & Draper, 1991) proposed a sociobiological theory in which early family conflict and instability (including father absence) lead to insecure attachment and the belief that others are untrustworthy and that resources are scarce, which provokes earlier pubertal development and sexual readiness.

A second possibility is that the association between father absence and earlier AAM can be accounted for by the genetic inheritance of AAM. To the extent that mothers who experience precocious puberty are more likely to become sexually active at a younger age and marry at a younger age, they are at an increased risk of divorce, often resulting in children raised in a mother-only family. Therefore, their daughters are more likely to grow up in the absence of their biological father, and, due to the high degree of genetic influence on AAM, they will also be more likely to experience early puberty.

A third possibility is that the relationship between father absence and early menarche is a result of the link between human social experience and hormonal activity. A large body of literature has

demonstrated that aspects of animal and human behavior are related to changes in hormones. Although the literature on humans is not as extensive as that on animals, studies have documented the synchronization of menstrual periods among girls living together, and that contact with the opposite sex causes menstrual regularity and shortens the menstrual cycle. Although these studies do not specifically examine pubertal timing, they provide evidence of the relationship between social experience and hormonal functioning.

Pubertal development is clearly related to endocrinological functioning; however, the events that initiate pubertal development in girls and eventually result in menarche are not well understood. This is in part because hormone measurement in studies of humans, especially young adolescents, is rather problematic. The methodologies used in hormonal studies in humans need to be refined so that we can better understand this important component of pubertal development.

In summary, evidence from *FT16* and *FT12*, as well as other genetically informative studies, suggests that pubertal development and its specific indices, such as AAM, are under significant and substantial genetic influence. This appears to be the case for pubertal development measured in both boys and girls, although the specific genetic influences in each sex are not completely overlapping. Other familial factors, such as father absence, may also contribute to variation in the timing of puberty.

CONSEQUENCES OF VARIATION IN PUBERTAL DEVELOPMENT

Smoking and Drinking

One of the most robust associations in the literature on pubertal timing and behavioral outcome is that of early maturation and increased substance use in early- to mid-adolescence in girls. Girls who mature earlier than their peers have an earlier onset of drinking and smoking than their later developing peers (Stattin & Magnusson, 1990); conversely, late maturation seems to be a protective factor for prolonged abstinence. Earlier initiation of substance use is an important phenotype to study, as it is a risk factor for the subsequent abuse of alcohol (Grant & Dawson, 1997), such that initiation before age

13 is associated with markedly elevated risk of later alcohol abuse/dependency.

In *FT16*, we studied extensively the relationship between AAM and substance use. Patterns of smoking and drinking were assessed with multiple items on both baseline and follow-up questionnaires. Each participant was asked her age when she first tried smoking, how many total cigarettes she had smoked in her lifetime, and how often she currently smokes. All girls also self-reported the age at which they first drank beer and the current frequency of alcohol consumption.

Between-family analyses revealed highly significant associations between AAM and substance use in the expected direction (Dick, Rose et al., 2000). Early maturers (classified as girls with AAM at or before 11 years of age) were more likely to initiate drinking at a younger age, whereas later maturers (AAM at or after 14 years of age) were nearly twice as likely to remain abstinent from alcohol at age 16. Additionally, early maturers were twice as likely as late maturers to report weekly drinking at age 16.

Significant associations were also found between AAM and smoking behavior: 34% of the early maturers reported that they were younger than 12 when they smoked their first cigarette, whereas only 13% of late maturers reported being this young. Conversely, only 37% of early maturers reported that they were older than 15 on first trying a cigarette (or had never tried smoking), compared to 56% of late maturers. A similar relationship was observed between AAM and total number of cigarettes smoked: Early maturers were more likely to report smoking more than 50 cigarettes (38% vs. 19% of late maturers), whereas late maturing girls were more likely to report that, at age 16, they had never smoked (43% vs. 30% of early maturers). Similarly, a chi-square test of association between AAM and current smoking habits revealed expected trends between AAM and the most frequent and infrequent categories of smoking; more than two times as many early maturers reported daily smoking, and later maturers more frequently reported having never smoked.

In addition, the large sample size of the population-based *FT16* project allowed us to extend our analyses to study extreme deviance on pubertal timing, as girls who reported AAM at or before 10 years old (~ -2 *SD* from the mean) made up 2.0% of the sample, and girls who reported AAM at age 15 or older ($\sim +2$ *SD* from the

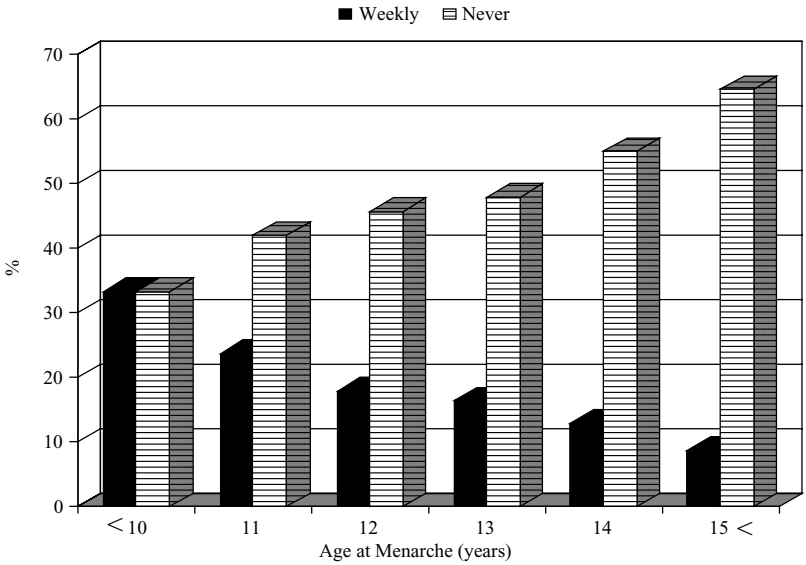

FIGURE 5.1. Relationship between age at menarche and drinking patterns at age 16.

mean) made up 6.8% of the sample. The results indicated that the extremely deviant maturers were also extremely deviant in their current smoking and drinking, even more so than "regular" early and late maturers. Extremely early maturers were *eight times* as likely to report weekly drinking as were extremely late maturers (Figure 5.1). Similarly, extremely early maturers were nearly three times as likely to report weekly smoking as extremely late maturers, whereas extremely late maturers were nearly twice as likely to report abstinence from smoking. The association between AAM and substance use was strongest at age 16 but appeared to decrease over time: Trends were still apparent at 17, 18.5, and even 22–25, both between and within families; however, they were no longer statistically significant after age 16.

Although the limited pubertal development information collected in *FT16* has not enabled us to do extensive analyses on puberty and substance use later in adolescence in boys, preliminary analyses suggest that interesting trends exist, even using the single crude index of voice change: less than 15% of boys who reported that their voice change began at age 12 reported abstinence from alcohol at age 16,

whereas nearly 35% of late-maturing boys who reported that their voice still had not changed by age 16 reported abstinence.

We have replicated the between-family association of pubertal timing and substance use in *FT12*, extending the finding by using the more complete index of pubertal development, by studying substance use earlier in adolescence (age 14), and by using a more valid assessment in boys. In *FT12*, PDS scores were significantly correlated with smoking and drinking practices at age 14 in both boys and girls (Dick, Rose, Pulkkinen, & Kaprio, 2001). For both genders, adolescents who were more developed reported engaging in substance use more often and having more friends who also engaged in substance use. For girls, age 12 PDS scores predicted age 14 substance use nearly as well as concurrent age 14 PDS scores. For boys, age 14 PDS scores were more consistently correlated with age 14 substance use, likely due to the lack of variability in PDS scores at age 12 in boys. Thus, the findings from *FT12* and *FT16* suggest that the association between pubertal timing and substance use across adolescence is parallel in boys and girls, with earlier maturers reporting increased substance use compared to later maturers.

Interpreting Associations

Although the associations between AAM and substance use are robust, between-family analyses are ambiguous in how to interpret this relationship. This is because pubertal timing is associated with a number of between-family differences, such as family structure and family conflict (Graber et al., 1995; Moffitt et al., 1992). Earlier onset of menarche has been associated with having fewer siblings, father absence, and conflictual family relations. That between-family factors associate with pubertal timing confounds interpretation of studies of singletons that report associations between pubertal development and various psychological and behavioral outcomes. Is the relationship between pubertal timing and a behavioral outcome due to pubertal timing? Or to a third factor, arising between families, that correlates with both pubertal timing and the behavioral outcome? For example, the association between pubertal timing and substance use could result from the fact that earlier maturers disproportionately come from families in which the father is absent. Father absence is

an etiological factor in early substance use, and the association of substance use with pubertal timing could result from their common relationship with father absence.

To more rigorously evaluate the relationship between pubertal timing and psychological and behavioral outcome we conducted within-family analyses, testing whether sisters who differ in pubertal timing show the same differences in outcome found in between-family analyses of unrelated singleton girls. In *FT16*, we identified 99 pairs of DZ twin sisters who were most discordant in their age at menarche; these 99 twin pairs – about 23% of the full sample – reported differing by 2 years or more in their AAM. In these pairs, we conducted directional tests of those pairs that were also discordant for their substance use, to examine whether the earlier maturing sister was the sister who was engaging in greater substance use. Not unexpectedly, about half of the pairs did not differ in their reported substance use, as shared, familial factors play a significant role in adolescent substance use. But among pairs discordant for substance use, an association with age at menarche, as found in between-family studies of singletons, was apparent. Among AAM-discordant pairs also discordant for current drinking frequency, the earlier maturing sister was more likely to report drinking more often. Similarly, in the majority of pairs discordant for initiation of drinking beer, the earlier maturing sister reported drinking first. All results from within-family analyses of smoking variables were also in the expected direction. Earlier maturing sisters were more likely to report first trying smoking, having smoked a greater total amount of cigarettes, and currently smoking with greater frequency (Dick, Rose et al., 2000).

Despite evidence for a relationship between pubertal timing and substance use, the pathways by which pubertal timing exerts its influence remain unknown. Perhaps the most widely accepted explanation was offered by Stattin and Magnusson (1990); interpreting data from their own longitudinal study, they proposed that the association results from differential peer influences on behavior. They hypothesized that pubertal timing influences the composition of the peer network, which results in differences in patterns of substance use. Girls who mature earlier are more likely to associate with older peers, resulting in the initiation of a more mature lifestyle at a younger age, including experimentation with alcohol and tobacco. In contrast, later

maturers are more likely to be perceived as developmentally immature and to engage in friendships with chronologically younger peers, resulting in a delayed transition to adultlike behaviors.

In *FT16* we attempted to test this hypothesis by conducting between-family tests of association between AAM and the self-reported proportion of peers who drink beer and liquor. Subsequently, within-family analyses were conducted using the 99 pairs of DZ twins highly discordant for AAM. Between-family analyses were significant: Early maturing girls were more likely to report that more of their peers drink, whereas later maturing girls reported that fewer of their peers drink. However, within-family analyses were not significant. Among the 99 DZ pairs highly discordant for AAM, there was no systematic relationship as to whether the earlier or later maturing sister reported a greater proportion of peers drinking beer or liquor. Thus, although the between-family analysis of AAM and proportion of drinking peers lent some support to the possibility that associations between AAM and substance are mediated by a relationship between pubertal timing and peer networks, we were unable to replicate the association of pubertal timing and proportion of drinking peers within-families – *even though the relationship between pubertal timing and substance use was replicated within families*. This result suggests that peer influences are not solely responsible for the association between AAM and substance use (Dick, Rose et al., 2000).

Another possible pathway by which pubertal development may be associated with substance use outcomes is personality factors. Studies in the substance abuse literature have found that personality differences, as measured by personality scales from the MMPI and Sensation Seeking Scales, associate with substance use and abuse (Mustanski, Viken, Kaprio, & Rose, 2003). The MMPI Pd Scale covers content areas such as family conflict, problems with authority figures, social isolation, and absence of satisfaction in everyday life; these problems have also been reported among early maturers. In addition, studies have found that early maturers are given more autonomy and monitored less by parents and teachers (Silbereisen & Kracke, 1997), which could lead to an enhanced opportunity to develop and engage in sensation-seeking behaviors. Accordingly, an alternative possibility is that the association between pubertal timing and substance use is mediated by personality differences.

In *FT16*, we included the Pd scale of the MMPI at the age 16 assessment, as well as the sensation-seeking scale at age 17. In between-family analyses, Pd scores were associated with AAM, with early maturers more likely to have the highest Pd scores, and late maturers over-represented among the lowest Pd scorers. However, in the 99 DZ pairs highly discordant for AAM, there was no relationship between whether the earlier maturing sister or later maturing sister had a higher Pd score. No relationship was found between AAM and SSS scores. These analyses suggest that it is not through personality differences that pubertal timing exerts within-family, individual-specific effects on substance use.

The literature on AAM could support several alternative explanations for an association between pubertal timing and substance use. Decreased parental supervision among early maturers may allow them more opportunities to engage in delinquent behaviors, such as drinking and smoking. Rejection by developmentally normative, same-age peers may drive early maturers to engage in self-destructive behaviors such as substance use. Shared genes may influence both traits. We are currently exploring these alternative possibilities in data from the younger twin cohort in *FT12*.

Sexual Experience

Previous studies have found that sexual behavior occurs more frequently, and at an earlier age, in early maturing girls (Alsaker, 1995). We replicated this finding using data from *FT16* in between-family analyses of the sample of girls studied for substance use at age 16 (Mustanski, personal communication). In the age 22–25 questionnaire follow-up of these women, we asked a series of questions about their sexual experiences. Although there was no association between AAM and total number of partners, there was a highly significant relationship between AAM and age at first sexual intercourse. Early maturers were more likely to report engaging in sexual intercourse at age 15 or younger (30%), compared to late maturers (10%). Extremely early maturers (AAM $\leq$ 10 years old) were even more likely to engage in intercourse at an early age: 40% of extremely early maturers had engaged in intercourse by the time they were 15, compared to 28% of "regular" early maturers (AAM at 11 years); 20% of the overall sample

had had sexual intercourse by age 15. Conversely, late maturers were more likely to report being 18 or older when they first experienced intercourse, 49% compared to 37% of early maturers.

Interestingly, these analyses were replicated in between-family comparisons. We studied the 99 pairs of discordant DZs examined in our earlier study of substance use; 71 pairs had complete data at the follow-up. Of these 71 AAM discordant pairs, 54 differed in their age at first sexual intercourse, and in 69% of the pairs, it was the earlier maturing sister who reported an earlier age at first intercourse. This finding is particularly interesting, as one might expect that decisions about the initiation of sexual behavior would be influenced by shared family values. However, we replicated the between-family association between AAM and age at first sexual intercourse *within-families*, demonstrating the significant risk relevance of AAM for age at first intercourse.

MODERATORS OF THE RELATIONSHIP BETWEEN PUBERTAL DEVELOPMENT AND OUTCOME

Many risk factors are known to influence behavioral outcomes in adolescence, such as parental and peer influences, school and community influences, and individual-specific risk factors, including genetic influences. Thus, pubertal development is just one of a constellation of factors known to impact adolescent socioemotional health. Current research is attempting to identify how pubertal development acts and interacts within the context of additional risk and protective factors to influence outcome.

As an example, in our analyses of AAM and substance use in *FT16*, the impact of AAM was not apparent within all pairs of sisters who were highly discordant for pubertal timing. This offered us an opportunity to study between-family factors that may moderate the association between pubertal timing and substance use. Other analyses from *FT16* have demonstrated that urban/rural environment moderates adolescent drinking behavior (Rose, Kaprio, Winter, Koskenvuo, & Viken, 1999), and this led us to ask whether the association of AAM with drinking varies by residency status of the twins' family. Using municipal codes and Finnish government statistics, we divided the 99 pairs of AAM-discordant sisters into urban/rural

residential environments and conducted within-family analyses in each group. Of the 99 AAM-discordant DZ twin pairs, 32 pairs were from rural environments and 67 pairs were from urban environments.

We found that the influence of AAM was evident only among girls from urban settings. Earlier maturing girls residing in urban environments were significantly more likely to report more frequent drinking than their later maturing twin sisters, but there was a chance split as to whether it was the earlier or later maturing sister who reported more frequent drinking among discordant pairs residing in rural environments. Thus, the association between AAM and substance use was completely moderated by urban/rural residency. Pubertal timing influenced alcohol use only among girls living in the city and not among those in the country. Diminished influence of AAM in rural settings could be related to the *FT16* finding of greater parental influence on drinking behavior in rural environments. Perhaps when there is a stronger effect of parental drinking on adolescent drinking, pubertal timing is no longer important.

Alternatively, there may be less opportunity to engage in alcohol use in rural settings, where friends are less likely to live nearby and alcohol is less readily available, creating an environment in which individual specific risk factors have a reduced impact on alcohol use. Other analyses of *FT16* data have demonstrated that common environmental influences have a much stronger effect in rural settings, whereas individual-specific factors are more important in urban settings. These findings further support those analyses and identify pubertal development as one of the individual specific risk factors that exerts a larger role in urban settings compared to rural settings.

Analyses by other research groups have also demonstrated contextual modulation of the effect of pubertal timing on developmental outcome. In data from Iowa (Ge, Conger, & Elder, 1996), early maturation and affiliation with mixed-sex friends led to higher psychological distress; distress levels for early maturers who affiliated with girl-only peers were not elevated. Similarly, early maturing New Zealand girls were at elevated risk for delinquency if they attended mixed-sex secondary schools (Caspi, Lynam, Moffitt, & Silva, 1993), and delinquent behavior was more stable and persistent among girls in mixed-sex schools than among those attending same-sex schools. Clearly, developmental consequences of pubertal maturation vary

as contextual variables interact with biological and dispositional differences.

Another complexity regarding the impact of pubertal timing was revealed in analyses of *FT12* data. Virtually all studies have related pubertal development at a certain age to a later outcome; however, not all adolescents are consistent in their developmental level across adolescence. For example, some adolescents may be more physically mature than their peers at age 12, but normative by age 14. With repeated measures of the PDS from age 12 to 14, we explored how developmental stability and change affected the relationship between pubertal development and adolescent substance use. Our longitudinal analyses suggest that the influence of pubertal development on substance use is complex.

Results for substance use variables were in the expected direction for the individuals who were consistent in their developmental level, with earlier maturing girls and boys reporting more substance use by themselves and their peers. Among those who changed developmental level from age 12 to 14 (e.g., were more advanced than their peers at age 12, but average by age 14) the associations between substance use and development were largely inconsistent and unpredictable. Such results underscore complications involved in understanding the impact of pubertal development on behavioral outcome and the necessity of conducting longitudinal studies of development.

CONCLUSIONS

The Finnish twin studies have provided a powerful framework for studying both causal influences on individual differences in pubertal timing and the consequences of variation in pubertal timing between adolescents. We find significant genetic influence on pubertal development in males and females, with genetic factors accounting for nearly 90% of the variation. Common environmental influences appear to play little to no role in pubertal timing, with the exception of age at menarche in females, which shows some evidence of common environmental effects. One such specific familial environment that may be important in influencing AAM is father absence, as suggested by our data and that of other research groups.

Data from the Finnish twin studies also suggest a significant relationship between early maturation and increased substance use in both girls and boys. This association is apparent at ages 14 and 16, although it appears to diminish by age 18, at least in females, as later maturers begin to exhibit a "catch-up" effect. In addition, early maturing girls are significantly more likely to engage in sexual intercourse at a younger age.

Perhaps most important, we replicate these between-family associations in within-family analyses of twin sisters highly discordant for their age at menarche, finding that even within the same family, early maturers are more likely to have increased substance use and a younger age of first sexual intercourse. Interestingly, the association between AAM and substance use is apparent only in girls residing in urban environments, suggesting that the effect of this individual specific risk factor is apparent only in certain contexts. These findings underscore the need for continued research to elucidate how individual specific risk factors, such as pubertal timing, act and interact with familial and other environmental factors to impact developmental outcomes.

6

Genetic and Environmental Influences on the Initiation and Continuation of Smoking and Drinking

Danielle M. Dick, Satu Barman, and Tuuli Pitkänen

INTRODUCTION

Substance use and misuse present major public health problems for essentially all societies worldwide. The World Health Organization (WHO) reports that alcohol causes 1.8 million deaths yearly. Illness related to tobacco addiction causes four million deaths per year worldwide and represents the single largest preventable cause of death. In addition to health consequences, the economic and societal costs related to alcohol abuse and nicotine dependence are substantial, underscoring the importance of research devoted to understanding the development of substance use and abuse.

The initiation of alcohol and cigarette use most frequently occurs at some point in adolescence, although there is considerable variability in when people initiate. Adolescence is an intense developmental period, involving both physical and hormonal changes as well as myriad psychological and cognitive changes, all accompanied by changes in social roles and environments. These transitions are embedded in a sociocultural context; an individual's community, historical period, and culture all influence the experience and impact of adolescence. In addition, individual characteristics such as gender, coping resources, and personality all influence developmental outcomes. Whether an adolescent engages in normative or high-risk behavior can depend on a complex interplay of these individual and environmental factors. Accordingly, longitudinal research is

necessary to study individual differences in paths of development, from childhood through adolescence to adulthood. It also allows prospective identification of precursors to the early initiation of substance use and the development of risky patterns of use. Identifying these precursors is important in order to design programs to prevent problematic substance use and to screen individuals who may be at risk.

Several ongoing studies in Finland have embraced this perspective and provided rich datasets for studying the initiation of substance use and the subsequent development of regular patterns of use. The Jyväskylä Longitudinal Study of Personality and Social Development (JYLS) was initiated by Lea Pulkkinen in 1968, when 12 complete school classes of second-grade pupils ($N = 369$) in the town of Jyväskylä were randomly selected for study. The participants (173 girls and 196 boys) were mostly born in 1959, and they have now been followed for nearly 35 years (see Chapter 1 for details). There are two ongoing population-based developmental twin studies of health risk factors beginning in adolescence: *FinnTwin12 (FT12)* and *FinnTwin16 (FT16)*. Each consists of five birth cohorts of twins who were identified through Finland's Central Population Registry. *FT12* has multiple assessments by self-report, parents, teachers, and peers and encompasses information about home, school, and community environments on adolescents starting at ages 11–12, with follow-up assessments at ages 14 and 17. *FT16* had initial assessments of substance use at age 16, with subsequent assessments at ages 17, 18.5, and 22–25. Accordingly, these studies provide comprehensive assessments on individuals from early adolescence through young adulthood (see Chapter 3 for complete details on the twin studies). The genetically informative nature of the twin data has allowed us to study both genetic and environmental influences on various dimensions of substance use, from initiation to persistence of use across development.

THE INITIATION OF SUBSTANCE USE

Why Early Initiation Matters

Early initiation of alcohol use is a significant risk factor for continued, heavier use and the development of alcohol abuse/dependence

in adulthood. Data from the ongoing JYLS have been particularly informative in explaining the relationship between the age of onset of drinking and subsequent patterns of alcohol use and abuse. Data on the use of alcohol were collected through interview and questionnaire at ages 14, 20, 27, 36, and 42 in this sample; 90.4% of the original participants (155 women and 176 men) have been followed from age 8 to age 42. The mean age of onset of drinking was 15.5 years and there were no differences between the genders (Pitkänen et al., 2005). Four categorized indicators of high adult alcohol use were examined: drinking at least every other day (17.4% of women and 33.9% of men), binge drinking at least once a week (7.7% of women and 22.3% of men), 4–8 points in the CAGE Questionnaire with response options 0 = *no*, 1 = *sometimes*, 2 = *often* (9.8% of women and 27.4% of men), and 6–9 points in Mm-MAST (5.4% of women and 46.0% of men). The CAGE questionnaire includes four questions: (1) Have you ever felt the need to *C*ut down on your drinking? (2) Have you felt *A*nnoyed by criticism of your drinking? (3) Do you feel *G*uilty about your drinking? (4) Have you ever had a drink in the morning to get mid of a hangover (an *E*ye opener)? (Ewing, 1984). Mm-MAST is a Scandinavian Malmö modification of the brief Michigan Alcoholism Screening Test (Kristenson & Trell, 1982). Both gender and the age of onset of drinking were significant predictors of all adult alcohol use measures.

As seen in Figure 6.1, the probability of later drinking problems and high alcohol consumption was higher with an earlier age of onset of drinking, and higher in men than in women. Logistic regression models using age of onset and gender as predictors found that the odds of using alcohol at least every other day decreased by 20% with each year that the onset of alcohol use was delayed, and the odds of weekly binge drinking decreased by 22%, compared to each preceding year. For the alcoholism screening tests, the odds of having high scores on the adult alcohol use measures decreased 27% for CAGE, and 28% for Mm-MAST for each year drinking onset was delayed.

Individuals who initiated drinking prior to age 14 scored significantly higher in all adult alcohol use indicators than individuals who began drinking at age 18 or later (the legal age limit) for both genders. The risks of using alcohol at least every other day, and of drinking heavily at least once a week, were more than 3.5 times higher among those who initiated alcohol use prior to age 14 than among those who

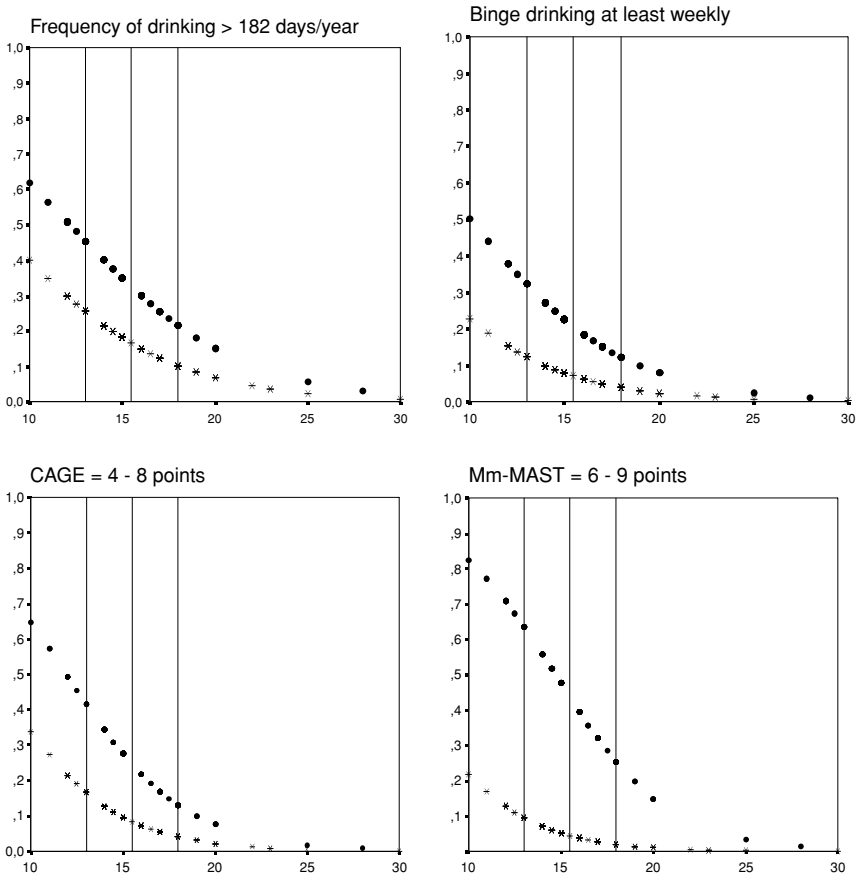

FIGURE 6.1. Predicted probabilities for the four high adult alcohol use indicators using gender and onset age as predictors. *Note*. Onset age on horizontal axis, reference lines set to 13, 15.5, and 18 years. Women marked with star (*) and men with circle (•).

were 16 or older when they began drinking. The risk of scoring high on the alcoholism screening tests was from 2.4 to 5.4 times higher among the early initiators. This pattern was found for both sexes.

These data are not unique to Finland. Data from the U.S. National Longitudinal Alcohol Epidemiologic Survey (Grant & Dawson, 1997) revealed that regular drinking prior to age 14 was associated with nearly a 50–50 risk of alcohol dependency in adulthood; those who were drinking regularly by age 14 were at least 3 times more likely to

meet lifetime diagnostic criteria than those who remained abstinent to age 21. Additionally, individuals who reported regular drinking prior to age 14 were 3 times more likely to concurrently report frequent high density drinking, 7 times more likely to report weekly intoxication, and significantly more likely to have placed themselves in situations after drinking that increased their chances of personal injury or accident, compared to individuals who remained abstinent to age 21. Other studies have also found a relationship between age at first drink and the later development of problematic drinking (Warner & White, 2003). Analyses of early onset drinking from the genetically informative Virginia twin study suggest that rather than a causal factor, early onset drinking may be a marker of other genetic or environmental processes that are associated with alcohol dependence (Prescott & Kendler, 1999). Clearly, understanding the initiation of substance use and influences on subsequent trajectories of use and/or abuse is critically important for informed and effective prevention and intervention efforts.

Factors Influencing Initiation

Genetically Informative Analyses

Data from twin studies suggest that the initiation of substance use is largely influenced by shared environmental factors. In the *FT16* sample, drinking initiation increases steadily from age 16 to 18: 75% of the adolescent twins reported at least some alcohol use at age 16, whereas more than 90% reported having initiated alcohol use by age 18. Smoking initiation follows a different pattern: approximately 50% of adolescents reported that they had tried smoking by age 16. This percentage was approximately equal in males and females. It remained virtually unchanged from age 16 to 18, suggesting that most individuals who initiate smoking in adolescence have done so prior to age 16.

Genetically informative models were applied to data on over 1,700 individuals from same-sex twin pairs at age 16 to study the extent to which genetic and/or environmental factors impact the initiation of smoking and alcohol use (as defined by reporting any smoking or alcohol use by this age). Common environmental influences played the largest role in impacting the initiation of both cigarette and alcohol

use, accounting for 55% of the variation in smoking initiation (95% confidence interval [CI], .42–.68), and for 77% of the variation in alcohol initiation (95% CI, .67–.86) by age 16. Genetic influences accounted for a smaller, albeit significant portion of the variance; for smoking, 38% (95% CI, .24–.51), and for drinking, 19% (95% CI, .09–.29). Overlap between smoking and drinking initiation was attributed both to shared genetic and environmental factors influencing both phenotypes. There were no significant sex differences in influences on substance use initiation by age 16.

The predominant role of common environment in influencing drinking initiation also has been replicated in *FT12* data (Rose, Dick, Viken, Pulkkinen, & Kaprio, 2001). About 35% of the twin individuals who were 14 years of age reported using alcohol. Based on the twins' responses to a series of questions about their alcohol use, the *FT12* data suggest that abstinence, as self-reported at age 14, means that alcohol is not used, not that it has never been tasted. Data from more than 1,300 same-sex and opposite sex twin pairs were used in genetically informative modeling to test (1) whether the magnitude of genetic/environmental influences on abstinence/drinking varies between males and females, and (2) whether the same genes/environments are influencing males and females. Contrary to the data from *FT16* examining initiation of alcohol use later in adolescence, *FT12* data suggested that significant sex effects exist at age 14: there was no evidence of genetic effects on alcohol initiation in males at age 14; however, females showed evidence of emerging genetic influence, accounting for 18% of the total variation in drinking initiation (95% CI, .10–.29). Common environmental (C) effects again accounted for the largest proportion of the variation in drinking practices, and the magnitude of these effects could be set equal in males and females. In both sexes, common environmental factors accounted for 76% of the variation in drinking frequency (95% CI, .68–.83).

These analyses suggest, however, that partially different shared environments may be important across the sexes. The correlation between the C effects for males and females was estimated to be .77 (CI: .61–.95), which implies that 77% of the C effects are shared by males and females, with the remainder specific to each sex. This would suggest that family and community influences are equally important for boys and girls, but that somewhat different

characteristics of the family or the community environment are important in determining drinking status in boys and girls. Unshared environmental effects were significantly more important for boys than for girls. This suggests that nonfamilial environments, not shared by twins, play a more important role in determining drinking initiation among boys than girls, while, in contrast, a modest genetic effect on initiation is evident only in girls.

The incorporation of data from age-matched same-sex controls in *FT12* has allowed for further characterization of environmental effects on substance use initiation. Common environmental influences, as defined in standard twin models, incorporate all environmental influences that are shared by siblings and contribute to their similarity. Thus, the "C" parameter, although often interpreted as familial influence, also incorporates school, neighborhood, and community influences as well.

In order to tease apart the effects of familial and extrafamilial influences, classmate controls were incorporated into the classic twin model. For a subset of the *FT12* twins, studied with an intensive in-classroom procedure, teachers were instructed to select a same-sex classmate closest in age to each twin (for some cohorts) or to select same-sex classmates adjacent to the twins in the alphabetized class roster of children's surnames. These classmate controls then completed questionnaires at age 12 identical to those completed by the twins. Included among the items asked in the questionnaire were two questions: whether the individual had ever smoked cigarettes, and whether the individual had drunk alcohol with friends without adults around.

In the overall sample, 7% of the children reported unsupervised alcohol use at age 12. If a child had an MZ co-twin who reported unsupervised drinking, the chance that they also reported unsupervised drinking was dramatically elevated: Approximately 55% of individuals with an MZ twin who reported drinking also reported drinking. The probability was also elevated if an individual had a DZ co-twin who reported unsupervised drinking: Approximately 45% of individuals with a drinking DZ co-twin also reported drinking. The elevated probability among siblings suggests substantial common environmental influences as well as some genetic influence, as evidenced by the greater similarity of MZs compared to DZs.

Most interesting, there was an elevation of risk among the classmate controls: if one of the classmates reported drinking, the probability that the second child would also report drinking was 21%. In other words, a child selected at random from a classroom was three times as likely to report unsupervised drinking if another child selected at random from that classroom also reported drinking. Because classmates shared neither household effects nor common genes, their similarity must be due to extrafamilial environmental influences shared in their schools or neighborhoods. In fact, formal modeling of these data demonstrate that extrafamilial school and community influences account for the largest percentage of variance in unsupervised drinking at age 12. Common environmental effects account for over 50% of the variation in drinking; however, extrafamilial effects account for more of the variation (32%) than familial effects (21%) (Rose et al., 2003).

Interestingly, initiation of smoking by age 12 shows a somewhat different pattern of effects. Although common environmental effects again account for the majority of the variance in this phenotype (63%), familial factors are more important than extrafamilial factors in early onset smoking, with familial effects accounting for 49% of the variation and extrafamilial effects accounting for 24% of the variance.

These results suggest that variation across communities, neighborhoods, and schools can exert causal influences on the initiation of substance use among children. This likely includes variation in neighborhood cohesion and attachment, religious practices, community monitoring, access to alcohol and tobacco, and other unidentified influences. The importance of these extrafamilial influences also appears to vary according to the behavior under study. They are the primary source of influence on early unsupervised drinking, whereas they play a secondary role to familial factors in the onset of smoking at this age.

Specifying Environmental Influences on Drinking

The pairwise analyses of the *FinnTwin* data at different ages across adolescence underscore the dominant influence of environmental factors shared by twin siblings, in their families and in their schools and neighborhoods, on initiation of drinking and smoking in adolescence. These findings have led to analyses of the twins as individuals, in

efforts to identify specific predictors of drinking and smoking initiation. Logistic regression analyses were performed using the twins as individuals, to examine the influences of parental monitoring and family home environment, as rated by the twins at age 12, as sources of risk-relevant shared environment on drinking initiation at age 14 (Rose, Dick, Viken, Pulkkinen et al., 2001).

Parental monitoring was assessed with three questions that asked the adolescents to report on the degree to which their parent(s) discuss with them their daily plans, know of their interests and activities, and know their whereabouts and the identity of their associates when they are not at home. Home atmosphere was assessed by the twins' self-reports of the degree to which each of the following described their home environment: warm/caring; encouraging/supportive; sympathetic/understanding; open; strict; unjust; quarrelsome; and indifferent. Teacher-rated behavioral and emotional problems assessed at age 12 using the Multidimensional Peer Nomination Inventory (MPNI) (Pulkkinen, Kaprio et al., 1999; see Chapter 1), and pubertal development self-reported by the twins at age 14 using the Pubertal Development Scale (PDS; Petersen et al., 1988), were also added into the logistic regression analyses.

Each of these variables contributed significantly to the initiation of drinking at age 14. Individuals who reported low levels of parental monitoring were substantially more likely to be drinking; the odds ratio (OR) associated with being in the lowest quartile of monitoring was 3.1, compared to twins in the highest quartile of parental monitoring. Similarly, there was increased drinking among individuals who reported a worse home atmosphere, although the effect was not as strong as for monitoring. There was a nearly linear increase in the proportion of drinking individuals with increasing pubertal development scores; 50% of individuals in the highest quintile of pubertal development scores reported drinking at age 14, whereas, only 21% of individuals among the lowest quintile of pubertal development reported drinking. Teacher-rated emotional problems and behavioral problems at age 12 were also associated with drinking at age 14; the OR associated with being in the highest quartile of behavior problems was 2.6. An increase in emotional problems was actually associated with decreased risk for having initiated drinking at age 14.

Results from the final model suggested an interaction with gender: In the context of pubertal timing, sex of the co-twin, teacher-ratings of behavioral and emotional problems, and twins' ratings of home atmosphere and parental monitoring, the odds ratio for being female increased to 1.68, from 1.16 (nonsignificant) in the unadjusted model. This suggests a greater sensitivity of girls to some, or all, of the other variables, including reduced parental monitoring and non-normative pubertal timing. Further exploration of this result finds that low parental monitoring makes girls particularly vulnerable to early-onset drinking, even girls for whom few behavioral problems are evident to their classroom teachers two years earlier. In contrast, for twins at the median or above in teacher-rated behavior problems, the combination of greater behavioral problems at age 12 and reduced parental monitoring at that age are joint, and equivalent, risk factors for both boys and girls.

These results suggest that girls may be more vulnerable to consequences of reduced parental monitoring. It seems likely that reduced monitoring is more risk-enhancing for girls because it is normatively more deviant. Both between- and within-families, the 14-year-old Finnish twin girls report more careful monitoring than do age- and cohort-matched twin boys. Throughout the entire *FT12* sample, girls report higher average levels of parental monitoring than do boys. And they do so *within* the same families, as well. Among brother-sister twin pairs who differed in their evaluation of parental monitoring, in 266 of the 457 pairs (60%), it was the girl who reported greater parental monitoring ($p < .001$). Thus, within the same family, assessing monitoring by the same parent(s) and at the same age, a daughter is more likely to report more rigorous parental monitoring than is her twin brother. Given that finding, we might anticipate that reduced monitoring is more risk enhancing for a girl. And our data do show that effects of reduced parental monitoring on drinking at age 14 are more salient for girls than for boys: among girls and boys reporting the highest level of monitoring, equal proportions (28% and 29%) report drinking; but that proportion escalates much more steeply across quartiles of reduced monitoring for girls (28 → 39 → 49 → 70%) than for boys (29 → 31 → 36 → 56%).

Prospective analyses of data from the JYLS also suggest that females may have unique factors influencing decisions about

substance use initiation. In the JYLS, female participants' aggressiveness and low self-control at age 8, as rated by teachers but not peers, predicted the early onset of drinking. These characteristics, accompanied by a very early onset of drinking, appeared more often in girls whose father (or the mother if she was a sole provider) was in a blue-collar occupation than in girls whose father was in a white-collar occupation. The early initiation of alcohol use in males was not related to socioemotional characteristics, school success, or father's occupational status assessed prior to the initiation of drinking (Pitkänen et al., 2005).

Factors Impacting the Initiation of Smoking

Analyses have also been carried out using *FT12* data to identify specific factors impacting the initiation of smoking. Initially, the roles of inattention and parental smoking were examined in relation to the probability that an adolescent reported smoking (Barman, Pulkkinen, Kaprio, & Rose, 2004). For these analyses, one twin from each family was randomly allocated to Group 1 and the co-twin to Group 2, in order for researchers to have an initial and a replication sample.

A progressive three-stage measure of adolescent smoking at age 14 was used: never-smokers, experimenters, and current smokers. Four parental smoking variables were examined: (1) *number of smoking parents*, based on current smoking of the mothers and the fathers; (2) *maternal smoking history* (never smoked, former smoker, current smoker); (3) *paternal smoking history*; and (4) *maternal smoking during pregnancy* (dichotomized into nonsmokers during pregnancy = 0, and smokers throughout pregnancy = 1). Mothers who ceased smoking during their pregnancy were excluded from the analyses to avoid possible confounding factors. These mothers were a heterogeneous group; some of them ceased smoking during the first month of pregnancy, while others ceased much later (range from 0 to 9 months); some smoked 1 cigarette per day, while some smoked 15 cigarettes. Inattentiveness was measured using the teacher rating form of the MPNI (Pulkkinen, Kaprio et al., 1999). These scores were categorized into tertiles, with the highest and lowest groups roughly equivalent to +/− 0.5 *SD*.

Most twins at age 14 had never tried cigarettes (57%), and only 9% were current smokers. Inattentiveness significantly predicted

smoking experimentation and current smoking: for experimentation, medium inattentiveness yielded a 65% higher risk and high inattentiveness a two-fold risk compared to low inattentiveness. For current smoking, high inattentiveness yielded nearly three-fold risk compared to low inattentiveness. In addition, all parental smoking variables (number of smoking parents, paternal smoking, maternal smoking, and smoking during pregnancy) significantly predicted both smoking experimentation and current smoking.

For experimentation, odds ratios (with 95% Confidence Interval, CI) for medium and high inattentiveness were 1.68 (1.30 – 2.17) and 1.95 (1.49 – 2.55), compared to low inattentiveness; and for one smoking parent and for two smoking parents 1.39 (1.09 – 1.77) and 1.74 (1.26 – 2.40), compared to nonsmoking parents. For current smoking, medium inattentiveness (OR 1.06, 0.63 – 1.80) did not add significantly to the risk, whereas high inattentiveness did: The risk for high inattentiveness was 2.34 (1.46 – 3.77). The OR for one smoking parent was 1.71 (1.08 – 2.69), and for two smoking parents 4.07 (2.51 – 6.62). The interaction term of inattentiveness and parental smoking was neither significant for experimentation ($p = .76$) nor for current smoking ($p = .67$). These results were replicated in Group 2.

In summary, these analyses showed that (1) inattentive behavior was associated with a significantly higher risk for smoking initiation (both experimentation and current use of cigarettes); (2) parental smoking (current and former) was significantly related to adolescent smoking; and (3) the effects of inattentiveness and parental smoking were additive and independent of each other. Thus, the probability of current smoking was 38% in the presence of two smoking parents and high inattentiveness, but 14% in the presence of nonsmoking parents and low inattentiveness. These results may be interpreted in the context of the hypothesis that susceptibility to smoking among subjects with attentional dysfunctions can be understood in terms of a self-medication hypothesis, based on the pharmacological effects of nicotine on attention and working memory. In addition, parental smoking is related to initiation of smoking in offspring, although it is not clear whether this is through genetic or environmental transmission.

The role of additional parenting variables on the initiation of smoking at age 14 has been further examined (Barman, personal

communication). Parental monitoring and home atmosphere were assessed as described above. Additionally, satisfaction with the child–parent relationship was measured (1) in the parental questionnaires using two items that asked mothers and fathers to report on how satisfied they were with their relationship with their children and (2) in the children's questionnaires, by asking parallel items regarding how satisfied they were with their relationship with their parents. Multivariate logistic regression was carried out separately for girls and boys, to assess the role of each of these aspects of parenting on the initiation of smoking, after controlling for parental smoking and family type (intact, single parent home, etc).

For girls, parental monitoring and satisfaction with the child-parent relationship were both significantly related to smoking initiation. Higher levels of monitoring were protective (OR = .30, 95% CI = .17 –.54), as were higher levels of satisfaction with the child–parent relationship (OR = .59, 95% CI = .40–.86). For boys, satisfaction with the child–parent relationship was similarly protective against smoking initiation (OR = .60, 95% CI = .43–.84), and reporting an unjust home atmosphere was a risk factor for smoking initiation (OR = 2.24, 95% CI = 1.48–3.40). These analyses suggest that some risk/protective factors for smoking initiation are shared between boys and girls, such as satisfaction with the child-parent relationship, but others are sex-specific. As with drinking initiation, parental monitoring appears to be a stronger influence in girls than in boys.

THE CONTINUED USE OF SUBSTANCES

Factors Influencing Smoking and Drinking Across Adolescence

Once drinking is initiated, drinking frequencies rapidly escalate during adolescence. Abstinence markedly declines, and drinking monthly or more often becomes normative. Individual differences in adolescent drinking patterns are large, and some patterns are predictive of subsequent drinking problems; accordingly, data from the Finnish Twin studies have been used to explore the gene-environment interactions that contribute to trajectories of individual substance use, once initiated.

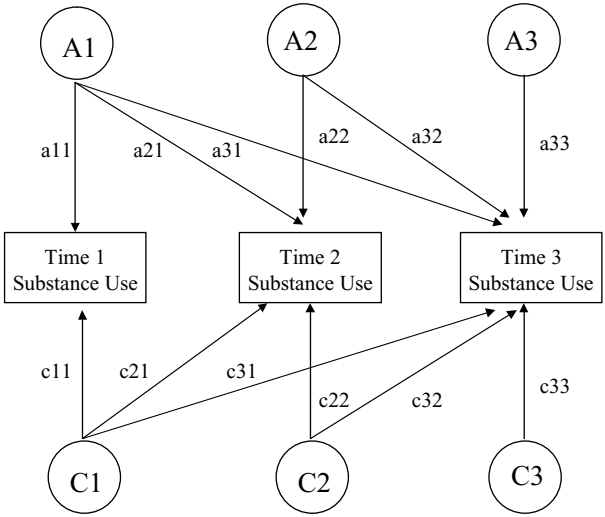

FIGURE 6.2. Trivariate Cholesky model fit to substance use at three time points. *Note*. For simplicity of presentation only latent genetic (A) and common environmental (C) factors are shown here. Unique environmental factors (E) follow the same pattern. The full trivariate Cholesky ACE model allows for genetic influences that impact substance use at all three time points (A1), additional genetic influences that impact only times 2 and 3 (A2), and genetic influences unique to substance use assessed at time 3 (A3). The pathways are represented by lowercase letters followed by two numbers, the first of which represents the variable being influenced, and the second of which reflects the latent factor.

In *FT16*, information was collected about the frequency of alcohol use and smoking over a 30-month period, with assessments at ages 16, 17, and 18.5. Analyses were limited to pairs that concordantly reported drinking or smoking (respectively, for each analysis) in order to study influences on the frequency of substance use, rather than the initiation of use. Previous analyses have suggested that these may be different dimensions of use, with common environmental influences largely impacting the initiation of substance use, as detailed above. Trivariate Cholesky decompositions were fit to drinking and smoking data at all three time points (Figure 6.2).

The Cholesky model allows for the evaluation of two types of developmental change: changes in the magnitude of genetic or environmental effects at different ages, and changes in the specific genes or environments influential at different ages. Thus, the full

model allows for (1) genetic influences on drinking at age 16 that persist to influence drinking at ages 17 and 18.5, (2) new genetic influences at age 17, also influencing drinking at 18.5, and (3) new genetic influences at age 18.5. Similarly, common environmental influences and unique environmental influences are each specified by three latent variables following the same pattern as those specifying genetic influences. Variance decomposition followed the logic of the basic twin model, as detailed above. A full model was fit first, allowing different additive genetic (A), common environmental (C), and unique environmental (E) influences on drinking at age 16, 17 and 18.5, as well as different magnitudes of ACE effects for males and females. Then a series of submodels was fit and the significance of dropping various parameters in the model was tested by evaluating the change in chi square between the two models.

For the 1,101 concordantly drinking same-sex twin pairs, MZ correlations were higher than DZ correlations at all three time points for males and females, suggesting significant genetic influence on drinking patterns. Formal model-fitting demonstrated that the importance of genetic effects increased significantly across the study period, with the most substantial increase found from age 16 to age 17. Genetic influences accounted for only a third of the variation in drinking frequency at age 16, but nearly 50% by ages 17 and 18. The influence of common environmental factors decreased progressively from 16 to 17 to 18.5, accounting for approximately 35% of the variance at age 16, but only approximately 15% by age 18. Unique environmental factors gained importance across the study period. Thus, the determinants of drinking appear to be changing during this 30-month developmental period, as adolescents move from early experimentation to more established patterns of alcohol use. Shared environmental effects declined from 16 to 18.5, while additive genetic effects increased in importance as individuals gained experience with alcohol use. Interestingly, the best-fitting model specified a single latent genetic factor influencing drinking at all three time points but allowed common environmental factors to be more age-specific, with some carryover effects from age 16 to 17. Thus, although the magnitude of importance of genetic factors increases across this age range, it appears that the same genetic influences are acting (Rose, Dick, Viken, & Kaprio, 2001).

Analyses of smoking frequency revealed a different pattern of results: the determinants of smoking were remarkably stable across this age range. Genetic factors accounted for approximately 50% of the variation at all time points; common environmental factors accounted for approximately 30% of the variation, and unique environmental influences accounted for the remaining 20% of the variation. However, although the relative importance of genetic factors remains stable from age 16 to age 18, the data suggested that different genes were acting at different ages for smoking. In contrast, the same common environmental influences appear to remain important for smoking frequency across this age range. The determinants of alcohol use or smoking frequency across this age range did not vary by gender.

Evidence for Gene-Environment Interaction

Analyses of *FT16* data have indicated that genetic and environmental influences on drinking frequency from age 16 to 18 are moderated by regional residency. Earlier analyses of *FT16* data suggested that the influence of abstinence in the co-twin or in the parents of these Finnish adolescents was modulated by urban or rural environmental residency. Accordingly, we extended these analyses of interactive effects on abstinence to longitudinal analyses of drinking frequency, studying Finnish twins who had concordantly initiated alcohol use at age 16 and who were classified by their urban/rural residency as determined by official statistical data linked to the municipal code of the twins.

Twin pairs were assigned to urban or rural municipalities based on their residence at age 16. Approximately 61% of the pairs resided in urban environments and 39% in rural environments. The distribution of drinking frequency did not differ between twins residing in urban and rural settings, suggesting that drinking patterns do not differ significantly by residency; however, larger twin correlations for DZ twins relative to MZ twins in rural settings suggested that factors influencing drinking frequency varied in the two environments.

Formal modeling confirmed that this was, in fact, the case. Across all time points, genetic factors were more important in urban settings

than rural settings, while common environmental factors were more important in rural than urban settings. At age 16, genetic factors accounted for a third of the variance in drinking frequency in urban settings, but only half that in rural settings. Conversely, common environmental effects accounted for more than half of the variance in drinking frequency in rural settings, but only one-third of the variance in urban settings (Rose, Dick, Viken, & Kaprio 2001).

However, urban/rural residency itself is not informative as to the underlying process. What about urban settings allows for greater expression of genetic effects? Why do common environmental influences exert a larger influence in rural settings? To explore these questions, we developed a model that allowed for moderating environments with multiple levels (Dick, Rose, Viken et al., 2001). We examined a series of socio-regional variables we hypothesized to be more proximal to the interaction effect. It is important to note that most studies examining the importance of group-level influences on adolescent alcohol use have focused on familial and peer influences, with relatively little attention paid to socio-regional variables. Fortuitously, Finland offers a unique opportunity to explore such effects, because the country is divided into municipalities, local government units that levy taxes and assume responsibilities for education, health care, and social services; Finland's municipalities range from those in the metropolitan Helsinki area to sparsely populated communities in Finnish Lapland and the Åland Islands. A wealth of sociodemographic information, relevant to risk for adolescent use/abuse of alcohol, can be linked to each municipality. This information was linked to each twin pair's municipal residency code, to identify risk-relevant characteristics about the community in which each twin pair lived, in order to study the influence of community-level factors on adolescent drinking outcomes.

In an attempt to better characterize the urban/rural interaction effect, we examined the percentage of young adults, ages 20 to 24, in the different municipalities, the percentage of migration into and out of different regions, and the per capita expenditure on alcohol in each region, relative to the mean amount spent in the entire country. Each of these three variables was chosen on theoretical grounds. We expected that there would be a larger proportion of young adults in urban settings where youth tend to move upon leaving home. This

larger proportion of young adults, slightly older than our adolescent twins, would offer a broader range of potential role models for the twins; thus, the urban environment would provide a wider range of potential friends and activities, allowing for greater expression of individual differences in genetic predispositions.

Percentage migration into and out of the region was examined under the assumption that urban settings would have more mobility, and that greater mobility in a local setting would create a more anonymous environment. Conversely, in a rural setting where there is more residential and generational stability, there may be more community monitoring, engendering more accountability for one's actions and more shared pressure to engage, or not engage, in certain behaviors. Again, this would create an atmosphere allowing for greater expression of genetic effects in urban settings and greater importance of common environmental influences in rural settings. Finally, we anticipated that there would be proportionately more money spent on alcohol in urban settings, where retail outlets of the state alcohol monopoly are much more prevalent. This would create an environment in which there is greater accessibility and, therefore, increased opportunity to choose settings more accepting of adolescent drinking, allowing individuals to express a range of genetic predispositions.

Each of these hypotheses was supported (Dick, Rose, Viken et al., 2001). The relative proportion of young adults in a regional area, the frequency of migration in and out of a region, and the relative amount of money spent on alcohol in an area all moderate influences on frequency of alcohol use among drinking adolescents. Additionally, when more continuous measures of the environment were incorporated into the model, dramatic changes in the relative importance of genetic and environmental effects across environmental extremes were found – for example, in neighborhoods with relatively few young adults, genetic factors accounted for only 13% of the variation in drinking frequency, whereas in the neighborhoods with the most young adults, genetic factors accounted for more than 60% of the variance in drinking patterns. Conversely, common environmental factors accounted for more than 50% of the variance among neighborhoods with few young adults but had no detectable influence among neighborhoods with many young adults. These analyses

demonstrate that the environmental context can have a powerful impact on the relative importance of genetic and environmental influences on substance use.

CONCLUSIONS

In conclusion, data from ongoing studies in Finland have been particularly informative in furthering our understanding of factors that contribute to the initiation and continuation of patterns of substance use. Across several genetically informative analyses, the predominant role of the shared environment has consistently been documented in impacting the initiation of both alcohol use and cigarette smoking. Furthermore, these influences appear to be both familial factors, found in the home, and extrafamilial influences, found in the school, neighborhood, or community. These findings have been expanded by attempting to specify the environmental factors that are important.

Our data suggest that low levels of parental monitoring and a poor home environment are significant risk factors for the initiation of early onset drinking. Girls appear to be particularly vulnerable to consequences of reduced parental monitoring. Pubertal development and behavioral problems are individual specific risk factors that further contribute to early alcohol use. Additionally, for smoking initiation, we find that inattentiveness and parental smoking appear to contribute additively to smoking practices at age 14.

While environmental factors appear to be particularly relevant for the initiation of smoking and drinking, once initiated, patterns of substance use among adolescents are under significant genetic influence. For drinking frequency, there are substantial increases in the importance of genetic factors from ages 16 to 18, with genetic factors accounting for only one-third of the variance in alcohol use at 16, but more than half by age 18. For smoking frequency, there is a somewhat different pattern of results: Although genetic factors play a significant role in smoking behavior, accounting for approximately half the variance, the magnitude of genetic influence remains relatively stable across this age range. Importantly, the relative impact of genetic and environmental factors is significantly moderated by environmental context.

Genetic influences are significantly more important among urban settings than among rural settings, whereas common environmental influences play a much larger role in rural settings. These effects appear to be attributed in part to differences in the availability of young adult role models, neighborhood stability, and availability of alcohol. Taken together, these analyses illustrate the complex interactions of genetic and environmental influences that contribute to the initiation and progression of substance use. It is our hope that this information will translate into the development of more informed programs for prevention and intervention, curbing the considerable problems associated with substance misuse worldwide.

7

Self-Rated Health

Precursors and Implications

Karri Silventoinen, Eero Lahelma, and Jaakko Kaprio

INTRODUCTION

Health is in multiple ways associated with many other characteristics in childhood, adolescence, and adulthood. Poor health in childhood may contribute to psychosocial problems and learning difficulties, which can strongly affect the entire adult life. These pathways, however, are likely to be reciprocal, and problems at school and in family environment can negatively affect children's health both directly and through health behaviors. Understanding these complex associations is challenging both for scientific research and for health care practice among children and adolescents.

In this chapter, determinants of health in the *FinnTwin16* data will be studied in a number of ways. First, a short introduction discusses the advantages and limitations of self-rated health, a health indicator used in this chapter. Second, we analyze the socioeconomic factors associated with self-rated health status and its change from adolescence to early adulthood. Third, we analyze the effects of genetic and environmental factors on self-rated health and how their effects may change during aging. Finally, we discuss policy implications of our results and suggest ways for further research within this area.

SELF-RATED HEALTH AS AN INDICATOR OF HEALTH STATUS

Measuring health is a complicated task, and each indicator captures only a limited domain of the comprehensive notion of health and

illness. Mortality is often regarded as a fundamental measure of population health, and it describes the most extreme outcome of ill health – that is, the end of life. Mortality is a superior indicator due to its reliability compared to other health indicators. In many countries, mortality registers cover virtually the entire population and allow long follow-ups. Focusing on mortality, however, ignores many non-fatal diseases, which may still strongly affect health, quality of life, and physical and psychological capabilities. Mortality is also relatively insensitive to rapid changes in the health status of a population. Examining the prevalence and incidence of specific diseases is needed when studying the etiology of diseases. However, the severity, for example, of the effect of many musculo-skeletal diseases on functional capabilities varies, and this may be difficult to take into account.

A common approach in the measurement of health is to rely on people's own reports of their health and accept the multidimensionality of the notion of health. Since self-rated health is based on people's own perceptions of their health status and is a "subjective" measure in this sense, factors other than physical ill-health alone may affect it. However, self-rated health has been found a good predictor of mortality, functional disability, and the use of health services (Heistaro, Jousilahti, Lahelma, Vartiainen, & Puska, 2001; Heidrich, Liese, Löwel, & Keil, 2002; Miilunpalo, Vuori, Oja, Pasanen, Urponen, 1997; Idler & Kasl, 1995). In their review, Idler and Benyamini (1997) summarized 27 studies on the association between self-rated health and mortality. They found that in nearly all studies self-rated health predicted mortality, even after several other health and socioeconomic indicators were adjusted for. The authors concluded that self-rated health covers domains of health that are difficult to reach by using indicators not based on self-reports, such as medically confirmed diseases or physiological measures. This is likely due to respondents' basing their assessments of health on many sources, including family history, diagnosed diseases, long-term changes in their health, and perceived symptoms. Thus, there is considerable overlap between self-rated health and other indicators of health, suggesting that self-rated health mainly reflects physical ill-health of a person (Manderbacka, 1998). Also test-retest reliability of self-rated health is fairly good, and only among elderly people

is the reliability somewhat poorer (Lundberg & Manderbacka, 1996; Martikainen et al., 1999).

Self-rated health status of a population correlates well with other health indicators. For example, age is strongly related to self-rated health in the same fashion that it is related to other health indicators (Silventoinen & Lahelma, 2002). Self-rated health also predicts mortality in a largely similar way among elderly people regardless of whether they were asked their opinion on health in general or compared to the respondents' age peers (Manderbacka, Kåreholt, Martikainen, & Lundberg, 2003). Geographic differences in perceived health are very similar to those found for mortality. In the former Soviet Union, a much larger proportion of the population rated their health as poor than in western European countries, which corresponds well to the lower life expectancy in these countries (Palosuo, Uutela, Zhuravleva, & Lakomova, 1998; Gilmore, McKee, & Rose, 2002). Thus, self-rated health is a useful health indicator also when comparing health status between different populations and does not only reflect the variation of health within each population.

Perceived health forms a continuum from poor to good health. It is possible that self-rated health is not unidimensional, but different factors may contribute to different parts of its distribution. For example, physical diseases and disorders may lie behind poor health but psychological problems behind good health. However, previous studies suggest that self-rated health is unidimensional rather than multidimensional. It has been found that the same socioeconomic factors and health behaviors explain both good and poor self-rated health (Manderbacka, Lahelma, & Martikainen, 1998). This is also supported by a previous study that used semistructured interviews among respondents to an earlier population survey (Manderbacka, 1998). This study confirmed that self-ratings of health were primarily based on physical ill-health and functional disorders rather than psychological characteristics.

SOCIOECONOMIC DETERMINANTS OF SELF-RATED HEALTH

Socioeconomic Variation in Self-Rated Health

Health is not randomly distributed among the population but is strongly associated with sociodemographic and socioeconomic

factors: people in lower socioeconomic positions have on the average poorer health than those in higher positions. Previous studies from Finland and several other countries have consistently shown clear socioeconomic gradients in self-rated health for education (Silventoinen & Lahelma, 2002), income (Rahkonen, Arber, Lahelma, Martikainen, & Silventoinen, 2000), and occupational social class (Lahelma, Arber, Rahkonen, & Silventoinen, 2000). All these indicators are mutually correlated but reflect partly different aspects of social position, which all are related to health (Lahelma, Martikainen, Laaksonen, & Aittomäki, 2004). It is also noteworthy that the socioeconomic variation is very similar for a number of physical health indicators (Lahelma, Martikainen, Rahkonen, Roos, & Saastamoinen, 2005) as well as overall mortality and most causes of death (Mackenbach, Kunst, Cavelaars, Groenhof, & Geurts, 1997).

Socioeconomic variation in self-rated health seems to be a universal phenomenon, although there are differences between countries in the magnitude of socioeconomic health inequalities. Within western European countries, relative socioeconomic differences in health are not necessarily narrower in the Scandinavian welfare states although they have internationally small income inequalities and free or strongly subsidized health care (Kunst et al., 2005). Although socioeconomic differences in health are consistent, their determinants may nevertheless vary between countries.

Different diseases are likely to explain socioeconomic variation in health within different geographic areas. In northern Europe, socioeconomic disparities in cardiovascular diseases strongly influence the overall socioeconomic disparities in mortality. In contrast to northern Europe, similar socioeconomic differences in cardiovascular diseases cannot be found in the Mediterranean countries and cardiovascular disease rates are generally low (Kunst et al., 1999), reflecting differences in the risk factor profiles (Keys, 1980). Differences in the magnitude and determinants of socioeconomic differences in health between countries suggest that these differences are not inevitable but can be narrowed, for example, by improving health behaviors, such as nonsmoking and healthy diet, as well as living conditions.

Possible Explanations for Socioeconomic Health Differences

The background of socioeconomic health differences is still inadequately understood, and a number of explanations have been

suggested. The key types of explanation for socioeconomic inequalities in health can be divided into (1) social selection explanations, emphasizing the role of health-related factors in social mobility; (2) material explanations, emphasizing the role of unequal distribution of material resources and living conditions between socioeconomic groups; and (3) behavioral explanations, emphasizing differences in health behaviors such as smoking, drinking, and diet (Macintyre, 1997). The current body of literature has lent some evidence to each of these explanations. However, the behavioral and material explanations are likely to be the most important (Laaksonen, Roos, Rahkonen, Martikainen, & Lahelma, 2005).

There are also biological mechanisms, which may mediate the effect of socioeconomic position on health. For example, Barker (1995) has suggested that material environment during fetal life and early childhood can contribute to adult socioeconomic health inequalities by inducing permanent metabolic changes. It has also been suggested that cognitive factors, such as intelligence, may contribute to socioeconomic differences in health (Gottfredson, 2004), but direct evidence is still lacking.

While there is a large body of evidence on socioeconomic health differences in developed countries, less is known about how self-rated health changes over time and how various social determinants may affect the changes of health status. Furthermore, only a few studies have focused on self-rated health in adolescents and young adults. Therefore, we examined changes over time in self-rated health and its socioeconomic determinants by using the *FinnTwin16* study.

Respondents were asked to self-rate their health in an identical fashion in the four surveys at ages 16, 17, 18.5 and, on average, 25. The response rates were high, that is, 90% or over, in each survey. The question reads: "What do you think about your current health status? Is it (1) Very good; (2) Fairly good; (3) Average; (4) Fairly poor; or (5) Poor?" Because only few respondents, less than 1%, reported their health as poor, this category was combined with "fairly poor" health. The data were analyzed by using logistic regression analysis. Self-rated health was used as the dependent variable and was dichotomized in the analyses by combining the categories "very good" and "fairly good" and the categories "average," "fairly poor,"

TABLE 7.1. *Distribution of Self-Rated Health at Ages 16, 17, 18, and 25 by Sex*

	Men				Women			
	16 years %	17 years %	18 years %	25 years %	16 years %	17 years %	18 years %	25 years %
Very good	44	42	42	36	36	31	30	28
Fairly good	43	45	44	51	50	54	52	54
Average	12	12	12	12	13	14	16	16
Fairly or very bad	1	1	2	2	1	1	2	2
All	100	100	100	100	100	100	100	100
(*N*)	(2510)	(2313)	(2293)	(2020)	(2668)	(2599)	(258)	(2418)

and "poor." Results are presented as odds ratios (OR), which give relative probabilities for reporting less than good self-rated health in the categories of independent variables as compared to the reference category (OR = 1.00). We also analyzed changes over time in self-rated health by classifying the change in the health status as "impaired self-rated health" and "no change or improved self-rated health." The health of a person was classified as impaired if poorer health was reported at follow-up compared to baseline status – that is, regardless of actual health status at baseline. The analyses were carried out using the STATA statistical package (*STATA User's Guide*, 2001). The effect of the nonrandom sample design of twin data on standard errors was taken into account by using the cluster option of STATA.

Table 7.1 shows the distribution of self-rated health in each survey. The proportion of participants rating their health less than good – that is, average or fairly poor or poor – was very consistent over the surveys in men: 13% to 14% of men in each survey rated their health less than good. The overall level of self-rated health in women was worse than in men in each survey, and it also decreased slightly from age 16 to 25. At age 16, 14% of women rated their health less than good while this proportion at age 25 was 18%. When examining the opposite end of self-rated health – those reporting fairly good or very good health – the results were largely similar: Health in men was better than in women and it deteriorated somewhat over the surveys in women. The only difference compared to less than good self-rated health was that over the surveys health deteriorated not only among women but also among men. The proportion of very good health

decreased from 44% in men and 36% in women at age 16 to 36% and 28%, respectively, at age 25.

Correlations of self-rated health between the surveys were only moderate and tended to decrease with the time difference between the surveys (data not shown). Spearman correlations between self-rated health at ages 16 and 17 were 0.47 in men and women but only 0.24 in men and 0.28 in women between ages 16 and 25. The correlations at ages 17 and 18.5 showed a similar pattern.

Parental Socioeconomic Status and Own Education

We next examined whether socioeconomic factors explained self-rated health in these data by using own achieved education by age 25 and parental socioeconomic status at baseline measured by education, occupational social class, and employment status. Since the educational level in Finland in the birth cohorts to which most of the parents belong was generally low, we dichotomized the variable as basic education or less and secondary education or more. Parents' occupational social class was classified into four categories: upper white-collar employees, lower white-collar employees, manual workers, and self-employed including entrepreneurs and farmers. Social class was based on the current occupation for those who were currently employed and on the previous occupation for those who were not currently employed, such as homemakers, unemployed, or retired persons. Since labor force participation in Finland is very common also in women, the proportion of unclassifiable / never employed was low in both sexes. Parental employment status was classified into employed, unemployed, and nonemployed. Those who reported that they worked at home were classified as nonemployed unless they were entrepreneurs.

Model 1 in Table 7.2 presents logistic regression models for self-rated health less than good (yes/no) at age 16. The factors most consistently associated with self-rated health were own education at age 25 and parental unemployment. There was an educational gradient among women as well as men showing that the lower the education, the poorer the health. The average health among those with basic education only at age 25 was poorer compared to those who had university-level education (OR = 2.46, 95% confidence interval [CI]

1.31–4.63 in men and OR = 3.64, 95% CI 2.11–6.29 in women). In women, those with secondary education had better health than those with basic education only but poorer health than the women with university-level education (OR = 1.73, 95% CI 1.27–2.37). Among men a similar tendency could be found, but those with secondary education (OR = 1.48, 95% CI 0.94–2.32) did not differ statistically significantly from those with university-level or basic education.

Both mother's (OR = 1.52, 95% CI 1.04–2.22 in men and OR = 1.52, 95% CI 1.04–2.20 in women) and father's unemployment (OR = 1.56, 95% CI 1.03–2.36 and OR = 1.50, 95% CI 0.97–2.33, respectively) was associated with a higher risk of self-rated health less than good compared to those whose mother or father was currently employed. This increase in the risk was almost exactly the same in men and women and irrespective of which parent was unemployed, albeit father's unemployment was only borderline statistically significant in women. Adjusting for other socioeconomic indicators did not abolish the effect of these indicators on self-rated health (data not shown).

The analysis was continued by examining whether the socioeconomic factors predicted impaired self-rated health from ages 16 to 25 (model 2 in Table 7.2). The only factor that was associated with impaired health was basic education at age 25 in men (OR = 1.59, 95% CI 1.01–2.49). These results particularly suggest that mother's or father's unemployment, which was associated with health status at age 16, did not generate additional health variations at a later age.

Effect of Genetic and Environmental Factors on Self-Rated Health

Previous Twin Studies on Self-Rated Health

Information on singletons only provides limited opportunities to study the nature of the observed trait variation and of the associations between exposures and the outcome of interest. For example, the above analyses showed that parental unemployment was associated with a higher risk for self-rated health less than good, but this does not tell us why such an association exists. Parental unemployment may be associated with economic difficulties or psychological stress

TABLE 7.2. *Proportion of Participants and Odds Ratios (OR) with 95% Confidence Intervals of Explaining Factors for Less than Good Self-Rated Health at Age 16 (Model 1) and Impairing of Self-Rated Health Age 16 to 25 (Model 2) by Own Education and Parental Social Class in Men and Women*

	Men					Women				
	% of cases	Model 1 OR	95% CI	Model 2 OR	95% CI	% of cases	Model 1 OR	95% CI	Model 2 OR	95% CI
Own education at age 25	(*N* = 2028)					(*N* = 2423)				
University education	13	1.00		1.00		23	1.00		1.00	
Secondary education	81	1.48	0.94–2.32	0.99	0.74–1.32	73	1.73	1.27–2.37	1.00	0.81–1.23
Basic education	6	2.46	1.31–4.63	1.59	1.01–2.49	4	3.64	2.11–6.29	1.24	0.79–1.97
Mother's education	(*N* = 2252)					(*N* = 2445)				
Secondary education or more	34	1.00		1.00		33	1.00		1.00	
Basic education only	66	1.03	0.79–1.35	0.93	0.75–1.16	67	0.92	0.70–1.19	1.04	0.85–1.28
Father's education	(*N* = 2070)					(*N* = 2176)				
Secondary education or more	27	1.00		1.00		26	1.00		1.00	
Basic education only	73	0.85	0.63–1.16	0.99	0.77–1.26	74	1.23	0.90–1.67	1.10	0.87–1.39
Mother's social position	(*N* = 2474)					(*N* = 2594)				
Upper white-collar worker	14	1.00		1.00		15	1.00		1.00	
Lower white-collar worker	49	0.92	0.63–1.35	0.83	0.61–1.12	49	1.38	0.94–2.05	0.81	0.61–1.07

Manual worker	22	1.10	0.71–1.69	0.82	0.58–1.17	22	1.67	1.09–2.55	0.79	0.58–1.08
Self-employed or entrepreneur	13	1.22	0.76–1.96	0.94	0.64–1.37	12	1.29	0.79–2.13	1.04	0.73–1.46
Never employed	2	1.14	0.44–2.94	1.51	0.80–2.85	3	1.41	0.64–3.07	0.67	0.35–1.28
Father's social position	($N = 2125$)					($N = 2271$)				
Upper white-collar worker	24	1.00		1.00		24	1.00		1.00	
Lower white-collar worker	17	1.54	1.02–2.34	0.64	0.45–0.91	17	0.71	0.45–1.13	0.90	0.66–1.24
Manual worker	38	1.26	0.87–1.83	0.98	0.74–1.29	38	1.12	0.81–1.57	0.87	0.68–1.12
Self-employed or entrepreneur	20	1.27	0.82–1.98	0.89	0.65–1.22	20	0.93	0.61–1.39	0.87	0.65–1.17
Never employed	1	0.92	0.21–3.99	0.68	0.18–2.57	1	1.98	0.76–5.14	1.08	0.47–2.47
Mother's occupational status	($N = 2512$)					($N = 2671$)				
Employed	73	1.00		1.00		75	1.00		1.00	
Unemployed	9	1.52	1.04–2.22	0.99	0.69–1.42	9	1.52	1.04–2.20	1.08	0.77–1.50
Not employed	18	1.19	0.87–1.62	0.80	0.61–1.03	16	0.98	0.71–1.34	1.07	0.84–1.36
Father's occupational status	($N = 2202$)					($N = 1915$)				
Employed	81	1.00		1.00		82	1.00		1.00	
Unemployed	8	1.56	1.03–2.36	1.18	0.79–1.77	8	1.50	0.97–2.33	1.06	0.74–1.52
Not employed	11	1.26	0.82–1.93	1.07	0.78–1.46	10	1.46	0.99–2.16	1.17	0.84–1.62

in the childhood family, which may further affect directly the health status of a child. Likewise a sick child may have caused financial difficulties and career obstacles for the parents, leading more often to unemployment. However, it is equally possible that since children inherit their genes from their parents, this association is generated by genetic factors. For example, low parental education may be associated with lower intelligence, which has been found to be highly heritable (Plomin & Spinath, 2004), and thus children of parents with low intelligence may also have lower intelligence due to the shared genes. This may further affect health-related factors such as health behaviors. The testing of these different hypotheses needs familial data including relatives sharing different genetic and environmental background, such as the classic twin design comparing monozygotic (MZ) and dizygotic (DZ) twins reared together.

There are only a few previous twin studies on self-rated health, and the evidence from these is summarized in Table 7.3. Of the existing five studies, four were from Scandinavian countries (Harris, Pedersen, McClearn, Plomin, & Nesselroade, 1992; Christensen, Holm, McGue, Corder, & Vaupel, 1999; Svedberg, Lichtenstein, & Pedersen, 2001; Røysamb, Tambs, Reichborn-Kjennerud, Neale, & Harris, 2003) and one from the United States (Romeis et al., 2000), including twins who served in the U.S. military during the Vietnam War era (years 1965 to 1975). Health indicators used in these studies are shown in Table 7.4. Thus, there is not very much geographic or ethnic variation in these studies. None of the studies reported follow-up information on the heritability of self-rated health.

A common feature in these studies is a strong effect of unshared environmental factors on self-rated health, varying from 60% to over 90% of the total variance. In the twin study design, unshared environment covers all environmental factors that make the twin pair dissimilar, that is, since MZ co-twins share the same genes, unshared environmental factors explain why they are not exactly similar. Since measurement error is included in the unshared environmental effect in a classic twin model, it inflates this part of the variation. However, since there was no information on the reliability of self-rated health in these studies, it is not possible to estimate the effect of measurement error on the results. When the part of the variation accounted for by familial factors was studied, some differences were found between

the studies as to whether shared environmental or genetic factors accounted for this variation. Such differences are understandable; because the sample size is small, the twin model cannot reliably distinguish between the effects of shared environment and genetic factors on the phenotype. Summarizing results from Table 7.3 shows that in most studies, genetic factors are a more important determinant for the interindividual variation of self-rated health than shared environmental factors, but the results are inconclusive.

Self-Rated Health from Adolescence to Early Adulthood

Because previous twin studies include no data on how heritability of self-rated health changes during aging, this was studied by using the *FinnTwin16* data. An advantage in the *FinnTwin16* data compared to the previous studies is that self-rated health was measured when the participants were at the same age, so age variation is minimal in these data. Modeling was done by using classic quantitative genetic modeling for twin data based on linear structural equations (Neale & Maes, 2004). Univariate modeling for dependent variables measured in an ordinal scale was used, that is, separate models were used to analyze self-reported health at each age. Modeling was done using the Mx statistical package (Neale, Boker, Xie, & Maes, 2004). In the course of modeling, we found that shared environmental factors were not a statistically significant explanation for the variation of self-rated health, and thus this component was excluded from the final models.

Table 7.5 presents pairwise polychoric correlations and standardized variance components in the final additive genetic/unshared environment model (AE-model) in each of the four surveys. Additive genetic factors accounted for 59% of the variation of self-rated health in men and 66% in women at age 16. Among both men and women, the proportion of the trait variance explained by additive genetic factors decreased over the surveys, and at age 25 this proportion was only 32% in men and 36% in women. The rest of the trait variation was explained by unshared environmental factors.

We also tested whether there were genes affecting the variation of self-rated health specific to one sex only using a sex-limitation model that utilizes the information from opposite-sex pairs. If the correlation within opposite-sex pairs is smaller than the correlation

TABLE 7.3. *Variance Components in the Previous Twin Studies on Self-Rated Health*

Study	Country	Sex	Age	Summary twin data[a]			% of variance explained[b] (95% confidence intervals)		
				Type	No of pairs	Correlation	a^2	c^2	e^2
Harris, J.R. et al., 1992	Sweden	Men and women[c]	50 or less	MZ	46	0.25	–	23	77
				DZ	53	0.19		(17–28)	(76–78)
				MZA	22	−0.01			
				DZA	72	0.28			
			50–59	MZ	37	0.29	–	25	75
				DZ	36	0.25		(19–29)	(74–76)
				MZA	18	0.19			
				DZA	46	0.21			
			60–69	MZ	48	0.20	29	–	71
				DZ	68	0.04	(25–33)		(70–72)
				MZA	35	0.40			
				DZA	62	0.26			
			70 or more	MZ	29	0.16	26	–	74
				DZ	54	0.28	(21–31)		(73–75)
				MZA	21	0.40			
				DZA	41	−0.01			
Christensen, K. et al., 1999[e]	Denmark	Men	75 or more	MZ	53	0.39	38	–	62
				DZ	66	0.18	(16–57)		(43–84)
		Women		MZ	117	0.16	10	6	84
				DZ	176	0.11	(0–32)	(0–24)	(68–98)
Romeis, J.C. et al., 2000	U.S.A.	Men	38 (mean age)	MZ	2551	0.40	40	–	60
				DZ	2087	0.17		(36–43)	(57–64)
Svedberg, P. et al., 2001	Sweden	Men	17–44	MZ	46	0.2	–	2	98
				DZ	43	0.01		(0–17)	(83–100)

		Women		MZ	47	−0.03	8	0	92
				DZ	44	0.05	(0–35)	(0–21)	(65–100)
				OSDZ	99	0.12			
		Men	45–64	MZ	19	0.38	44	–	56
				DZ	31	0.33	(26–60)		(40–76)
		Women		MZ	31	0.48	40	0	60
				DZ	41	0.04	(0–62)	(0–35)	(38–88)
				OSDZ	72	0.19			
				MZ	52	0.39	40	–	60
				DZ	70	0.11	(26–52)		(48–74)
				MZ	66	0.46	44	0	56
				DZ	113	0.15	(8–59)	(0–23)	(41–76)
				OSDZ	191	0.13			
				MZ	18	−0.06	–	21	79
				DZ	27	−0.05		(9–32)	(68–91)
				MZ	64	0.27	0	29	71
				DZ	69	0.28	(0–45)	(0–45)	(53–87)
				OSDZ	100	0.18			
Røysamb, E. et al., 2003[d]	Norway	Men	18–31	MZ	526	0.36	36	–	64
				DZ	397	0.17	(29–42)		(58–71)
		Women		MZ	777	0.26	16	10	74
				DZ	655	0.18	(0–32)	(0–25)	(68–81)
				OZDZ	979	0.12			

a^2 = additive genetic variance, c^2 = shared environmental variance, e^2 = unshared environmental variance

[a] MZ = monozygotic (identical) twins reared together, DZ = same-sex dizygotic (fraternal) twins reared together, OSDZ = opposite sex DZ twins reared together, MZA = monozygotic twin pair reared apart, DZA = dizygotic same-sex twin pair reared apart

[b] In each sex and age group the best-reported model was selected

[c] No sex-specific results presented, 60% of participants females

[d] Because all parameters needed are not presented in the original publication, the variance components and the confidence intervals were re-computed from the published correlations using the Mx statistical package (Neale et al., 2004) under an ACE model.

TABLE 7.4. *Used Cohort and Health Indicators in Previous Studies on Self-Rated Health*

Study	Name of the cohort	Indicator of perceived health
Harris, J.R. et al., 1992	Swedish Adoption/Twin Study of Aging (SATSA)	Self-rated health was measured by four questions, whose values were standardized separately and then summed. The questions read: (1) How would you rate your health status? (2) How would you rate your health status compared to 5 years ago? (3) How would you rate your health status compared to others in your age group? (4) Do you think your health prevents you from doing things you would like to do?
Christensen, K. et al., 1999	Danish Twin Registry	How would you rate your health in general: very good, good, fair, poor, very poor?
Romeis, J.C. et al., 2000	Twins who served in the U.S. military during the Vietnam era (1965–1975) (VET-registry)	Would you say that your health in general is excellent, very good, good, fair, or poor?
Svedberg, P. et al., 2001	Screening Across the Lifespan Twin Study (SALT)	How would you rate your general health status: excellent, very good, good, fair, poor?
Røysamb, E. et al., 2003	Norwegian Twin Registry	What is your health like, at present: the scale from 1 = poor to 4 = very good

TABLE 7.5. *Polychoric Correlations for MZ, Same-Sex DZ and Opposite-Sex DZ Twins and Parameter Estimates for Men (m) and Women (f) in Additive Genetic/Unshared Environment (AE) Univariate Model for Self-Rated Health at Ages 16, 17, 18, and 25.*

	16 years	**17 years**	**18 years**	**25 years**
Correlations				
MZ_{male}	0.59	0.54	0.45	0.31
DZ_{male}	0.34	0.34	0.20	0.10
MZ_{female}	0.65	0.56	0.54	0.38
DZ_{female}	0.35	0.20	0.14	0.13
$DZ_{male\text{-}female}$	0.13	0.21	0.19	0.14
Variance components				
A_m	0.59	0.52	0.43	0.32
E_m	0.41	0.48	0.57	0.68
A_f	0.66	0.55	0.51	0.36
E_f	0.35	0.45	0.49	0.64
Test for sex-specific genetic effect	$p < 0.001$	$p = 0.21$	$p = 0.35$	$p = 0.61$

within like-sexed pairs, there may be genetic effects that are affecting only one sex. Theoretically, this difference could also be because of shared environmental factors affecting one sex only, but we found this implausible as the effect of shared environmental factors was not statistically significant in the modeling. The sex-specific genetic component (22%) was statistically significant at age 16 but not at later ages.

In this study we obtained evidence suggesting that self-rated health worsened slightly on average from age 16 to age 25. The impairment in health was found only in women when we were studying self-rated health less than good, but also in men when we were studying respondents who rated their health as very good. This is an interesting finding because chronic diseases are not likely to have major effects on health at this age. There was also considerable variation in self-rated health between the surveys, and correlations in self-rated health even between surveys conducted in subsequent years were less than 0.5. This variation probably reflects rather moderate reliability of self-rated health or susceptibility of self-rated health for quite short-term health problems in this population rather than variation

in the stable part of health status. A previous Finnish study on the reliability of perceived health (Martikainen et al., 1999) showed that the test-retest agreement of perceived health was around 70%. Even when this can be regarded as fairly good reliability, together with short-term fluctuation in the health status it can well explain why the intra-individual correlations of self-rated health were not higher in this study. A similar decrease in rank-order correlations over time has also been found in personality traits (Roberts & DelVecchio, 2000), and thus it is probably a general feature of psychological traits rather than a feature specific to self-rated health only.

When examining the role of socioeconomic factors behind the variation of self-rated health, we found that the respondent's own achieved educational level by young adulthood and parental unemployment were the main factors affecting self-rated health at age 16. These factors had a much weaker role, however, when we studied impairment of health from age 16 to age 25. The weakening effect of parental unemployment over time suggests that if family background affects health its effect is seen already in adolescence and has a less important role in early adulthood. Studying further the role of family background by using quantitative genetic methods, we found no evidence showing that shared environmental factors would have an effect on self-rated health. Shared environmental factors include all the environmental factors that make family members – such as siblings or a twin pair – similar. Factors related to family environment are presumably the most important ones included in the shared environment for twins reared together but do not preclude effects due to shared peers or friends. This suggests that parental unemployment, found to predict self-rated health in this study, does not affect health directly through family environment but rather reflects genetic factors or interacts with them.

When we studied the respondent's own education the causal relationships are probably more complex than in the case of parental unemployment. Because parental social class is probably associated with the educational level of the child, this variable partly reflects family background. However, it is also possible that health directly affects education, as the school performance of children with physical or mental disabilities is probably impaired. Our results showed that poor health at age 16 predicted low education at age 25. It is

noteworthy that at age 16 Finnish school students have just completed their mandatory basic-level education and the decision of whether they will continue their education at the secondary level and further at the university level must have been made.

Thus, it is quite possible that poor health at age 16 negatively affects the possibilities for continuing education, for example, because of poorer academic performance at primary level or decreased motivation for further education. However, we also found that the health status of those men who did not continue their education after the mandatory level was impaired more than among those who completed at least secondary-level education. Thus, poor motivation or capability for education in men may predict subsequent poor health status. This may be related, for example, to health-damaging behaviors, such as smoking or alcohol abuse, or suboptimal mental health such as depression or behavioral problems.

Discussion on Heritability of Self-Rated Health

The effect of additive genetic factors consistently decreased during aging and at the same time the relative role of specific environmental factors increased in our study. This was somewhat unanticipated as one might have expected that if genetic factors have an effect on health – for example, through health behaviors – this effect would rather strengthen than weaken during aging. The increasing effect of genetic factors during aging was found, for example, in intelligence (Plomin & Spinath, 2004). However, given that actual physical diseases affect self-rated health, increases in disease burden would increase environmental effects.

Nevertheless, our results are in accordance with previous studies on the heritability of self-rated health. When compared to a previous Norwegian study including young adults aged 18–31 (Røysamb et al., 2003), a nearly identical genetic component was found in this study in men (36%) as we found at age 25 (32%). Among women the difference was larger and the Norwegian study showed lower heritability in women (16%) than in men whereas our results showed that heritability was at a similar level in women (36%) and men. However, the confidence intervals were so large in both studies that this difference can be because of sample variation.

Another study (Romeis et al., 2000) including young male adults, the U.S. study on veterans, also gave a very similar estimate for the heritability of self-rated health (40%). Three other previous twin studies on self-rated health included mainly older twins than our study, and the sample sizes were so small in these studies that the interpretation of the results is difficult. Thus the results on the twin studies for young adults suggest that the heritability of self-rated health is likely to be about 30% in men. In women the results are less conclusive, but they do not indicate that the heritability of self-rated health would be substantially different in women and men. However, real population differences in genetic or environmental factors affecting self-rated health may exist, accounting for heritability differences between studies.

When interpreting the previous results on the heritability of self-rated health, it is important to take into account the limitations of our study when considering generalization of the results to other populations. First, Finland represents an affluent western welfare state. Although the response rate in our data is high – more than 90% of all Finnish twins in the studied birth cohorts – children in the most disadvantaged families nevertheless may not have participated in the surveys.

The study cohorts were born in the 1970s when the standard of living was much higher in Finland than only two or three decades earlier. Thus, these results can be applied only to similar cohorts, mainly middle-class families in affluent and relatively egalitarian societies, whereas in societies where the standard of living is lower or socioeconomic differences in the standard of living are larger, familial factors are likely to have a stronger effect on self-rated health. For example, a previous comparative study on Finland, Sweden, Denmark, and Norway showed that the average level of self-rated health among the elderly population was worse in Finland than in the other countries (Silventoinen & Lahelma, 2002). Comparison of surveys conducted at two points of time showed that this difference was likely to be because of a cohort effect and was restricted to birth cohorts born before the Second World War. This cohort effect may further be related to poor childhood environments, as the standard of living at this time was much lower in Finland than it was in the other studied Nordic countries, and poor nutrition, strenuous work in childhood, and poor

hygiene were common in Finland. If the variation in childhood living conditions had been larger in our data, shared environmental factors would probably have shown stronger effects on the variation of self-rated health than those found in this study.

THE BACKGROUND OF SOCIOECONOMIC HEALTH DIFFERENCES

A major question raised by this study concerns the background of socioeconomic differences in self-rated health. As our results do not support the influence of family environment on health, it is likely that genetic factors or unshared environment affect these differences directly or in interaction with family environment. It is highly likely that health-damaging behaviors and risk factors, such as obesity, smoking, and alcohol abuse, explain, at least in part, the variation in self-rated health. These factors show a strong genetic component and thus they may give considerable insight into both the genetic and the unshared environmental factors affecting self-rated health (Boomsma et al., 2002). Also, considerable socioeconomic variation has been found among Finnish adolescents in health behaviors and risk factors, especially in smoking (Paavola, Vartiainen, & Haukkala, 2004), physical inactivity (Aarnio, Kujala, & Kaprio, 1997), and obesity (Mikkilä, Lahti-Koski, Pietinen, Virtanen, & Rimpelä, 2003), and thus they may also explain the socioeconomic differences in self-rated health found in our study.

Including specific measures of the family environment in our models would permit us to better tease out gene-environment interaction effects, and that remains to be done in further analyses. Unshared environment consists mostly of a large number of minor incidents and experiences specific to the individual during the life course in addition to the effect of measurement error, and thus it is difficult to study what the role of unshared environment might be in the production of socioeconomic health differences. The role of genetic factors behind socioeconomic differences in health is also poorly understood, but some studies support the association between genetic factors and socioeconomic differences. In our previous study on middle-aged Finnish twins (Silventoinen, Sarlio-Lähteenkorva, Koskenvuo, Lahelma, & Kaprio, 2004), we found that genetic factors largely explain the relatively modest association between education

and obesity, which is a major risk factor of many diseases in the middle-aged population. The background of this association is not yet known, but it is possible that intelligence contributes both to education and obesity and might explain this association.

The results of previous studies have shown clear socioeconomic health differences, and we found by using the *FinnTwin16* data that these differences are present already in adolescence and early adulthood in Finland. Narrowing of socioeconomic health inequalities is a key target in the national public health policy in Finland as well as in many other countries. However, while efforts to reduce socioeconomic health differences have been made, inequalities in health have nevertheless widened rather than narrowed (Mackenbach et al., 2003). This indicates that these differences may be rooted in factors other than the unequal distribution of material resources or the differences in access to health care between social classes.

Note that Finland has a universal and subsidized health care system, and thus it is not likely that differences in the quality of health care strongly contribute to socioeconomic health differences. Also, income inequalities are small in Finland, and transfers have a substantial effect on the income level among people in lower social positions. Thus, it would be tempting to start to search the background of socioeconomic health differences not only in the distribution of material resources but also the genetic differences between individuals as suggested by our results on the effect of genetic factors on self-rated health.

It is not very likely, if not biologically impossible, that the same genes would directly affect social position and health-related factors, but there are certain mediating factors that explain this association. We have already mentioned intelligence as a possible candidate for a common background factor for social position and health. It is obvious that intelligence strongly affects not only educational level but also many other indicators of social position, such as income.

There is not yet very much sound empirical evidence that intelligence is directly linked to health or health-related factors. However, as described in a review by Gottfredson (2004), intelligence would explain many details in the socioeconomic patterning of health that

are difficult to explain by unequal distribution of material resources. These include the smooth social gradient in health over the entire social strata as well as the universal nature of socioeconomic health inequalities in spite of substantial differences in income distribution and health care and social systems between countries.

However, it is also possible that the effect of genetic factors on socioeconomic health inequalities is mediated by factors other than intelligence. For example, many mental disorders with strong genetic predisposition may affect both social position and multiple health behaviors. Understanding these mediating mechanisms is necessary before concrete steps toward decreasing health inequalities can be considered.

If socioeconomic health differences are strongly modified by genetic factors, this raises an obvious question: What kinds of implications does this have for efforts to decrease these differences? Naturally genes do not act deterministically but affect our predispositions and development patterns. Even if genetic factors do affect socioeconomic health differences directly there is no reason to assume that this would somehow make it impossible to reduce these differences.

The high heritability of a trait does not mean that a change in environmental factors could not affect it. A good example is human stature. The heritability of stature is very high and genetic factors account for more than 80% of height differences between individuals, at least in Caucasian populations (Silventoinen, Sammalisto et al., 2003). However, the mean stature of a population has dramatically increased in most of the countries in the world during the 20th century, and at the same time socioeconomic differences have decreased (Silventoinen, 2003).

No major changes have taken place in the gene pools, so these changes must have resulted from changes in environmental factors or determinants of gene expression. Thus even in a situation when socioeconomic health differences would have been largely determined by genetic factors, it is still possible to influence both the average level of health in the population and the magnitude of socioeconomic health differences. Hence, it is most likely that efforts should be targeted on families with young children and support their development throughout infancy and the early school years.

TOWARD A HOLISTIC VIEW: INTERPLAY BETWEEN NATURE AND NURTURE

So far, we have discussed the effects of genes and environment separately. However, it is very likely that this is an oversimplification and in the real world genetic and environmental factors do not affect health independently but rather interact with each other. We close this chapter on self-rated health and its determinants in young Finnish twins by discussing two possible models that theoretically can create interplay between genes and environment. Currently gene-environment interactions are poorly understood, and there is only some emerging empirical research on this issue relevant to the topic of this chapter. However, the question of interaction between environmental and genetic factors will most probably become an important topic in future behavioral genetics.

The real possibility of interplay between nature and nurture is also important to consider as it can strongly affect how we interpret the effect of genetic and environmental factors on health. Our statistical models for examining the empirical data do not sufficiently capture this complexity, and hence we need to be cautious in drawing strong conclusions based on our limited models. Thus, this discussion helps give possible alternative interpretations for the previous results on socioeconomic health differences as well as suggest ways for further research.

It is likely that the relative effect of genetic and environmental factors on self-rated health is not the same in all populations but varies between different sociodemographic groups. We have already found evidence that this actually is the case between age groups, and the relative effect of genetic factors seems to be stronger in adolescence than it is in early adulthood. It is, however, possible that similar variation can be found equally between socioeconomic groups. There is some previous evidence that socioeconomic variation in the relative effect of genetic and environmental factors actually exists in intelligence. A study by Turkheimer and co-authors (Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003) showed that genetic factors had a much stronger effect and common environmental factors a much weaker effect on intelligence among children at age 7 in families with high socioeconomic status compared to families with

low socioeconomic status. This suggests that children in higher social classes reach their genetically determined intelligence capacity but in low social classes poor childhood living conditions create additional variation in intelligence among children.

Regional differences in the relative effects of genetic and environmental factors on alcohol use have also been found in the *FinnTwin16* data (Rose et al., 2001; Rose, Dick, Viken, & Kaprio, 2001). Genetic factors have a stronger effect on drinking habits in urban than rural areas in Finland, even when the drinking frequencies were very similar in both areas. This is probably because in urban areas social norms do not regulate alcohol use as strictly as in rural areas, and thus individual genetically determined preferences can fully affect drinking habits. In rural areas, common environment is a more important determinant for drinking – that is, drinking is largely regulated by the social environment in which an adolescent is living and not so much his or her own preferences for alcohol use.

If this model of various effects of genetic factors in different social environments were applicable to health-related factors, it would offer broad applications for health policies. It is possible that the effect of a common environment on health and health-related factors is restricted to lower social class families, and above a certain threshold this effect disappears. This socioeconomic variation in the effect of genetic factors weakens the effect of common environmental factors if the analyses are not stratified by social class, especially when common environmental factors have an effect on health only in the lowest social classes, and families in low social classes are underrepresented in the sample.

Thus, our results on a small effect of common environment on self-rated health may be applicable to the general Finnish population, but there still may be subgroups in which the effect of familial factors is stronger. In health policies this would mean that efforts to support families and improve childhood living conditions should be targeted to those social classes in which familial variation can actually affect the health status of children. A problem for testing this hypothesis is that families in which social problems accumulate are difficult to reach by surveys.

The variation in the relative effect of genetic and environmental factors between different socioeconomic groups described here does

not yet represent gene-environment interaction in the sense that the effect of the environment would be modified by the genotype. It is possible, however, that this actually is the case and genes and environment affect health in interaction. In practice this would mean, for example, that the same family environment could have different effects on the children in a family based on their genetic susceptibility to environmental factors. This type of interaction decreases correlations within DZ twin pairs and thus diminishes the estimate of common environmental factors on health.

There is some previous evidence of this type of interaction in traits potentially important for socioeconomic health differences. In two classic papers, Caspi and co-authors showed that a particular gene protects a child from developing antisocial behavior (Caspi et al., 2002) and another gene predisposes a child to depression (Caspi et al., 2003) in adulthood in the presence of stressful living conditions in childhood. Among noncarriers of these genes, no differences were found in antisocial behavior or depression in adulthood regardless of childhood living conditions; in the absence of childhood stress, genetic variation in these genes did not account for individual differences in outcome. It is too early to argue whether similar interactions in other traits related to health and health behavior exist. This is, however, a real possibility, and the question about genetic factors that protect or predispose for the negative effects of stressful life events will probably become a very important topic in further research.

CONCLUSIONS

In this chapter we studied how genetic and environmental factors affect self-rated health and its change from adolescence to early adulthood. We found that a respondent's own education achieved by age 25 and parental unemployment explained self-rated health of "less than good" at age 16 in men and women. When we studied the change in self-rated health from age 16 to 25, the only factor that explained impaired health was own education at age 25 in men.

The effect of genetic factors on self-rated health was substantial at age 16 but its effect decreased toward age 25 and simultaneously the effect of unshared environmental factors increased. We did not find evidence that common environmental factors would affect

self-rated health. The heritability of self-rated health was largely similar in men and women, but at age 16 we found a sex-specific genetic effect affecting self-rated health, which, however, disappeared at later age.

Our results suggest that socioeconomic differences affect self-rated health in Finland by respondents' adolescence and early adulthood. The background of these differences is, however, not in family background but rather in genetic factors. An important question for further studies is whether genetic factors affect self-rated health independently or in interplay with home environment or other environmental factors.

PART III

SOCIOEMOTIONAL BEHAVIOR IN EARLY ADOLESCENCE

This section introduces three major components of socioemotional behavior: externalizing problem behaviors, internalizing problem behaviors, and adaptive behaviors, and a Multidimensional Peer Nomination Inventory for their assessment. The inventory was developed within the framework of the model of emotional and behavioral regulation (Chapter 1). Parallel versions are available for peer nomination, teacher rating, and parental rating. Research results presented in Chapters 8 to 12 are based on JYLS data (Chapter 1) and *FinnTwin12* data (Chapter 3). For the JYLS data, analyses are extended to both the school-aged offspring and the aging parents of the original sample. Thus three generations are met in this section.

Chapter 8 by Vierikko and Pulkkinen shows that independent of the informant, boys exceed girls in externalizing problem behaviors, and girls exceed boys in internalizing problem behaviors and adaptive behaviors. Both types of problem behaviors decrease from ages 12 to 14 whereas compliant behavior increases. Typically, additive genetic factors explained about half of the phenotypic variance in socioemotional behavior for boys and girls, and half of the variance was attributed to environmental factors. Significant variation from this 50–50 split in sources of variance was, however, evident across gender and across dimensions of socioemotional behavior. Gender

differences emerged in aggression, depression, anxiety, and social activity.

Chapter 9 by Kokkonen and M-L. Kinnunen analyzes the construct of emotion regulation as a process and an outcome. Emotion regulation strategies may be adaptive or maladaptive. Emotion regulation deficiency in adults is related to poor physical and mental health. Externalizing problem behaviors in boys and internalizing problem behaviors in girls are related to poor teacher-rated self-control (used as a synonym of self-regulation); problem behaviors, in turn, are associated with recurrent self-reported pain, accidents, and poor health habits in children and adults.

Chapter 10 by Metsäpelto and Juujärvi presents results on the impact of parenting on children's socioemotional behavior. High parental knowledge, as reported by the parents, was associated with children's adaptive behavior. High parental knowledge, as reported by the children, was not related to their behavior, but a negative family atmosphere, as reported by the children, was associated with both high externalizing problem behaviors and low adaptive behaviors. If family atmosphere was positive, parents' and children's reports on parental knowledge correlated with each other, but they did not correlate if atmosphere was negative.

Chapter 11 by U. Kinnunen and Rantanen reviews the literature on the links from the parents' negative job-related affects through the quality of parenting to children's behavior and well-being. Parents who feel exhaustion due to their job may not be as involved in their children's lives; low parental knowledge on children's activities is, in turn, linked to their low adaptive behavior. Many men and women benefit from multiple roles, but the positive spillover between work and family is not well known from the child's point of view. Parents and children see parental work differently, and lack of parental time may be detrimental to children.

Chapter 12 by Hurme analyzes the role of grandparents in the development of children and as a support for their adult children. On the basis of earlier studies, several grandparent types from distant through formal to positively active types are discerned. One of the roles of the grandparents is to act as a support person for their grandchildren. The chapter also presents results from the JYLS study

concerning help from the parents to their adult children. They show that the parents help in child care and household tasks, and give money and emotional support. Contacts between the three generations are intense in spite of geographical distance, and the relationships are good. There is reciprocity, especially in mental and social support.

8

Genetic and Environmental Factors in Girls' and Boys' Socioemotional Behavior

Elina Vierikko, Lea Pulkkinen, and Richard J. Rose

Previous studies have shown that boys more often than girls develop externalizing problem behaviors such as aggression (Keiley, Bates, Dodge, & Petit, 2000), while internalizing problem behaviors such as depressive symptoms are more common in girls, at least in adolescence (Nolen-Hoeksma & Girgus, 1994). Girls are also perceived to be more prosocial, as well, although contradictory findings exist, as reviewed by Eisenberg and Fabes (1998). *FinnTwin12* data provide an excellent opportunity to examine gender differences in a variety of socioemotional behaviors in middle childhood and early adolescence using multiple informants. Furthermore, the data permit studying gender differences in genetic and environmental effects on socioemotional behavior.

Gender differences in socioemotional behavior

Multidimensional Peer Nomination Inventory

The multidimensional inventory of children's socioemotional behavior was initially constructed for peer nominations (MPNI; the Multidimensional Peer Nomination Inventory; Pulkkinen, Kaprio, et al., 1999) to represent the two-dimensional model of emotional and behavioral regulation (see Chapter 1). The MPNI consists of 30 items assessing four behavioral types – aggressive, anxious, constructive,

and compliant behavioral types – defined by the model. Seven additional items concerning low self-control of behavior were added to Teacher and Parent Rating Forms of the MPNI to increase the coverage of externalizing and internalizing problem behaviors.

A factor analysis of the inventory resulted in three factors for both the MPNI and the Teacher and Parent Rating Forms (Pulkkinen, Kaprio, et al., 1999). Items for hyperactivity-impulsivity, aggression, and inattention loaded on the first factor, and this factor was identified as externalizing problem behaviors (also called behavioral problems) referring to low control of emotions and social activity. The second factor was loaded by constructiveness, compliance, and social activity, and it was identified as adaptive behaviors, referring to both socially active and passive behaviors characterized by high control of emotions. Items for depressive symptoms and social anxiety loaded on the third factor, which was identified as internalizing problem behaviors (also called emotional problems) referring to low emotional control and social passivity.

The reliabilities (coefficient alpha) of the scales were satisfactory for all assessments, being highest for peer nominations. The agreement of ratings was higher between teachers and peers than between teachers and parents or between parents and peers (Pulkkinen, Kaprio, et al., 1999). Thus, the agreement was highest between the informants who observed the child's behavior in similar contexts. Interrater agreement was slightly higher in assessing boys' behavior than that of girls.

Consistency Across Informants

Gender differences in socioemotional behavior were assessed at age 12 based on peer nominations and teacher and parent ratings. At age 14, information was obtained from teacher ratings, self-ratings, and co-twin ratings using the same MPNI items as at age 12. Data about singleton children, who were the classmates of the twins, were available at age 12, as well, based on peer nominations made in 1,002 classrooms including 23,200 classmates of the twins (Pulkkinen et al., 2003).

Comparisons between boys and girls in the mean level of the MPNI scales showed (Table 8.1) that independent of the informant and

TABLE 8.1. *Comparison of Boys and Girls in Externalizing and Internalizing Problem Behaviors, and in Adaptive Behaviors*

	Peer nomination		Teacher rating		Parental rating	Self-rating	Co-twin rating
	Age 12		Age 12	Age 14	Age 12	Age 14	Age 14
	Twins 916 boys 912 girls	Singletons 11,904 boys 11,297 girls	Twins 2312 boys 2276 girls	Twins 1469 boys 1542 girls	Twins 2475 boys 2412 girls	Twins 924 boys 896 girls	Twins 922 boys 894 girls
Externalizing problem behaviors	B>G[a]	B>G[a]	B>G[a]	B>G[a]	B>G[a]	B>G[a]	*ns.*
Hyperactivity-impulsivity	B>G[a]	B>G[a]	B>G[a]	B>G[a]	B>G[a]	B>G[d]	*ns.*
Aggression	B>G[a]	B>G[a]	B>G[a]	B>G[a]	B>G[a]	B>G[a]	B>G[a]
Inattention	B>G[a]	B>G[a]	B>G[a]	B>G[a]	B>G[a]	B>G[c]	G>B[d]
Internalizing problem behaviors	G>B[a]	G>B[a]	G>B[a]	G>B[a]	G>B[b]	G>B[a]	G>B[b]
Depressive symptoms	G>B[a]	G>B[a]	G>B[a]	G>B[c]	*ns.*	G>B[a]	G>B[b]
Social anxiety	G>B[a]	G>B[a]	G>B[a]	G>B[a]	G>B[a]	G>B[a]	G>B[b]
Adaptive behaviors	G>B[b]	G>B[a]	G>B[a]	G>B[a]	G>B[a]	G>B[d]	*ns.*
Constructive behavior	G>B[a]	G>B[a]	G>B[a]	G>B[a]	G>B[a]	G>B[a]	G>B[a]
Compliant behavior	G>B[b]	G>B[a]	G>B[a]	G>B[a]	G>B[a]	*ns.*	*ns.*
Socially active behavior	*ns.*	*ns.*	G>B[d]	G>B[a]	G>B[a]	B>G[b]	*ns.*

Note: The mean of boys differs from the mean of girls: [a]$p < .001$. [b]$p < .01$. [c]$p < .05$. [d]$p < .10$.
B = boys, G = girls, *ns.* = nonsignificant sex differences.

the age of the participants, boys received higher ratings than girls in aggression whereas girls were rated higher than boys in social anxiety and constructive behavior. In general, boys scored higher than girls in the scales for externalizing problem behaviors, and girls scored higher than boys in internalizing problem behaviors and adaptive behaviors. This pattern of gender differences was evident in peer nominations and parental ratings at age 12, and in teacher ratings at ages 12 and 14. Self-ratings at age 14 resulted in a similar pattern of gender differences, although the difference was only a trend for hyperactivity-impulsivity and nonsignificant for compliant behavior.

The subscale for socially active behavior (including popularity, good at leading a group play or class outing, being often with other kids after school) showed the least consistent pattern of gender differences. Girls were assessed as socially more active by parents at age 12, and by teachers at ages 12 and 14 whereas boys obtained higher scores than girls in self-ratings at age 14; gender differences were not significant in either peer nominations or co-twin ratings. Although there was some variation in behavioral assessments depending on the informant and context of the behavior, the results of *FinnTwin12* showed that gender differences in socioemotional behavior were very consistent with parents, teachers, peers, and twins themselves as informants. Gender differences were less evident at age 14 in co-twin ratings.

It is noteworthy that gender differences in peer-rated socioemotional behavior were similar in twins and same-aged singletons (Table 8.1). When twins were contrasted with singleton classmates, no group differences were found in externalizing and internalizing problem behaviors, but both male and female twins were rated higher than singletons in adaptive behaviors, especially in socially active behaviors (Pulkkinen et al., 2003). The positive impact of the twinship on adaptive behaviors seemed to occur mainly in opposite-sex DZ twins, who were rated higher than gender-matched singleton classmates in these MPNI-item domains. This finding challenges the assumption that twinship would lead to deficits in cognitive, particularly language, development and increase risk for other psychological functions. On the contrary, not only were male and female twins rated higher in socially active behavior, both were rated lower in inattention

TABLE 8.2. *Teacher Ratings on Socioemotional Behavior of Twins at Ages 12 and 14; Wilcoxon Test for Boys and Girls*

	Boys ($N = 670$)		Girls ($N = 695$)	
Scales	**Age 12** *M (SD)*	**Age 14** *M (SD)*	**Age 12** *M (SD)*	**Age14** *M (SD)*
Hyperactivity-impulsivity	0.91 (0.79)	0.68 (0.75)***	0.44 (0.53)	0.33 (0.53)***
Aggression	0.70 (0.66)	0.40 (0.54)***	0.49 (0.56)	0.23 (0.39)***
Inattention	0.91 (0.73)	0.82 (0.73)***	0.49 (0.55)	0.44 (0.55)*
Depressive symptoms	0.65 (0.52)	0.49 (0.47)***	0.70 (0.53)	0.57 (0.50)***
Social anxiety	0.75 (0.66)	0.66 (0.70)**	0.95 (0.77)	0.88 (0.78)*
Constructive behavior	1.70 (0.70)	1.68 (0.69)	1.93 (0.64)	1.98 (0.65)
Compliant behavior	1.82 (0.72)	1.98 (0.73)***	2.11 (0.64)	2.26 (0.64)***
Socially active behavior	1.83 (0.63)	1.81 (0.65)	1.89 (0.70)	1.94 (0.68)

Note: ***$p < .001$. **$p < .01$. * $p < .05$ for differences between ages.

than were singletons, and male twins were lower in depressive symptoms than were male singletons.

Consistency Across Time

Based on teacher ratings, consistency of gender differences in socioemotional behavior was high from age 12 to age 14 (Table 8.1). In all studied variables, gender differences were in the same direction at both ages and significant, except for socially active behavior, in which gender difference became more salient across time. It is notable that the gender differences remained the same, although the level of behavior changed; the change occurred in the same direction in both genders.

Socioemotional behavior remained on the same level from age 12 to age 14 in constructive and socially active behaviors for boys and girls on the basis of teacher ratings (Table 8.2). Only one of the twins from each pair, randomly chosen, was included in the sample. For both genders, there was a decrease in the mean level of teacher-rated aggression, hyperactivity-impulsivity, inattention, depressive

TABLE 8.3. *Correlations Between Teacher Ratings at Ages 12 and 14;* FinnTwin12.

	Boys ($n = 2311$)	**Girls ($n = 2279$)**
Hyperactivity-impulsivity	.47	.39[a]
Aggression	.35	.26[a]
Inattention	.46	.40[b]
Depressive symptoms	.23	.24[ns.]
Social anxiety	.27	.34[c]
Constructive behavior	.37	.32[c]
Compliant behavior	.36	.32[ns.]
Socially active behavior	.37	.43[c]

Note: All correlations were significant at level of $p < .001$. The correlation of boys differs from the correlation of girls: [a]$p < .001$. [b]$p < .01$. [c]$p < .05$. *ns.* = nonsignificant sex difference.

symptoms, and social anxiety. The mean level of compliant behavior (is peaceable and has a lot of patience, never quarrels, is kind and friendly) increased during the two-year period for both boys and girls. Thus, problem behaviors decreased and compliant behavior increased in early adolescence. The decrease also occurred in girls' depressive symptoms, although these often are assumed to increase during adolescence.

The age-to-age correlations in Table 8.3 show the relative stability of teacher-rated socioemotional behaviors. For all studied behaviors, the stability coefficients were significant, reflecting moderate stability. The coefficients were lowest for depressive symptoms and highest for hyperactivity-impulsivity and inattention. The stability was higher in boys than in girls for externalizing problem behaviors (hyperactivity-impulsivity, aggression, and inattention) and for constructive behavior. Social anxiety and socially active behaviors were slightly more stable in girls than in boys. No gender differences were found in the stability of depressive symptoms or compliant behavior.

Research on mean gender differences in aggression has indicated that boys are more aggressive than girls, both physically and verbally (Knight, Fabes, & Higgins, 1996), and that these differences appear as early as during the preschool years (Maccoby & Jacklin, 1980). In middle childhood, gender differences in aggression have been argued to be more qualitative than quantitative: boys having

a tendency to harm others by physical and verbal aggression and girls by relational, indirect forms of aggression (Björkqvist, Österman, & Lagerspetz, 1994). Recent studies of gender differences in different types of aggression have, however, shown that boys have higher mean levels of direct aggression whereas gender differences are small (Salmivalli & Kaukiainen, 2004) or nonexistent (Vierikko, Pulkkinen, Kaprio, Viken, & Rose, 2003) in relational, indirect aggression. A noteworthy finding is that no differences were identified using the MPNI scale of aggression, a scale that includes items for both direct aggression and relational aggression, with the latter taken from the measure developed by Lagerspetz, Björkqvist, & Peltonen (1988). On the basis of current research, one could conclude that while direct aggression is more typical of boys than of girls, indirect aggression is no more typical of girls than of boys; girls reach boys' level only in relational, indirect aggression. In children rated as highly aggressive, no gender differences have been found in the frequency or severity of aggressive behavior (Cairns & Cairns, 1994).

It is argued that gender differences in depressive symptoms begin to occur in adolescence and persist throughout adulthood, girls having more depressive symptoms than boys (Nolen-Hoeksema & Girgus, 1994). This gender difference emerged in the *FinnTwin12* data by the time the participants were 12. Almqvist et al. (1999) have, however, found higher means in 8- to 9-year-old Finnish boys than in girls ($N = 6017$) in depressive symptoms assessed by parents, teachers, and self. These contradictory findings, from two studies in the same country with representative samples, suggest that the prevalence of depressive symptoms is higher in boys than in girls during younger school ages whereas depressive symptoms become more common among girls than boys in later middle childhood and early adolescence. Longitudinal study across these school ages would be necessary to definitively investigate possible change in boys' and girls' depressive symptoms and the causes for it.

Further, additional longitudinal research would be needed for understanding the development of gender differences in adaptive behaviors. In the present study, girls were consistently higher than boys in constructive, compliant, and socially active behavior in late middle childhood and early adolescence when rated by teachers. Perhaps patterns of prosocial behavior start to differentiate boys and girls

during toddler and preschool years (Eisenberg & Fabes, 1998; Hay, 1994).

GENETIC AND ENVIRONMENTAL EFFECTS ON SOCIOEMOTIONAL BEHAVIOR

Twin Method

FinnTwin12 data from five epidemiological cohorts of same-sex MZ and DZ twins and opposite-sex DZ twins permit studying gender differences in genetic and environmental effects on socioemotional behavior using the general principles earlier outlined in Chapter 3.

Examining twin correlations separately for boys and girls offers a descriptive test of quantitative gender differences in genetic and environmental effects on aggression. A differing pattern of twin correlations for boys and girls suggests differences in the respective magnitudes of genetic and environmental effects on boys and girls. Qualitative gender differences, meaning that boys and girls are being influenced by different sets of genes and environmental factors, are suggested when the opposite-sex DZ twin (DZO) correlation is substantially lower than the correlation for same-sex DZ twin pairs.

A rather consistent pattern of MZ and DZ correlations was found for the MPNI scales across peer nominations, teacher ratings, and parental ratings (Pulkkinen, Kaprio, et al., 1999). In general, MZ correlations were significantly higher than DZ correlations in all scales, except in teacher- and parent-rated depressive symptoms, suggesting that additive genetic effects have a major role in explaining children's differences in socioemotional behavior. In the teacher- and parent-rated depressive symptoms, the magnitudes of MZ and DZ correlations did not differ, suggesting large common environmental effects (environmental effects that influence all children within a family similarly).

The importance of genetic and environmental factors on children's behavioral and emotional problems was formally tested by fitting genetic models to the data using the software program Mx. The major results of previous analyses of these data, enhanced by some new findings based on current analyses of the genetic and environmental

effects on socioemotional behavior, are presented and discussed in the following sections.

Externalizing Problem Behaviors

Genetic and environmental effects on teacher-rated aggression for twins at age 12 were studied in a sample of 1,651 twin pairs (Vierikko et al., 2003). The twin correlations suggested significant effects from common environments as well as significant additive genetic effects, but the pattern of twin correlations differed for girls and boys. Differences between MZ and DZ twin correlations were larger for girls than boys, suggesting a larger contribution from genetic factors for girls and a greater contribution from effects of common environments for boys. Accordingly, structured equation sex-limitation models were fit to the data, allowing for sex-specific common environmental variance in boys.

Model-fitting results (Vierikko et al., 2003) showed genetic effects that were about twice as high for girls as for boys, and correspondingly, common environmental effects contributed more to boys' differences in aggression than to differences among girls. Two-thirds of the common environmental effects were sex-specific for boys. A sibling interaction effect, which produces differences in variance between MZ and DZ twins, was added to the sex-limitation model, and the most parsimonious model with fewest parameters was evaluated using the chi-square difference test. Parameter estimates obtained with a model that allowed a sex-specific common environment and sibling interaction for male twins, with E set equal for girls and boys, is shown in Table 8.4 (row 1). The sibling effect parameter is of modest magnitude, but note that its value is negative; if due to interactions of twin brothers, the negative value suggests a competition effect such that greater aggressiveness of one twin brother decreases the level of aggression in the other; if due to a contrast effect in the ratings, it suggests that when teachers rate one twin brother very highly on aggression, they tend to rate the co-twin lower.

A possible source for the sex-specific common environmental effects found here may lie in differential expectations regarding the expression of aggression among boys and girls; aggression is usually seen as more acceptable among boys than girls (Björkqvist et al., 1994).

TABLE 8.4. *Standardized Parameter Estimates and Their 95% Confidence Intervals for Additive Genetic (A), Common Environmental (C), Specific Environmental (E), Male Specific Common Environmental (C′), and Sibling (s) Effects on Socioemotional Behavior*

	Males				Females						
	A	**C**	**E**	**C′**	**A**	**C**	**E**	***S***	χ^2	***df***	***p***	**AIC**
Aggression	27	.15	.07	.31	.54	.37	.09	−.09	3.832	8	.872	−12.168
E m = f	(.18–.39)	(.06–.27)	(.06–.09)	(.40–.60)	(.43–.68)	(.23–.48)	(.08–.11)	(–.17– –.02)				
Hyperactivity-Impulsivity	.49	.03	.12	.36	.55	.32	.14		5.389	10	.864	−14.611
A, E m = f	(.40–.59)	(.00–.09)	(.11–.14)	(.27–.44)	(.45–.66)	(.20–.42)	(.12–.16)					
Inattention	.50	–	.19	.31	.53	.32	.15		10.941	10	.362	−9.059
A m = f	(.42–.58)		(.17–.23)	(.23–.38)	(.45–.61)	(.24–.40)	(.13–.18)					
Depression	.60	.12	.27	–	.39	.42	.19		7.942	9	.540	−10.058
	(.50–.69)	(.06–.21)	(.23–.32)		(.27–.54)	(.28–.53)	(.16–.22)					
Anxiety	.82	–	.18	–	.59	.24	.18		14.952	11	.185	−7.048
E m = f	(.79–.84)		(.16–.21)		(.47–.71)	(.11–.35)	(.16–.20)					
Constructiveness	.46	.05	.18	.31	.45	.42	.13		6.227	9	.717	−11.773
A m = f	(.38–.56)	(.01–.10)	(.16–.21)	(.22–.39)	(.36–.54)	(.33–.51)	(.11–.15)					
Compliance	.53	–	.19	.28	.56	.31	.12		15.674	10	.109	−4.326
A m = f	(.46–.61)		(.16–.22)	(.21–.36)	(.49–.63)	(.23–.39)	(.11–.15)					
Social Activity	.82	–	.18	–	.60	.23	.17		11.698	11	.387	−10.302
E m = f	(.79–.84)		(.16–.21)		(.49–.73)	(.11–.34)	(.15–.19)					

Note: m = males; f = females. Except for Depression, the best-fitting model is one with one or more parameters constrained to equality across male and female twins. For other behavioral categories, one or two parameters were set equal for males and females as follows: Additive genetic effects (A) for Inattention, Constructiveness, and Compliance; specific environmental effects (E) for Aggression, Anxiety, and Social Anxiety; and both A and E for Hyperactivity-Impulsivity.

Sex-specific effects did not, however, emerge in parental ratings on aggression in the same data set (Vierikko et al., 2003). Otherwise, however, analyses of parental ratings on aggression showed the same pattern of effects as for teacher ratings: Genetic effects were higher for girls than for boys, and common environmental effects were higher for boys than for girls.

The magnitude of genetic and environmental effects for teacher-rated hyperactivity-impulsivity was rather similar for both boys and girls. These effects were studied in a sample of 1,636 twin pairs (Vierikko, Pulkkinen, Kaprio, & Rose, 2004), again fitting sex-limitation models as described above for teacher-rated aggression. Results of the best-fitting model again allowed for sex-specific common environmental effects for boys. But in contrast to aggression, genetic effects were similar across gender, and both A and E could be set equal for boys and girls (Table 8.4, row 2). Genetic effects accounted for about half the total variance, with common environmental effects accounting for about one-third of it. The residual variance came from environmental effects unique to individuals. Part of the common environmental effect was sex-specific.

In both boys and girls, more variance (about four-fifths) was attributable to additive genetic factors in parent-rated hyperactivity-impulsivity, and one-fifth to unique environmental factors (Vierikko et al., 2004); but the latter was not significant. Nor did common environmental factors contribute to children's differences in parent-rated hyperactivity-impulsivity. Thus, results of these analyses for hyperactivity-impulsivity differed across different informants.

A new analysis of genetic and environmental effects on teacher-rated inattention at age 12 was performed for this chapter with data from 2,102 twin pairs (344 monozygotic or MZ boys; 359 MZ girls; 376 DZ, same-sex dizygotic boys; 337 DZ girls; 686 OSDZ, opposite-sex dizygotic twin pairs). No gender differences emerged in additive genetic and common environmental effects on inattention (Table 8.4, row 3). About half the total variance was accounted for by genetic factors, one-third by common environmental factors, and the rest of the variance by unique environmental effects.

In sum, additive genetic factors explained a significant proportion of the individual variation in each of the subscales for externalizing problem behaviors, but the estimated magnitude of those estimates

varied across subscales and gender. Significant gender differences in genetic and environmental effects on aggression and related problem behaviors have been found in other studies as well, but uncertainties remain. The importance of both genes and environments in individual differences in externalizing problem behaviors is well established for both boys and girls, but the extent to which these factors differ across gender remains unresolved. These gender differences seem to vary depending on the age of the participants and the type of behavior studied.

Genetic effects in mother-rated aggression were slightly higher for girls than for boys at age 3, *but* higher for boys than for girls at ages 7, 10, and 12 years in a Dutch twin study (Van Beijsterveldt, Bartels, Hudziak, & Boomsma, 2003). Similarly, for very young children, ages 2 to 3, higher heritability for girls than for boys was reported in mother-rated externalizing problem behaviors (Van der Valk, Verhulst, Stroet, & Boomsma, 1998). At later ages, Eley, Lichtenstein, and Stevenson (1999) found no gender differences in the etiology of mother-rated aggression in Swedish twins aged 7 to 9 years and British twins aged 8 to 16 years. Gender differences emerged, however, when both aggressive and nonaggressive antisocial behaviors were fitted in the same model. Genetic effects were higher and common environmental effects lower for girls than for boys in both Swedish and British samples. Our results are consistent with the latter findings. Nevertheless, an adoption study on parent-rated problem behaviors in twins and singletons at ages 10 to 15 revealed higher heritability for boys than for girls (Van den Oord, Boomsma, & Verhulst, 1994), as did a twin study on mother-rated externalizing problem behaviors at age 8 to age 16 (Silberg et al., 1996).

Variation in the estimates of genetic and environmental effects across studies may, in part, be due to differences in the content of the variables measuring socioemotional behavior. For example, variability in behavioral genetic results for aggression may be caused by heterogeneity in item-content included in the measures that make up different types of aggression or correlates of aggression, such as hostility or anger, even antisocial behavior (Tremblay, 2000). In addition, some evidence has been found of a modest increase in heritability with increasing severity of externalizing behavior (Gjone, Stevenson, Sundet, & Eilertsen, 1996). Also, aggregating different

forms of problem behaviors – such as aggression, hyperactivity, impulsivity, and delinquency – to a broader scale for externalizing or antisocial behavior may modify the results, because these different behaviors have been found to have some nonoverlapping etiology (Vierikko et al., 2003). For such reasons, more attention should be paid to the content of the items measuring externalizing behavior.

The magnitude of common environmental effects found in the present study was greater than that reported in other studies of problem behaviors. This finding may reflect bias in teacher ratings or the existence of factors in Finnish school environments that inflate similarity of DZ twin pairs. In Finnish public schools, co-twins are rarely separated into different school classes; about 90% of the co-twins in our sample shared the same classroom and were rated by the same teacher, and, perhaps as a result, all same-sex twin correlations were inflated. Such bias, if present, would inflate estimates of effects from common environments.

Moderate stability correlations (.35 for boys; .26 for girls; Table 8.3) for aggression from age 12 to 14 indicated both continuity and change in aggression from middle childhood to early adolescence. Our results with the sample of 1,041 twin pairs have revealed that the effects of genes and environment were not stable through these years (Vierikko, Pulkkinen, Kaprio, & Rose, in press). Significant genetic and environmental effects were found at both ages, but these effects were not stable over time, and the estimates differed markedly by gender (Vierikko, 2004). For boys, genetic effects and unique environmental effects increased (from around 30% to 40% and from 10% to 50%, respectively) whereas common environmental effects disappeared (from about 15% to zero) and sex-specific common environmental effects decreased to a small fraction (from 45% to 5%). The pattern of changes for girls was the opposite: Genetic effects decreased (from 70% to 40%) and unique environmental and common environmental effects increased (from around 10% to 30% and from 20% to 30%, respectively) during these two years. As the result of these changes, additive genetic effects on aggression were equal at age 14 for boys and girls. Among boys, unique environmental effects explained individual differences in aggression more highly than among girls whereas common environmental effects were more influential in girls than in boys.

The phenotypic continuity of aggression, indicated by the stability correlation of teacher ratings between ages 12 and 14, was influenced by common environmental factors for both genders, and common environmental factors and genetic factors for boys. For girls, there was no genetic correlation across ages 12 and 14; almost all of the phenotypic continuity of aggression was explained by common environmental factors. Unique environmental factors had a minor albeit significant role in that continuity, indicating that systematic bias in ratings or systematic experiences unique to a child continue to affect aggression from age 12 to age 14. For boys, the phenotypic continuity of aggression was explained by genetic and common environmental factors influencing aggression at both age 12 and age 14.

In very young children, genetic effects on continuities in behavior may be greater than for older children. A recent study by Price et al. (2005) showed that what was stable for attention deficit hyperactivity disorder (ADHD) symptoms from 2 to 4 years of age was largely genetic; genetic influences explained 91% of the stable variance in ADHD symptoms across these ages. A study of maternal-rated aggression from age 3 to age 12 showed that genetic factors accounted for approximately 65% (and common environmental factors for 25%) of the stability of aggression (Van Beijsterveldt et al., 2003). More longitudinal studies are needed to enhance our understanding of how genetic and environmental factors influence continuity in behavior at different ages.

Change in aggression in the study by Vierikko et al. (in press) was mediated by genes and unique environmental factors in both boys and girls. The moderating effects of these factors were evident in genetic and unique environmental effects emerging at age 14, and accordingly, these effects influenced aggression only at that age. Approximately 84% of the genetic variance, and all unique environmental variance, at age 14 in boys, and all genetic variance, and almost all unique environmental variance in girls, were independent of the genetic variance at age 12. The results regarding genetic change underscore the fact that effects of genes on behavior and development are not constant throughout life. Genetic and unique environmental sources of developmental change have been found for adolescent antisocial behavior (O'Connor, Neiderhiser, Reiss, Hetherington, & Plomin, 1998), as well.

Internalizing Problem Behaviors

Heritability of depressive symptoms was studied in *FinnTwin12* in data from the first four twin cohorts of the population-based, epidemiological sample ($n = 1{,}366$ twin pairs) using the Parental and Teacher Rating Forms of MPNI, and in the intensively studied subsample ($n = 497$ twin pairs) using peer nominations and self-ratings (Happonen et al., 2002). The self-ratings of depressive symptoms were based on the CDI (Children's Depression Inventory; Kovacs, 1992), which included 27 items measuring various depressive symptoms covering disturbed mood, hedonic capacity, vegetative functions, self-evaluation, and interpersonal behaviors. The heritability estimates varied widely across gender and informant.

Heritability estimates have ranged widely also in other studies of children's depressive symptoms, as reviewed by Eley (1999). Age seems to be a critical modulator of the genetic and environmental contributions to depressive symptoms. During childhood and early school years, environmental factors have a considerable influence on depressive symptoms whereas genes play only a minor role. In adolescence, the genetic effects are substantial and the impact of common environmental effect is more modest.

Analyses of genetic and environmental effects on depressive symptoms and social anxiety were performed for this chapter using data from all five cohorts of 12-year-old twins (344 monozygotic or MZ boys; 359 MZ girls; 376 DZ, same-sex dizygotic boys; 337 DZ girls; 686 OSDZ, opposite-sex dizygotic twin pairs). The results, shown in Table 8.4 (rows 4 and 5) indicated that genetic and environmental contributions differed for boys and girls. For boys, genetic contribution was high in both depressive symptoms and social anxiety (60% and 82%, respectively), and common environmental contribution was low in depressive symptoms and nonsignificant in social anxiety. For girls, the genetic contribution was smaller than for boys (about 40% for depressive symptoms and 60% for social anxiety), and the effects of common environmental factors were correspondingly higher. Gender differences were not found in the effects of unique environmental factors (about 20%). These findings of higher heritability in depressive symptoms and social anxiety for boys than for girls

are in line with earlier studies (Eley & Stevenson, 1999; Eaves et al., 1997).

The genetic architecture of clinically relevant depression differs in adolescence from that of depressive symptoms. Sihvola et al., (2005) investigated characteristics and genetic epidemiology of *DSM-IV* major depression (MDD) and minor depression (MD) using the intensively studied subsample of *FinnTwin12*. Samples of 909 girls and 945 boys, with a mean age of 14.2 years, were interviewed by trained staff using the Semi-Structured Assessment for the Genetics of Alcoholism (SSAGA). The lifetime prevalences for *DSM-IV* MDD and MD were 2.3% and 12.0%, respectively. Genetic modeling suggested the importance of genetic and individual environmental factors for clinically defined depression in adolescent girls. In boys, no genetic effects were detected, and individual environmental factors contributed largely to the development of depression (Sihvola et al., 2005, manuscript submitted).

Adaptive Behaviors

The effects of genetic and environmental factors on adaptive behaviors were studied for each subscale (constructiveness, compliance, social activity) in the full sample containing 2,102 twin pairs. Patterns of genetic and environmental effects were quite similar for constructiveness and compliance in boys and girls (Table 8.4, rows 6–8). For constructiveness, most of the variance was accounted for fairly equally by additive genetic effects (45% in boys; 44% in girls) and common environmental effects (37% in boys; 43% in girls). For compliance, the genetic effects (51% in boys; 58% in girls) were higher than were common environmental effects (30% in both boys and girls). The residual variance was attributed to unique environmental effects for both behaviors.

The genetic contribution to social activity (82% for boys, 60% for girls) was higher than that for constructiveness and compliance, particularly so among boys. All remaining variance was explained in boys by unique environment. In contrast, effects of both common (23%) and unique environment (17%) were significant in girls. The different pattern of genetic and environmental effects may reflect the

substantial contribution of temperament to social activity and its high heritability among boys.

The etiology of adaptive and prosocial behaviors has been studied less frequently than that of externalizing and internalizing behaviors. Findings reported by Scourfield, John, Martin, and McGuffin (2004) have documented the importance of both genes and environmental factors on adaptive or related behaviors during childhood and adolescence. This research group found that genetic effects accounted for approximately half the variance of prosocial behavior (is helpful, is considerate of other people's feelings, is kind to younger children, etc.) assessed by teachers in twins aged 5 to 12 years and almost 90% in twins aged 11 to 17 years. Common environmental effects accounted for about one-third of the variance in younger twins, but were nonsignificant in older twins. At age 14, our study of adaptive behaviors showed a smaller contribution of genetic factors and a greater contribution of common environmental factors. More longitudinal research is needed with different types of indicators of adaptive behaviors to ascertain the role of genetic and environmental factors in adaptive behaviors at different ages. Nor should the possibility of true cultural differences in effects of common environment on adaptive behaviors be ignored.

Accumulation of Behavior Problems

The co-occurrence of problem behaviors is a well-established finding in a research of childhood and adolescence (Biederman, Newcorn, & Sprich, 1991; Jensen, Martin, & Cantwell, 1997). Aggression at ages 4 through 18 has been found to be highly comorbid with attentional problems in both clinical and general population samples as measured by teacher, parent, and self-ratings (McConaughy & Achenbach, 1994). Behavior genetic methods can be used to study the extent to which the co-occurrence of different behavioral problems is explained by shared genetic and environmental factors. For instance, the high co-occurrence of depressive symptoms and social anxiety was explained by the same genetic factors affecting both behaviors in analyses reported by Eley and Stevenson (1999).

Shared genes and environmental effects in the covariation of teacher- and parent-rated aggression and hyperactivity-impulsivity

and possible gender differences in these effects were examined with the epidemiological sample of 12-year-old Finnish twins (Vierikko et al., 2004). As expected, the phenotypic correlation between aggression and hyperactivity-impulsivity was high (in teacher ratings .72 for boys and .52 for girls; in parent ratings .70 for boys, .44 for girls), and these high phenotypic correlations were explained by extensive genetic and common environmental overlap. Rater and gender differences, however, emerged in genetic and environmental mediation of the correlation between the behaviors.

In teacher ratings, genetic factors and both common and unique environmental factors significantly contributed to the correlation between aggression and hyperactivity-impulsivity found among both boys and girls. In parent ratings, the correlation was mediated by genetic, common environmental, and unique environmental factors as well, but the genetic correlation was higher for boys than for girls. In addition to a shared etiology, behavior-specific genetic and environmental effects also emerged. That finding supports the notion that by aggregating different forms of problem behaviors, researchers may lose important information on their development and etiology.

Research has frequently reported a strong association between the subscales of externalizing and internalizing behaviors in both clinical and epidemiological samples. Genetic and environmental effects have been found to correlate strongly between both categorical and dimensional measures of ADHD and oppositional defiant disorder/conduct disorder (ODD/CD) (Nadder, Silberg, Eaves, Maes, & Meyer, 1998; Silberg et al., 1996), and between dimensional measures of aggression and attentional problems (Schmitz & Mrazek, 2001), suggesting that these behaviors share a common etiology. Although evidence of different etiology for boys and girls has been found in aggression and categorical ADHD, the extent and magnitude of gender differences in the co-occurrence of behavioral problems have not been tested before.

CONCLUSIONS

Results of the analyses reported here provide clear evidence of gender differences in socioemotional behavior in early adolescence. Boys exceeded girls in externalizing problem behaviors whereas girls

scored higher in internalizing problem behaviors. Girls were rated as more constructive and compliant than boys, but gender differences in social activity were less evident. Gender differences in socioemotional behavior were consistent across different contexts (home, school), child status (twin, singleton), informants (peers, teacher, parent, self), and age (12 and 14 years). Our large and representative samples of twins and their classmates, along with our multirater, longitudinal research design, offer unusual strength to these gender comparisons of socioemotional behavior. The pattern of differences found in Finnish children robustly replicates reports by other research groups studying samples from other cultures, convincingly demonstrating that these gender differences are not specific to culture, age, a twin relationship, sibling structure, or measurement procedures.

Gender modulation of genetic and environmental effects on dimensions of socioemotional behavior was found as well. Both genetic and environmental effects were found to be significant for both boys and girls, but the estimates differed across gender and across subscales of socioemotional behavior. A large proportion of the variance in socioemotional behavior was attributed to genetic factors, although considerable gender-specific variation existed. Genetic effects were estimated to be about two-fold larger for aggression among girls as among boys, and, in contrast, substantially more genetic effects were found among boys than girls for both depression and anxiety. The standardized estimates of genetic effects ranged widely across dimensions of socioemotional behavior, accounting for 27% to 82% of the phenotypic variance in boys and between 39% to 60% in girls. The remaining variance was explained by common and unique environmental effects in most of the behavioral scales. Typically, about half the trait variance has been attributed to genetic factors and half to environmental factors across many domains of personality and social behavior. That general result may well be descriptive of findings from self-report personality questionnaires in adults, but data in Table 8.4 suggest that significant and substantial variation from this 50-50 split in sources of variance is evident across gender and across dimensions of socioemotional behavior in early adolescence.

The effects of common environmental factors were larger than those reported in earlier studies. In part, this difference may be

related to the person reporting the child's behavior; the analyses of genetic and environmental effects on socioemotional behavior reported here were based on teacher ratings; in contrast, most of the earlier studies used parent ratings. Parents benefit from opportunities to observe their children over long time periods and in different settings, and parents are exposed to many aspects of children's behavior. In contrast, teachers observe twins' social interaction and behavior only in school environments and in a peer group, and teachers have a large reference group of same-aged children for comparison purposes.

The twin relationship may create special demands on meaningfully assessing each twin's behavior, especially when the same teacher rates both co-twins. A teacher may tend to perceive similarity in siblings' behavior, particularly when the children are of the same gender and exactly matched for age. Further, a teacher may have difficulties in attributing behavior to a correct co-twin, because the co-twins of some pairs may be confused with one another (Simonoff et al., 1998). Confusing co-twins is easy, particularly if they closely resemble each other and spend much time together or in the same peer group. Knowing that siblings are twin siblings may induce expectations for the teacher that the two will behave similarly. As evidence, we, like others, found larger twin correlations for aggression and hyperactivity-impulsivity among co-twins rated by the same teacher than for those independently rated by separate teachers (Vierikko et al., 2004). In Finnish culture, twin children are usually placed in the same classrooms; in this study, initially 87% of the co-twins were in the same classroom and had the same teacher rate their socioemotional behavior.

But differences between sets of ratings are not necessarily due solely to rater biases. As research on children's behavioral problems has acknowledged (Achenbach, McGonaughy, & Howell, 1987; Pulkkinen, Kaprio, et al., 1999), it is likely that a child's socioemotional behavior varies in different situations and is different in the school context from that observed at home. For example, depressive children may not show depressive symptoms among their classmates. Instead, they may be aggressive or hyperactive in peer groups. The consistency across raters has been found to be higher in externalizing behaviors than in emotional problems (Achenbach et al., 1987). Thus,

it is important to bear in mind the context of the rated behavior when interpreting results concerning the children's behavior.

The estimates of genetic and environmental effects varied widely across the subscales of socioemotional behaviors. Furthermore, aggression and hyperactivity shared partly the same etiology (Vierikko et al., 2004). Studies have also shown that depressive symptoms and social anxiety share the same genetic etiology, but different environmental factors are contributing to these behaviors (Eley & Stevenson, 1999). Aggregating different forms of problem behaviors into a large scale of externalizing or internalizing problem behaviors may be at the cost of losing important information on the diversity of behavior. Finding etiological differences in the subscales of externalizing and internalizing behaviors suggests different implications for their prevention and treatment.

Genes and environmental factors do not operate independently; rather, biological capacities and environmental characteristics reciprocally interact throughout the life span. Nor, of course, do genes directly influence the behaviors we measure with instruments such as the MPNI. More likely, as others have hypothesized, the genotype affects physiological characteristics such as hormonal levels or reactivity patterns of the autonomic and central nervous systems, and these characteristics, in turn, predispose the developing child toward behavioral and cognitive styles (Plomin, DeFries, McClearn, & Rutter, 1997). Experience provides opportunities for each child's dispositional characteristics to find expression, and their expression gets reinforced, so that dispositional differences between children become larger across development.

Thus, differences in genetic effects found for boys and girls during early adolescence may reflect developmental consequences of differences in hormonal levels and pubertal timing and many other differences across genders. Dispositional contributions to personality and social adaptive behavior are transmitted from generation to generation through indirect pathways and polygenic mechanisms rather than single genes. Hence, different forms of socioemotional behavior are likely to be results of multiple genes, mediated by neurobiological systems in an exquisite interaction with cumulative social experience.

9

Emotion Regulation and Well-Being

Marja Kokkonen and Marja-Liisa Kinnunen

INTRODUCTION

After decades of neglect, psychology rediscovered emotion in the 1980s (Gross, 1999a). Although there is still controversy about how emotions should be defined, the current definitions emphasize their dynamic, functional, and adaptive nature. However, profiting from the adaptive features of emotion requires effective emotion regulation (Paivio & Laurent, 2001). Given the lack of consensus on the definition of emotion, it is unsurprising that emotion regulation, grown out of the earlier lines of research into stress, coping, and temperament, and out of psychoanalytic research (Eisenberg, 1998; Gross, 1999b), also has been defined in various ways.

The concept of *emotion regulation* has sometimes been used when emotions have been regarded as inherently regulatory, influencing, for example, physiological and social processes. Probably more often, however, emotions have been seen as the targets of regulation, and emotion regulation has referred to the processes of initiating, maintaining, modulating, or changing the occurrence, intensity, or duration of emotion-related physiological processes and internal feeling states, which often serve the attainment of one's goals (Eisenberg, Fabes, Guthrie, & Reiser, 2000). This dynamic view of emotion regulation emphasizes the fact that emotions can be regulated.

The lack of clarity in the definition has been due in part to the large number of similar concepts. For instance, some researchers

have considered emotion regulation a synonym for *coping* (Brenner & Salovey, 1997, p.170) or a type of coping (Eisenberg, Fabes, & Losoya, 1997), notably emotion-focused coping (e.g., Eisenberg, 1998). On the other hand, emotion regulation and coping have been seen as distinct terms because of, for example, different emphases on either a subjective state or objective circumstances (Larsen, 2000) or different attitudes toward the operation of the possible underlying processes (Parkinson & Totterdell, 1999). Another overlapping pair of concepts is *self-regulation* and *self-control*. Despite the strengthening trend of using these terms synonymously (Creer, 2000; Zeidner, Boekaerts, & Pintrich, 2000), many researchers still consider them distinct. In the domain of emotion, the child development literature has typically seen self-regulation as a more adaptive, mature form of control, whereas self-control has been regarded as more rigid, less flexible, and less adaptive (Diaz, Neal, & Amaya-Williams, 1990; Kopp, 1982; Zimmerman, 2000).

In daily life, however, emotion regulation is not always optimal. *Emotion dysregulation* is viewed as difficulty in modulating both the experience and expression of emotion in response to contextual demands and in controlling the effect of emotional arousal on the organization and quality of thoughts, actions, and interactions (Cole, Michel, & Teti, 1994). Reflected in most externalizing and internalizing behavioral problems in later childhood, emotion dysregulation is characterized by existing control structures that operate in a maladaptive way and direct emotions toward inappropriate goals (Cicchetti, Ackerman, & Izard, 1995), resulting in emotional, cognitive, and behavioral outcomes that are counterproductive for the individual in a particular situation (Garber & Dodge, 1991).

In this chapter, we focus on the significance of emotion (dys)regulation in both psychological and physical well-being. After a brief overview of emotion regulation as a process and its associations with well-being, we turn to the connections between well-being and emotion (dys)regulation as an outcome. Next, we discuss the central findings on emotion regulation, self-control of emotions, and well-being drawn from the Jyväskylä Longitudinal Study of Personality and Social Development (JYLS) and the *FinnTwin12* studies. Finally, we present our recent findings on children's self-control, externalizing and internalizing problem behaviors, and adaptive behaviors.

EMOTION REGULATION AS A PROCESS

In the strategic approach, emotion regulation is viewed as a process rather than an outcome. Here, different ways of regulating emotions are typically referred to as "emotion regulation strategies" (Eisenberg et al., 2000), "affect-regulation strategies" (Parkinson & Totterdell, 1999), "mood regulation strategies" (Mayer & Stevens, 1994), "emotional self-regulatory styles" (Thompson, 1990), "emotion regulation/management skills" (Thompson, 1994), and "coping strategies" (Saarni, 1997). Emotion-regulation strategies have been grouped in various ways. For example, Gross (1999a, 1999b) divided emotion-regulation strategies into antecedent-focused and response-focused processes, whereas Brenner and Salovey (1997) described strategies along the dimensions of external-internal and social-solitary.

The most general classification of emotion-regulation strategies can be seen in Parkinson and Totterdell (1999), who identified 162 specific strategies from research using questionnaires, interviews, and group discussions. The strategies eventually condensed into two main clusters: cognitive strategies and behavioral strategies. The strategies range from venting (e.g., screaming), disengagement (e.g., trying to think of nothing), reconceptualization (e.g., thinking of things one could do to keep the mood in question), to rationalization (e.g., thinking rationally about the problem), reappraisal (e.g., telling oneself that the bad situation will pass), and distraction (e.g., thinking of other places one could go). The behavioral strategies range from acting happy, undertaking relaxing/pleasant activities (e.g., sleeping), activating constructive strategies (e.g., exercising), to writing, and seeking social support (e.g., seeking reassurance).

Research focused on emotion-regulation strategies has discovered general developmental trends – for example, that emotion regulation gradually shifts from a reliance on external sources (e.g., caregivers) to more intraindividual, internal sources, whereas concrete, behavioral ways of regulating emotions are mostly replaced by more self-initiated, mentalistic, cognitive emotion-regulation strategies (Eisenberg, 1998; Walden & Smith, 1997). As Brenner and Salovey (1997, p. 175) suggest, the use of emotion-regulation strategies differs not only as a function of age but also as a function of sex, resulting in three salient differences between boys and girls. They conclude that

girls are more likely than boys to rely on social support and emotion-focused regulation, whereas boys are more likely than girls to use physical exercise.

According to Bonanno (2001), one of the most essential questions to be answered by future research is whether specific emotion-regulation strategies are adaptive or maladaptive. Erber (1996, p. 262) assumes that some strategies might be inherently worse than others in achieving the desired effects. In the light of the most recent but very limited and largely cross-sectional literature, there is some evidence that not only emotional states (see Salovey, Rothman, Detweiler, & Steward, 2000 for review) but also strategically-approached emotion regulation have ties to psychological and physical well-being. Findings in the more frequently studied field of psychological well-being show that rumination (Nolen-Hoeksema, 2000), suppression (Gross & John, 2003), lower use of approach coping, and higher use of avoidant coping (Herman-Stahl, Stemmler, & Petersen, 1995) are linked to more depression. Longitudinally, active goal-oriented coping reduced symptoms of anxiety, and seeking social support decreased depressive symptoms, but venting emotions, alcohol/drug use, and distraction had a negative impact on psychological well-being (Vollrath, Alnaes, & Torgersen, 1996).

The link between emotion regulation and physical well-being has been examined less frequently, and primarily in terms of physical symptoms or self-assessed well-being. It has been argued that inhibition and suppression (Gross, 1998; Pennebaker, 1997), worry, ruminating, and perseverative thinking (Brosschot & Thayer, 2004) are detrimental to physical health. In particular, the behavioral strategies through which negative emotions are regulated are especially relevant: Substance abuse, problematic eating, and unprotected sex have both immediate and long-term consequences for individuals' well-being. In contrast, using instrumental mastery-oriented coping appears to be linked to fewer complaints about pain and gastrointestinal problems (Eriksen, Olff, & Ursin, 1997). Also, the strategy of repair, that is, an individual's active attempt to mentally repair a negative emotion in a more positive direction by planning, recalling, and imagining something desirable, has been associated with lower levels of self-reported physical symptoms (Goldman, Kraemer, & Salovey, 1996; Salovey, Stroud, Woolery, & Epel, 2002) and with less bodily

pain and fewer problems with work or other daily activity as a result of physical health and emotional problems (Extremera & Fernández-Berrocal, 2002).

EMOTION REGULATION AS AN OUTCOME

The alternative approach, regarding emotion regulation and dysregulation as outcomes rather than processes, has especially focused on various individual indexes of emotion dysregulation and its connections to poor health. For example, a sizable body of evidence addresses the link between alexithymia, an emotion regulation deficiency in which difficulties are experienced by identifying and describing feelings to others, and poorer mental and physical health (Taylor, Bagby, & Parker, 1997). As summarized by Taylor (2004), alexithymia has been associated with hypertension, inflammatory bowel disease, hypochondriasis, functional gastrointestinal disorders, eating disorders, substance use disorders, and panic disorder. It has also been found to be connected to greater somatic complaints (Deary, Scott, & Wilson, 1997), poorer perceived health status (Pandey, Gupta, & Upadhyaya, 2000), tonic physiological hyperarousal (for review see Lumley, Stettner, & Wehmer, 1996), greater percentage of body fat, increased perceived stress (Waldstein, Kauhanen, Neumann, & Katzel, 2002), and most dramatically, with all-cause death, especially from external causes, such as injury, suicide, and homicide (Kauhanen, Kaplan, Cohen, Julkunen, & Salonen,1996). The link between alexithymia and premature death has also been explained by maladaptive health behaviors, such as the poor nutrition, sedentary lifestyle, and substance abuse common to many alexithymic individuals (Helmers & Mente, 1999).

Emotional ambivalence, another marker of emotion dysregulation, reflects an inability to accept or cope properly with the standard limitations of emotions (Mayer & Salovey, 1995). Emotionally ambivalent individuals either want to express emotions but do not, or express emotions but later regret their expressiveness (King, 1998), thus experiencing a conflict over the expression of experienced emotion (King & Emmons, 1990). They also seem to be more alexithymic (King, Emmons, & Woodley, 1992), paranoid, obsessive-compulsive, phobic, psychotic (King & Emmons, 1990), depressive (Katz &

Campbell, 1994; King & Emmons, 1990), and neurotic (King & Emmons, 1990; Laghai & Stephen, 2000); they also experience higher levels of negative affect (King, 1998). In addition, emotional ambivalence has been linked to lower satisfaction with life, lower self-esteem (King & Emmons, 1990), lower positive affectivity (King & Emmons, 1991), and lower levels of general self-control (King et al., 1992).

Proponents of this approach that sees emotion regulation as an outcome have also been interested in the indirect relationship between emotion (dys)regulation and health-related behaviors that are likely to jeopardize well-being. Emotional lability or problems with emotion regulation have, indeed, been found to predispose people to diametrically opposed behaviors – those categorized as either a risk behavior (such as smoking and drinking) or a preventive behavior (such as exercising) known to increase or decrease the risk for a variety of health problems (Donovan, Jessor, & Costa, 1993). Studies in the United States have shown, for example, that markers of emotion dysregulation, such as anger, hostility, aggression, and poor self-control, have been associated with substance abuse (for summary, see Wills, 1998). Also, studies based on the JYLS data (e.g., Kokkonen, Kinnunen, & Pulkkinen, 2002; Pulkkinen, 1995) have repeatedly reported the connection between low self-control of emotions and problem drinking.

LESSONS LEARNED IN THE JYLS AND THE *FINNTWIN12* BY COMBINING THE APPROACHES

The model of emotional and behavioral regulation (Pulkkinen 1995, 1996) has greatly extended our knowledge about the links between emotion (dys)regulation and well-being because it includes indexes for both outcome-like emotion regulation (i.e., high self-control of emotions) as a result of the neutralization process of emotion, and outcome-like emotion dysregulation (i.e., low self-control of emotions) as a result of the intensification process of emotion. Stressing the outcome nature of emotion (dys)regulation, Pulkkinen (1995) has shown longitudinally, based on the JYLS data collected from 147 boys and 142 girls, that suffering from different types of accidents and resulting physical impairment by the age of 27 was most frequent among men characterized by low emotional and behavioral

regulation at ages 8 and 14. The most generalized childhood predictor of accidents was noncompliance operationalized by disobedience to a teacher. In adulthood, heavy drinking increased the risk of accidents.

The results also indicated that a larger proportion of men than women admitted at age 27 that accidents and injuries had affected their health. Also, at age 36, the JYLS men ($n = 129$) suffered from more accidents and traumas than did the JYLS women ($n = 123$) (Kokkonen et al., 2002). Path analysis showed that in men, low self-control of emotions at age 14 was indirectly linked to self-assessed poor health and self-reported psychosomatic symptoms at age 36 because of heavy drinking, and directly linked to disabilities at age 36. In women, the more essential mediator between childhood low self-control of emotions and adult well-being was tobacco use, leading to more self-reported psychosomatic symptoms, disabilities, and poorer self-assessed health (Kokkonen et al., 2002).

In the JYLS and the *FinnTwin12*, high self-control of emotions has sometimes been marked by adaptive behaviors, whereas low self-control of emotions has been marked by externalizing and internalizing problem behaviors. To study emotion (dys)regulation through these behaviors, Pulkkinen, Kaprio, and Rose (1999) developed the Multidimensional Peer Nomination Inventory (MPNI; see Chapters 1 and 8). Based on the teacher-rated behavior of 414 twins, researchers found that in 11- to 12-year-olds, externalizing and internalizing problem behaviors were related to recurrent self-reported pain, independent of past injuries and chronic illnesses (Vaalamo, Pulkkinen, Kinnunen, Kaprio, & Rose, 2002). In girls, excessive constructive behavior, shown in immoderate caring about others and overconscientiousness, was additionally associated with recurrent pain, suggesting that they might have exceeded the optimal level of emotion regulation (Vaalamo et al., 2002).

In the long run, however, constructive and compliant behavior in childhood have proved to be positively related to individuals' later psychological and social well-being in the JYLS. In the search of childhood antecedents of adaptive functioning in the adulthood of 130 men and 131 women, Pulkkinen, Nygren, and Kokko (2002) found that teacher-rated constructiveness at age 8 was positively associated with psychological well-being and satisfaction with life in

36-year-old men. Teacher-rated compliance at age 8 was related to controlled drinking in both men and women at age 36. Further analysis with structural equation models showed that boys' constructive and compliant behavior at age 8, together with school success and good family circumstances, led to good social functioning (i.e., integration to society, controlled drinking, and stable career line) at age 36 (Pulkkinen et al., 2002). On the other hand, individuals' psychological ill-being in adulthood has been indirectly connected to childhood emotion dysregulation in the JYLS. Kokko, Pulkkinen, and Puustinen (2000) found that low self-control of emotions at age 8 was linked to long-term unemployment (longer than 2 years in total between ages 27 and 36), which was further related to increased current psychological distress as indicated by low self-esteem, depressive symptoms, and anxiety.

Taking advantage of these perspectives on emotion (dys)-regulation, objective health measures, and a longitudinal JYLS data set from 96 women and 85 men, Kinnunen, Kokkonen, Kaprio, and Pulkkinen (2005) explored whether self-perceived emotion regulation, the cognitive emotion regulation strategies of repair and maintenance, and emotional ambivalence were connected to the subjective health factor (including self-rated health and self-reported psychosomatic symptoms) and the metabolic syndrome factor, a cluster of risk factors for the cardiovascular diseases. The results indicated that emotion (dys)regulation and the subjective health factor explained 23% of the variance of the metabolic syndrome factor indexed by high-density lipoprotein, triglycerides, systolic and diastolic blood pressure, plasma glucose, and waist circumference. The structural equation modeling showed that higher repair led directly to the low level of metabolic syndrome factor, and indirectly to poorer subjective health. Good self-perceived emotion regulation – that is, a sense of control over one's emotions – and maintenance – a tendency to preserve an ongoing emotion unchanged – were negatively connected to the metabolic syndrome factor through poorer subjective health whereas in the case of emotional ambivalence, the associations were positive.

The associations between self-control and adaptive and maladaptive behavior have also been studied cross-sectionally in the family research project of Emotional and Behavioral Regulation, an

TABLE 9.1. *Mean Values, and Standard Deviations (SD) of Self-Control and MPNI Variables*

	Boys	Girls
Variables	**Mean (*SD*)**	**Mean (*SD*)**
Self-control	5.25 (1.21)**	5.92 (0.88)
MPNI		
Externalizing problem behaviors	0.22 (1.08)*	−0.29 (0.84)
Internalizing problem behaviors	−0.07 (0.96)	0.08 (1.03)
Adaptive behaviors	−0.23 (1.08)*	0.30 (0.78)

* mean value differs from girls at $p < .05$
** mean value differs from girls at $p < .01$

extension of the JYLS. Our most recent investigations have focused on the connections between 8- to 13-year-old children's (56 boys, 44 girls) general self-control and their externalizing and internalizing problem behaviors and adaptive behaviors. Our measures included the shortened 20-item teacher form of the Self-Control Rating Scale (SCRS; Kendall & Wilcox, 1979), and the teacher form of the MPNI (Pulkkinen, Kaprio et al., 1999). The comparisons between boys and girls showed that teachers rated girls higher in self-control and in adaptive behaviors whereas they saw boys as suffering more from externalizing problem behaviors (Table 9.1).

Our correlational findings based on teacher ratings revealed moderate to strong associations between children's general self-control and their behavior, in accord with the model of emotional and behavioral regulation (Pulkkinen 1995, 1996; Chapter 1). Low self-control correlated with high externalizing problem behaviors ($r = .74$, $p = .000$ for girls and $r = .82$, $p = .000$ for boys). Low self-control also correlated with high internalizing problem behaviors, particularly in girls ($r = .43$, $p = .003$; for boys: $r = .23$, $p = .083$). In contrast, high self-control was related to high adaptive behaviors ($r = .33$, $p = .028$ for girls and $r = .65$, $p = .000$ for boys).

To further study the effects of self-control on children's behavior, we conducted a multivariate analysis of variance (MANOVA) with Bonferroni's post hoc tests. Three self-control groups with separate cut-off criteria for boys and girls were formed: high (above the 75th percentile), medium (from the 25th to the 75th percentile), and low (under the 25th percentile) self-control groups. Differences among the

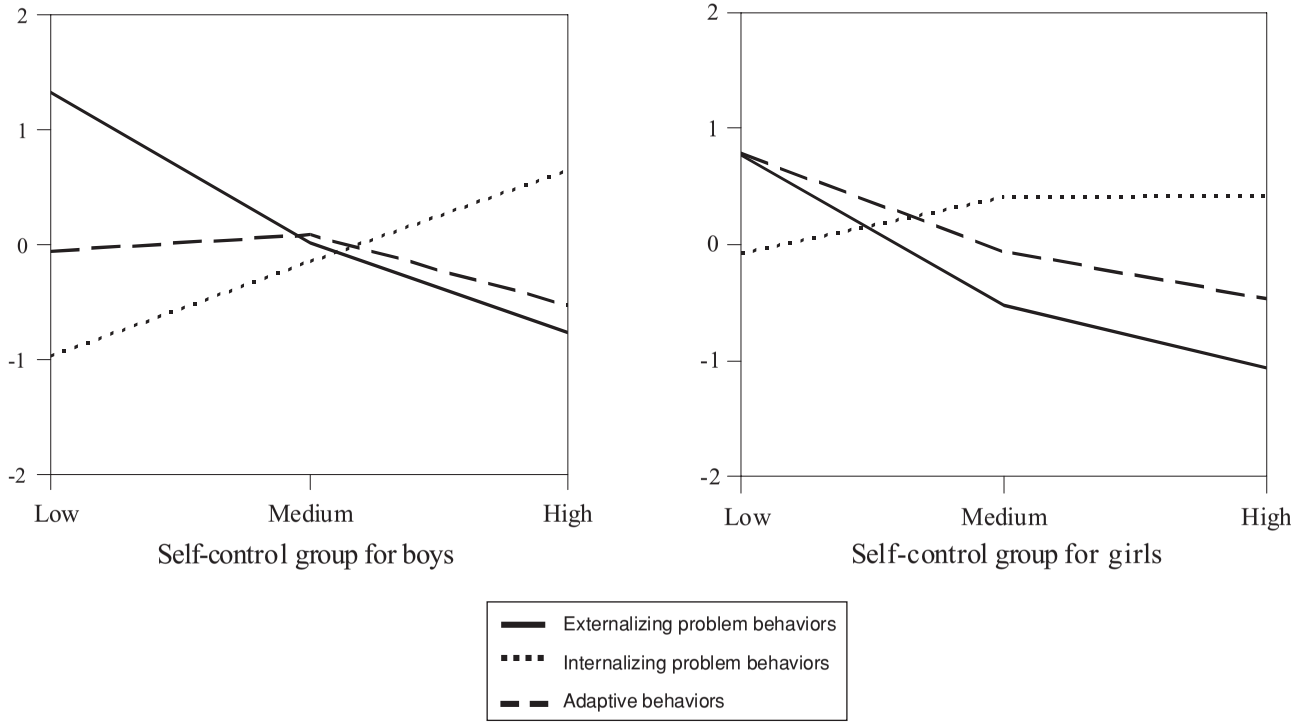

FIGURE 9.1. Mean values of externalizing and internalizing problem behaviors, and adaptive behaviors in different self-control groups in boys and girls; behavior variables normalized.

self-control groups were studied on normalized variables of externalizing and internalizing problem behaviors and adaptive behaviors separately for boys and girls.

In boys, self-control was associated with externalizing problem behaviors, $F(2, 53) = 35.35, p < 0.00$, and adaptive behaviors, $F(2, 53) = 11.54, p < 0.00$. Post hoc tests revealed that boys in the low self-control group had more externalizing problem behaviors and less adaptive behaviors than boys in the medium or the high self-control groups; also the medium and the low groups differed significantly from each other, respectively (Figure 9.1). Thus, the more self-control boys had, the less they suffered from externalizing problems and the more adaptive behaviors they had at school.

In girls, self-control was related to externalizing, $F(2, 41) = 21.04$, $p < 0.00$, and internalizing problem behaviors, $F(2, 41) = 5.36$, $p < 0.00$). Post hoc comparisons showed that girls in the low self-control groups had more externalizing and internalizing problem behaviors than girls in the medium or high self-control groups, but the high and medium groups did not differ significantly from each other (Figure 9.1). Self-control was not significantly associated with adaptive behaviors in girls, $F(2, 41) = 1.33, p = 0.28$, or in internalizing problem behaviors in boys, $F(2, 53) = 1.70$, $p = 0.19$, which was likely due to our small sample size, resulting in the low power of the study. The mean differences between higher and lower self-control groups were, however, in the expected directions, particularly for girls' adaptive behaviors.

CONCLUSIONS

Our present study explored the associations between children's general self-control and their emotion (dys)regulation indicated by adaptive behaviors and externalizing and internalizing problem behaviors. When assessed by the teachers, boys with the lowest general self-control expressed highest externalizing problem behaviors and least adaptive behaviors. Girls with the lowest general self-control suffered with highest externalizing and internalizing problem behaviors. Our present findings thus showed that the synonymous use of two overlapping concepts, self-control and self-regulation (Creer, 2000; Zeidner et al., 2000), is done for a good reason.

The previous findings based on the JYLS and the *FinnTwin12* data sets have further strengthened the evidence that emotion (dys)regulation plays a significant role in individuals' health and health-related behavior. Childhood emotion dysregulation, indicated by the low self-control of emotions in the model of emotional and behavioral regulation (Pulkkinen 1995, 1996), has been found to be linked to recurrent self-reported pain (Vaalamo et al., 2002) and later accidents resulting in physical impairment (Pulkkinen, 1995). Childhood emotion dysregulation has also been connected to such mediating factors as heavy drinking (Kokkonen et al., 2002) and long-term unemployment (Kokko et al., 2000) that in turn have been associated with self-assessed poor health, self-reported physical symptoms, and psychological distress. Childhood high self-control of emotions, on the other hand, has partially accounted for good social functioning (Pulkkinen et al., 2002). As for the strategically approached emotion regulation, for instance, the strategy of maintaining an ongoing emotion unchanged appears to be negatively connected to the objectively measured metabolic syndrome factor through poor subjective health (Kinnunen et al., 2005).

When it comes to well-being, the question of the (mal)adaptiveness of a specific emotion-regulation strategy might have to do not only with the fact that some strategies might be inherently worse than others. The continuity of the strategy use is probably equally important. Emotion-regulation strategies with the most satisfying outcomes generalize (Thompson, Flood, & Lundquist, 1995), and with time, individuals may start to prefer certain styles or patterns of regulation, so that these strategies might even be interpreted in dispositional terms (Eisenberg et al., 2000). In the future, the research on the links between emotion regulation and well-being might benefit most if the continuity of different emotion-regulation strategies is taken into account. This is possible only by conducting well-organized, carefully planned prospective longitudinal studies.

10

Parental Knowledge and Family Atmosphere in Relation to Children's Socioemotional Behavior

Riitta-Leena Metsäpelto and Petri Juujärvi

INTRODUCTION

The central goal of parenting is to socialize children to conform to the demands of society while helping them to develop and maintain a sense of personal integrity and autonomy (Baumrind, 1971). Although the specific characteristics, skills, and knowledge considered desirable in children vary from one culture to another, there is general agreement that children should be reared to become adults who are mentally and physically healthy, are productive at work, and have the ability to form relationships with other people (Maccoby & Martin, 1983). Parents are not the only socialization agents that contribute to the development of children, but they are considered central sources of influence (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000).

The goal of this chapter is to present research findings on parenting and child development, based on the Jyväskylä Longitudinal Study of Personality and Social Development (JYLS). First, we summarize earlier JYLS findings demonstrating the role of parenting and family circumstances in the development of children. Second, we focus on the challenge of conceptualization and measurement of parenting. In this connection, we present approaches used in the JYLS to determine the quality of parenting. We also describe recent results that concern the selection of the informant and parental personality characteristics as the source of variation in parenting. Finally, we further

elaborate the issue of measurement of parenting by linking multi-informant data on parenting to child socialization. This is accomplished by presenting new findings that show how the degree of knowledge parents have on children's whereabouts and activities (as reported by children and parents) and the quality of family atmosphere (as reported by children) are interrelated and linked with the adaptive and maladaptive forms of children's social behavior (as reported by parents and teachers).

CHILD-CENTERED PARENTING AND DEVELOPMENTAL OUTCOMES IN CHILDREN

The conceptual framework broadly accepted among parenting researchers suggests that parents characteristically differ in their attitudes and behaviors toward parenting, but that their individual patterns of such are relatively stable. These so-called parenting styles originally evolved out of the researchers' interest in finding constellations of parental behaviors that would reliably distinguish between more and less favorable child outcomes (Baumrind, 1971), and they reflect the idea that if parenting has an influence on child development, it must be based on behavioral variance that has some stability across time and situations (Maccoby & Martin, 1983). The perspective investigates parenting as a characteristic of the parent and emphasizes that due to the asymmetry in power and competence between parents and children, parents have a unique role in the socialization of children.

The JYLS provides an important contribution to the study of parent and family influences on child development, as it offers a possibility to examine longitudinally the role of family circumstances for the development of the offspring. The parenting style that has been shown to be important for the children's development is the parents' child-centeredness (Pulkkinen, 1982; see also Kokko & Pulkkinen, 2000; Männikkö & Pulkkinen, 2001; Pulkkinen, Nygren, & Kokko, 2002). It is a broad construct describing child-rearing conditions. Basically, child-centered parents create a safe atmosphere in which children can grow. The parents are both interested in and controlling of their children's activities, they are trusting and warm, and they consider their children's opinions. They also respect their children

as individuals and avoid using unjust discipline or physical punishment. In the JYLS, child-centered parenting has been found to be longitudinally connected with positive adult outcomes such as high self-control of emotions (Pulkkinen, 1982). Moreover, accepting and emotionally warm parental attitude toward the child, combined with inductive guidance and supervision in childhood, has been shown to contribute to a high sense of coherence and optimism in adults (Chapter 14) and to decrease the risk for long-term unemployment (Kokko & Pulkkinen, 2000).

At the level of ongoing parent-child interactions, child-centered parents exert their influence on their children by sensitively adapting their own behavior to behavioral cues provided by the children, whereas parent-centered parents organize their interactions with their children almost exclusively around self-oriented goals, thereby failing to meet their children's developmental needs. In the JYLS, parents, observed during three interactive situations with their school-aged children, were found to differ in the degree of their child-centered behavior (Metsäpelto, Pulkkinen, & Poikkeus, 2001). Child-centered parents were consistently more capable of organizing their behavior from the perspective of the child by providing a context in which the child could feel the parents' warmth and acceptance, sustained involvement and interest in the child's activities, consideration of the child's opinions, and responsiveness to the child's needs for comfort and guidance. The further analysis revealed that parents tended to maintain their position relative to other mothers and fathers across multiple interactive situations, suggesting that individual differences in parenting were deeply ingrained.

The results of the previous study were expected, as parenting involves repeated interactions between parents and children that over time result in an anticipation of the behavior of the interacting partner and that create reciprocal responses that are likely to sustain the style of parenting (see Caspi, Elder, & Bem, 1987). The stability of parental behavior is part of the broader phenomenon concerning the continuity of family environments. For instance, Loeber and colleagues (2000) reported that maladaptive family interaction patterns (e.g., poor communication and bad relationship between parents and children) showed high relative stability from age 6 to age 18. The information about the stability of parental behavior and the

continuity of family environments is helpful for understanding the child development – for example, the development and maintenance of problem behaviors in the offspring.

Despite the high relative stability of parental behavior, the study by Metsäpelto and colleagues (2001) showed that parenting became more difficult as the situational demands for the parents' behavior increased. The requirement of accomplishing the interactive tasks within a strict time limit, of allowing the child the possibility of independent problem solving, and the presence of other family members appeared to distract the parents and result in less child-centered behavior. This finding was in line with previous findings, which have shown that when faced with more challenging interaction conditions, mothers experience and display less positive and more negative emotions (Martin, Clements, & Crnic, 2002). As Martin and colleagues (2002) have pointed out, such parental emotions and behaviors may serve to motivate the dyad to negotiate the demands of the challenging situation and to complete the task; alternatively, they may have dysfunctional qualities, potentially disrupting any effective cooperation. When designing family interaction studies, an understanding of how different situations modify average levels of parental behaviors is highly valuable.

Although the quality of parenting appears to be an important predictor of a child's future development, the investigation of how broader family circumstances affect parenting and children has also been the focus of interest among parenting researchers. The demographic category often discussed is socioeconomic status (and in this connection, education), because differences have been shown to exist between parents drawn from different socioeconomic (SES) groups. In their review, Hoff, Laursen, and Tardif (2002) concluded that on average, parents with lower SES emphasize parental authority and conformity to societal expectations in children, use punitive practices when their directives are violated, are more directive of their children's behavior, and use less time conversing with their children than higher-SES parents. Conversely, parents with higher SES foster the development of initiative in their children, emphasize the negotiation of rules and equality between themselves and children, and are less apt to use punitive and harsh parenting practices. In addition, they are more conversational and less directive toward children.

The JYLS findings have indicated that parents from lower SES groups have more authoritarian child-rearing attitudes compared to parents from higher SES, who are more authoritative (Metsäpelto & Pulkkinen, 2004).

However, the influence of SES on the development of the next generation, particularly girls, seems to be less pronounced in Finland than in many other cultures. The findings by Pulkkinen et al. (2002) showed that for males, successful social functioning at age 36 was explained by a favorable developmental background in childhood and preadolescence. This background consisted of high self-control over emotions in childhood, school success and high school motivation in preadolescence, and good family circumstances. Good family circumstances included child-centered parenting, the parents' controlled drinking, and high SES. The results for women were, in general, comparable to those for men, but the parents' SES was not a significant factor for favorable developmental background.

INDIVIDUAL DIFFERENCES IN PARENTING

When conceptualizing parenting, researchers have typically employed factor analysis to extract a smaller number of key parenting dimensions from a larger number of child-rearing practices or behaviors. This kind of operational definition of research phenomena has been named the *variable-oriented approach*: It examines statistical relations between variables across individuals at the group level, focusing on single variables or combinations of variables, their interrelations, and their relations to a specific criterion (Magnusson, 1998).

The portrayal of parenting in terms of distinctive dimensions has been criticized for offering a limited perspective on parenting, because it concentrates on discrete behaviors rather than on parents as individuals (Jain, Belsky, & Crnic, 1996). For instance, Baumrind (1971) recognized the need to look at multiple parenting dimensions in order to understand the overall quality of the parenting relationship, arguing that the influence of any one aspect of parenting is dependent on the configuration of all other aspects. These considerations were reflected in her influential research contribution, in which she studied parenting and child outcomes and defined three parenting styles: authoritative, authoritarian, and permissive.

This approach to the conceptualization of parenting has been named the *person-oriented approach* (Block, 1971; Magnusson, 1998). It postulates that individuals can be conceptualized as belonging to different groups or homogeneous clusters, each with its characteristic properties. The approach, thereafter, investigates how groups of individuals who share the defining features compare to other groups of individuals.

In the JYLS, both variable- and person-oriented approaches have been utilized to describe the quality of parenting (Metsäpelto & Pulkkinen, 2003). Parental self-reports have been collected in adulthood (at ages 36 and 42) in order to obtain general information about participants' parental behaviors, attitudes, goals, and child-rearing values. In line with the variable-oriented approach, the analysis of the questionnaire data has yielded broad parenting dimensions that are known to be robust correlates of child's developmental outcomes: the extent to which parents report being loving, responsive, and involved (variously labeled nurturance, emotional support, or child-centeredness); the degree to which parents report exerting psychological control over children (restrictive or authoritarian control); and the amount of knowledge parents report having about the children's whereabouts, friends, or activities (parental knowledge or monitoring).

Person-oriented methods have been used to obtain a more ecologically valid description of parenting. Metsäpelto and Pulkkinen (2003) investigated child-rearing data, based on the JYLS participants' self-reported nurturance, restrictiveness, and parental knowledge at age 36, by means of cluster analysis to identify parenting types. The analysis yielded six parenting types: *authoritative* parents and *emotionally involved* parents were high in nurturance and high to moderate in parental knowledge. *Authoritarian* parents and *emotionally detached* parents were low in nurturance, high to moderate in restrictiveness, and moderate to low in parental knowledge. *Permissive* parents were low in restrictiveness and parental knowledge and moderate in nurturance, whereas *engaged* parents were high in all parenting dimensions.

The findings suggested that by investigating parenting dimensions it is possible to generate parenting types beyond those that have been traditionally described in the literature. Collectively, the

study by Metsäpelto and Pulkkinen (2003) and previous research (e.g., McGroder, 2000; Jain et al., 1996) indicate that person-oriented methods can be used as exploratory tools for extracting patterns of parenting, for instance, in low-income or minority populations, and for creating typologies of parenting that are more differentiated than in existent models. As an example of the latter, the JYLS findings showed that the parenting types were gender related. Among the more competent parenting types, the traditional authoritative pattern was more typical of mothers, while emotionally involved parenting characterized by nurturance and moderate restrictiveness was more prevalent in fathers. Among the less competent parenting types, the classic authoritarian parenting type was more typical of fathers, whereas emotionally detached parenting characterized by low nurturance was more prevalent in mothers.

The analysis by Metsäpelto and Pulkkinen (2003) showed that parenting types were closely related to parents' personality traits. In brief, authoritative and emotionally involved parents were extraverted, open, and emotionally stable, whereas authoritarian and emotionally detached parents were low in extraversion and openness, and high in emotional instability. The significance of the personality trait theory for understanding parenting is based on the fact that the personality traits describe differences between normal individuals in their tendency to feel, think, and behave, thereby providing a framework for the categorization of personal dispositions in nonclinical samples. This is an important strength, as it has been common in the field to concentrate on psychological disturbances and their linkages with parenting.

The approach that investigates the Big Five personality traits as determinants of parenting is part of a larger explanatory framework that focuses on parents' intrapersonal factors. Personality characteristics are claimed to be critical determinants of parenting, as their influence is direct, and also indirect, through the way parents function in the larger social context (Belsky, 1984). Correspondingly, Männikkö and Pulkkinen (2001) showed that women and men who had conflicts within themselves (i.e., neurotic or anxious behavior) or with their environments (i.e., antisocial behavior) gave less guidance and emotional support to their children than did well-adjusted individuals. Furthermore, the quality of parenting appeared to be associated

with one's developmental background and, in particular, with experiences of being parented as a child and adolescent: Individuals who had grown up in a family with child-centered parents adopted a similar parenting style with their own offspring. Similarly, individuals who had had authoritarian or indifferent parents failed to provide emotional support and guidance to their children.

MULTIPLE INFORMANTS AND THE DIVERGENCE OF INFORMATION ON PARENTING

Besides the increasing appreciation of different approaches to the conceptualization of parenting, recent years have witnessed a growing awareness among parenting researchers of the differentiation between parental behaviors, emotions, and cognitions. Therefore, one is inclined to ask whether parenting types, based on self-reports, reflect the cognitive internal states that mothers and fathers have formed of their actions, behaviors, and practices as parents instead of their actual behavior as parents when interacting with their children. Previous findings have typically found only modest associations between the way parents describe their child-rearing and the way in which they interact with their offspring, suggesting that parents' self-reports and behavioral observations tend to provide different kinds of information about their child-rearing (e.g., Bornstein, Cote, & Venuti, 2001). In the JYLS, information about parenting was gathered from multiple informants, that is, the parents themselves, their children, and the observers of parent-child interaction. These data allow one to address the question of how uniformly the quality of parenting is described by different informants.

Metsäpelto and Pulkkinen (2005) investigated whether parental self-reports on the degree of parents' involvement, love, and responsiveness (i.e., nurturance) were associated with their behavior during parent-child interaction (child-centered behavior). In line with many previous studies, the findings indicated a lack of association between the way parents described their child-rearing and the way they actually interacted with their children. Further analysis of the JYLS data suggested that the relationship between self-reported and observed behavior might be more complex than generally believed. More specifically, the findings showed that parents' personality trait

of extraversion was related to parenting measures and indicated that traits can have a moderating effect on the relation between self-reported and observed parenting.

Among parents who judged themselves to be highly nurturant, mothers were observed to be highly child-centered if they were extraverted, whereas fathers were observed to be highly child-centered if they were introverted. When the children's views about parenting and family atmosphere were examined, parents' introversion was related to a more favorable family environment. Apparently, assertive behavior and a rapid personal tempo, characteristic to extraverted individuals, may result in failure to adopt goals and behaviors that are compatible with those of their children. In addition, highly extraverted parents are likely to be intensively engaged not only in parenting but also in various other social activities. The sociable nature of extraverts may be at odds with the low amount of social exchange experienced particularly by those parents who stay at home all day with children (Belsky & Barends, 2002).

In addition to personality characteristics of individual members of the parent-child dyad, the quality of relationship among family members may be associated with the information different informants provide about parenting. Data about parental knowledge, drawn from the JYLS, provide an example. Parental knowledge refers to the degree to which the parent is aware of the child's interests, friends, and whereabouts. Parental knowledge (often referred to as monitoring) is based mainly on the unsolicited self-disclosure of information by the child, although parents' active seeking of information concerning their children's whereabouts and friends as well as parental control over children also contribute to the level of parental knowledge (Stattin & Kerr, 2000).

In the JYLS, *parent-reported parental knowledge* was based on the 28-item Child-Rearing Practices Questionnaire (CRPQ; Metsäpelto & Pulkkinen, 2003), which concerned parents' behaviors, attitudes, goals, and child-rearing values. The present analysis used data collected in the 1997–1999 data wave from the spouses ($n = 76$; 42 women and 34 men) of the original sample individuals. In the questionnaire, the parents evaluated on a 4-point Likert-scale the degree to which items described them as parents (*1 = not at all*, *4 = very much)*. The items were formulated in the first-person format and

they were drawn from various sources by Pulkkinen, particularly the Child Rearing Practices Report (Roberts, Block, & Block, 1984) and the inventory by Gerris et al. (1993). The composite score for parental knowledge, based on the factor analysis of the CRPQ (Metsäpelto & Pulkkinen, 2003), was calculated as the mean of the three items (Cronbach's alpha = .74): "I know my child's daily schedule," "I know where and with whom my child is when she/he is not at home," and "I know what my child is interested in and where she/he spends her/his leisure time."

Child-reported parental knowledge was measured using a 16-item Family Atmosphere Questionnaire (FAQ), in which the child ($n = 106$; 59 boys and 47 girls, between 8 and 14 years old) evaluated the extent to which the items characterize his or her parents' child-rearing. The composite score (Metsäpelto & Pulkkinen, 2005) included three items (Cronbach's alpha = .64): "My parents know about my daily program," "My parents have a pretty good idea of my interests, my activities, and whereabouts," and "My parents know where I am and with whom when I am not at home."

The correlational analysis with parental knowledge measures showed that parents and children were generally not consistent in their judgments about the degree of parental knowledge (Pearson $r = .00$). This finding was in line with earlier studies that have found parental self-reports and children's reports to be only modestly related (Crouter & Head, 2002; Stattin & Kerr, 2000). One explanation may be that children and adolescents regulate the degree of disclosure: They may lie, distort, or omit information from their parents. It has been argued that children are more likely to confide to their parents if the parents encourage two-way dialogue and are psychologically present to their offspring. In such an open, accepting, and supportive family atmosphere, parents are more likely to be knowledgeable of their children's activities. In contrast, parental permissiveness, hostility, and negativism discourage disclosure by the child.

The JYLS data provided evidence of the relationship between the quality of family atmosphere and the degree of parental knowledge. A series of regressions was computed involving parental knowledge, as reported by children and their parents, and positive family atmosphere, as perceived by children. Positive family atmosphere was

TABLE 10.1. *Hierarchical Regression Analysis Predicting Child-Reported Parental Knowledge*

Predictor	***B*(*SE*)[a]**	***t***	***p***
Step 1. Parental knowledge (parent-report)	.03(.13)	0.21	.84
Positive family atmosphere (child-report)	.40(.13)	3.07	.00
R^2 change $F(2, 73) = 3.14$, $p = .05$			
Step 2. Parental knowledge (parent-report) x Positive family atmosphere (child-report)	.20(.10)	1.98	.05
R^2 change $F(1, 72) = 3.90$, $p = .05$			
Total model $F(3, 72) = 3.48$, $p = .02$; $R^2 = .13$			

[a] *B*, *SE*, and *t*-values are drawn from the final regression model.

Note: As the parents' data involved both mothers and fathers with differing SES, we tested a model in which the sex and the SES of the parent were entered to the hierarchical regression model in the first step. Since parents' sex or SES produced no significant main effects for the child-reported knowledge, they were dropped from the final regression model.

measured using the FAQ. The child was asked to evaluate the extent to which he or she lived in a (1) warm and caring, (2) supportive and creative, (3) trusting and understanding, and (4) open family atmosphere (*1 = completely*, *5 = not at all*). The scale was reversed before calculating the composite score (Cronbach's alpha = .72). Hierarchical regression analyses were used to predict the children's reports on parental knowledge from parent-reported knowledge, child-reported positive family atmosphere, and their interaction. The decision to use the children's report on parental knowledge as a dependent variable was based on the earlier findings suggesting that knowledge is based on the child's willingness to disclose to parents (Stattin & Kerr, 2000); we therefore assumed that children provide more accurate estimates of the extent of their parents' knowledge. This approach also underscores the active role of the child in the parent-child relationship, which has recently been increasingly acknowledged.

Regression analysis showed that positive family atmosphere, when entered at Step 1 (Table 10.1), predicted the degree of parental knowledge: The more positively children experienced family atmosphere, the more knowledgeable they reported their parents to be. Parent-reported knowledge, in contrast, was not a significant predictor of child-reported knowledge. Entering the interaction term (parent-reported knowledge × positive family atmosphere) at Step 2

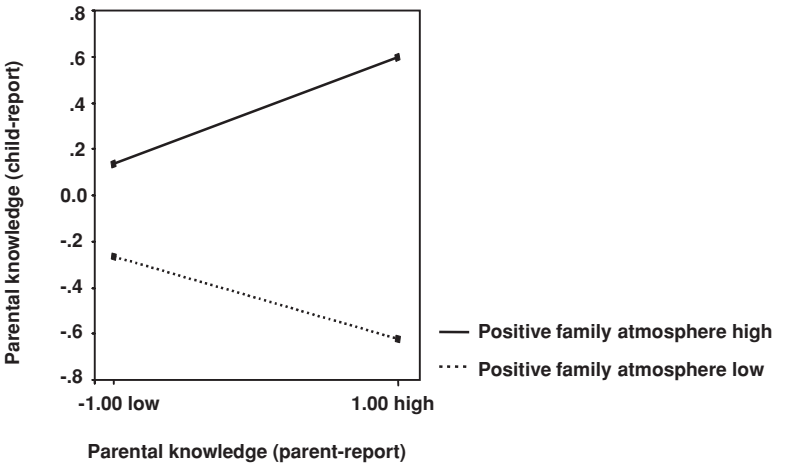

FIGURE 10.1. Interaction between parent-reported parental knowledge and child-reported positive family atmosphere and their associations with child-reported parental knowledge. *Note:* Low and high values correspond to −1 *SD* and +1 *SD* from the means, respectively.

increased the prediction significantly. To describe the interactions, the slope of the final equation was computed at points that corresponded to high and low levels of the predictor variables – that is, one standard deviation below and above the mean.

The results showed that high parent-reported knowledge was associated with high child-reported knowledge in families in which children perceived the family atmosphere positively – that is, as highly supportive, trusting, open, and warm (Figure 10.1). A warm and supportive relationship possibly motivates the parent to stay informed and creates a context in which the child or adolescent can freely self-disclose to the parent (see Crouter & Head, 2002). In contrast, for those families in which children experienced a lack of warmth, support, trust, and openness in the family, high parent-reported knowledge was inversely related to child-reported knowledge: Although parents considered themselves knowledgeable, children reported that their parents were unaware of their activities, friends, and whereabouts. It is plausible that in these families, the children have created an illusion of disclosure by employing partial disclosure, avoidance, or lying (Crouter & Head, 2002). Alternatively,

it is possible that the parents provided socially desirable responses to the questionnaire.

PARENTAL KNOWLEDGE AND FAMILY ATMOSPHERE IN RELATION TO SOCIAL BEHAVIOR IN CHILDREN

The JYLS findings presented earlier indicate that the informant and the method of data collection used should be critically considered in seeking to determine the quality of parenting. Interestingly, such critical considerations are seldom found when parenting measures are investigated in relation to various other measures, for instance, measures of child development. Yet, the selection of the informant can profoundly affect the findings obtained. This is illustrated by the following JYLS findings, based on the 1997–1999 data wave, which examined parental knowledge and family atmosphere in relation to social behavior in children.

Children's social behavior was conceptualized as externalizing and internalizing problem behaviors and adaptive behavior. These behavioral dimensions were measured by means of the Multidimensional Peer Nomination Inventory (Pulkkinen, Kaprio, & Rose, 1999). This 37-item inventory comprised 17 items for externalizing problem behaviors (i.e., aggression, hyperactivity-impulsivity, and inattention), 8 items for internalizing problem behaviors (i.e., depression and social anxiety), and 12 items for adaptive behaviors (i.e., constructiveness, compliance, and social activity). Each item was rated on a 4-point scale (from *0 = does not apply* to *3 = applies in a pronounced way*) by fathers ($n = 88$), mothers ($n = 95$), and teachers ($n = 100$). The composite variables for externalizing problem behaviors, internalizing problem behaviors, and adaptive behavior were calculated separately for each informant, and they had acceptable levels of internal consistency. The Cronbach's alphas ranged from .67 to .88 for the fathers' ratings; .74 to .83 for the mothers' ratings; and .82 to .91 for the teachers' ratings. Negative family atmosphere was measured using the FAQ and it described the child's experience of the family atmosphere as (1) harsh, (2) unfair, (3) quarrelsome, and (4) indifferent (Cronbach's alpha = .63).

Bivariate correlations of parental knowledge and family atmosphere with dimensions of social behavior in children, obtained from

different informants, were generally modest in magnitude and, in part, inconsistent (Table 10.2). High father-reported knowledge, for instance, was related to low externalizing problem behaviors in children, as assessed by mothers only (Pearson $r = -.27, p < .05$). The most consistent findings were for child-reported negative family atmosphere in relation to children's social behavior: High negative family atmosphere was related to high externalizing problem behaviors and low adaptive behavior. These correlations were in the same direction independent of the informant, although some of them failed to reach significance. In addition, mothers' and fathers' reports on parental knowledge were related to their assessments of adaptive behavior in their children, although these correlations may, in part, reflect method variance. Overall, the correlational findings indicated substantial diversity in findings according to the informant.

Consequently, the associations of parents' knowledge and family atmosphere with their children's social behavior were investigated by means of structural equation modeling (SEM; Jöreskog & Sörbom, 1996; Jöreskog, Sörbom, du Toit, & du Toit, 1999). SEM allows the controlling of measurement errors unique to each informant, resulting in more reliable measurement. In SEM, children's externalizing problem behaviors, internalizing problem behaviors, and adaptive behaviors were predicted from the levels of parental knowledge, reported by the children and their parents, and from the degree of positive and negative family atmosphere, obtained from the children.

The hypothesized SEM model consisted of, first, two measurement models that specified the latent factors for the children's social behavior as well as for the parental knowledge and family atmosphere (see Figure 10.2). In the measurement model for the children's social behavior, the composite variables for externalizing problem behaviors, calculated separately for the fathers, the mothers, and the teachers, were used as indicators of the latent externalizing problem behaviors factor. Corresponding latent factor structures were constructed for internalizing problem behaviors and adaptive behaviors. Along similar lines, the parental knowledge items (i.e., knowledge of daily schedule, interests, and whereabouts) were considered to be indicators of the latent parental knowledge factor. Such latent parental knowledge factors were constructed for parents and children separately. Similarly, the family atmosphere items were used

TABLE 10.2. *Pearson Correlations Among the Composite Variables for Parental Knowledge, Family Atmosphere, and Children's Social Behavior*

	Externalizing problem behaviors			Internalizing problem behaviors			Adaptive behaviors		
	Father	**Mother**	**Teacher**	**Father**	**Mother**	**Teacher**	**Father**	**Mother**	**Teacher**
1. Parental knowledge (F)	−.05	−.27*	.04	−.01	.01	−.03	.24*	.23	−.04
2. Parental knowledge (M)	−.11	−.13	−.09	−.03	.03	.03	.18	.24*	.14
3. Parental knowledge (C)	−.19	−.06	−.19	−.02	−.01	−.05	−.01	.04	.17
4. Positive atmosphere (C)	−.05	−.03	.01	.09	−.15	−.03	.09	.14	.06
5. Negative atmosphere (C)	.28**	.19	.28**	−.03	−.09	.14	−.15	−.23*	−.34**

Note: N = 74–100; $^{**}p < .01$. $^{*}p < .05$. F = fathers' report; M = mothers' report; C = children's report

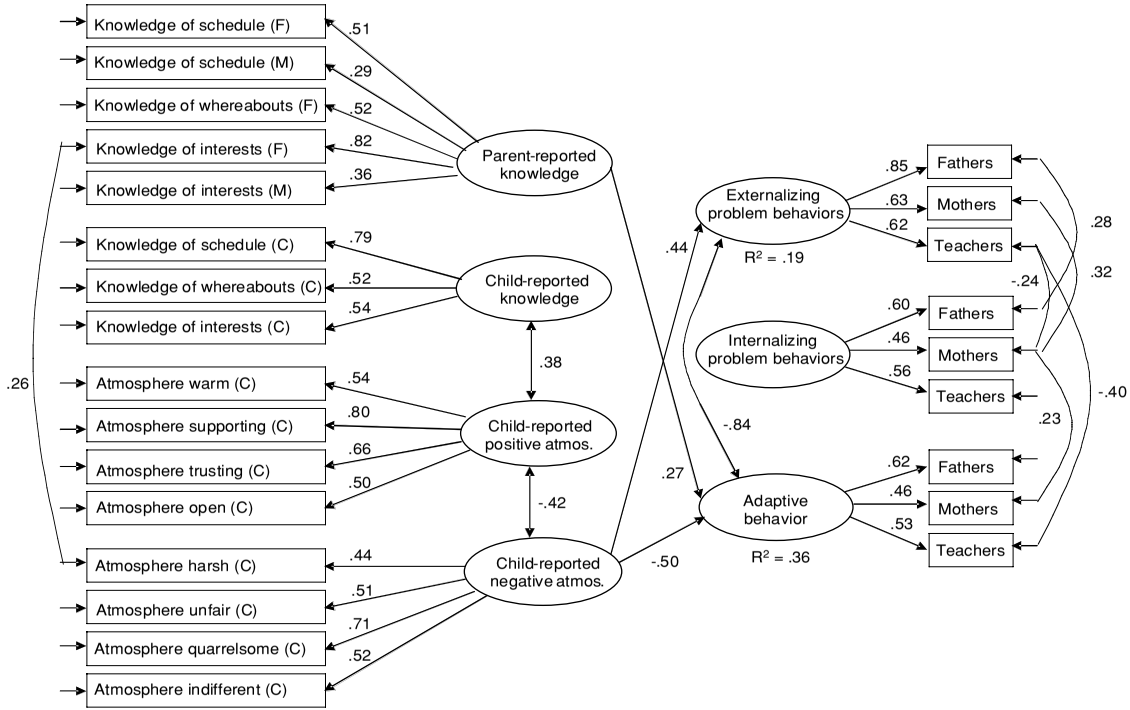

FIGURE 10.2. The structural equation model predicting the children's social behavior from parental knowledge and family atmosphere. *Note:* F = father's report; M = mother's report; C = children's report; atmos. = atmosphere. Owing to the nonsignificant loading to the hypothesized latent factor (*t*-value below |1.96|), one item measuring mother's parental knowledge ("I know where and with whom my child is when she/he is not at home") was omitted from the model.

as indicators of latent positive atmosphere (warm, supporting, trusting, and open) and latent negative atmosphere (harsh, unfair, quarrelsome, and indifferent) factors. When constructing measurement models, the error covariances between observed variables and the residual covariances between the latent factors, suggested by large modification indices (values 8.0 and above were taken into consideration) were released.

Second, the hypothesized model consisted of a structural equation model, identifying the relationships among the latent variables. The structural equations between latent factors were identified by first specifying the full model with estimations of all possible paths between the latent criterion (children's social behavior) and predictor (knowledge and family atmosphere) factors and deleting the nonsignificant paths ($t < |1.96|$) starting from the smallest t-value.

The model, in which the paths were statistically significant and the covariances suggested by large modification indices were released, provided an adequate fit with the data, $\chi^2(259) = 251.45$, $p = .62$, root mean square error of approximation (RMSEA) = .00, comparative fit index (CFI) = .97 (Figure 10.2). The findings showed that high parental knowledge was associated with children's adaptive behavior: When parents reported being knowledgeable of their children's daily schedule, whereabouts, and interests, the children used constructive, compliant, and active behavioral strategies. These findings were in line with the earlier studies indicating that parental knowledge is associated with development in children. Previous results have, however, often concentrated on low parental knowledge (or monitoring) and a range of problem behaviors in children, for instance, conduct problems, substance abuse, or juvenile delinquency (Crouter & Head, 2002). These findings were extended by our results, which demonstrated that high parental knowledge coincided with adaptive behavior in the children. It should be noted that the present analysis leaves open the question of directionality of the relationship between parental knowledge and children's adaptive behavior. It is possible that parental knowledge is part of a supportive family environment that affects children and, in the long run, fosters successful development in the next generation. Alternatively, it may be that children who prefer adaptive behavioral strategies want their parents to stay knowledgeable and therefore willingly self-disclose to them.

A negative atmosphere children reported experiencing at home was related both to high externalizing problem behaviors and, particularly, to low adaptive behavior. Indeed, in families where the atmosphere is harsh, unfair, quarrelsome, and indifferent, mothers and fathers most likely provide unfavorable models of interaction when settling controversies or conflicts. Consequently, children lack opportunities to learn adaptive strategies that facilitate interactions with others. Thus, negative family atmosphere may be a risk factor for developing an adequate capacity for emotion regulation, as children experience intense negative emotions that they do not learn to cope with or to express in controlled ways. Previous JYLS findings have shown that children, indeed, differ with respect to their emotional reactivity, and difficulties in (cognitive) regulation of emotions seem to form a basis for aggressive behavior (Juujärvi, Kaartinen, Laitinen, et al., in press; Juujärvi, Kaartinen, Vanninen, et al., in press).

Interestingly, children's reports on parental knowledge were not directly associated with their social behavior, but they were associated with positive family atmosphere. Children who considered their parents knowledgeable of their daily schedule, whereabouts, and interests experienced the family atmosphere as warm, supporting, trusting, and open. Negative family atmosphere in turn was related to low adaptive behaviors and high externalizing problem behaviors. Overall, differences in the relationships of parental and child reports on parenting with child outcome are worthy of note and underline the need to carefully consider the source of information about parenting.

The fact that parental reports were associated with children's social behavior provides evidence of the criterion validity of these measures. At the same time, the findings cast doubt on children's measures. The ability of children to produce reliable and valid reports of their experiences of parenting and home environment has, indeed, been questioned, but recent evidence suggests that children are capable of reporting on their social relationships (Galinsky, 2000). Children have remained a largely neglected source of information about parenting, and more research is needed to fully understand the experiences of different family members and their ability to provide information about family relations.

Neither parental knowledge nor family atmosphere predicted internalizing problem behaviors in children. It is possible that

difficulties in the measurement of internalizing problem behaviors in children account for this finding, as depression and anxiety may not be easily observable or they may manifest themselves in varied ways. In the present case, the measure for internalizing problem behaviors was based on the information provided by mothers, fathers, and teachers and modeled by means of SEM. This technique allows the controlling of measurement errors unique to each informant, resulting in more reliable measurement and robust associations among study constructs. As such, our results can be interpreted to support the earlier findings (Jacobson & Crockett, 2000), according to which parental knowledge more strongly contributes to variation in children's social behavior (i.e., adaptive behavior) than to variation in their emotional well-being.

CONCLUSIONS

The development of children from newborns to adults involves a diverse range of experiences – an unfolding of many skills, increased independence, successes and failures in the school and at work, and the formation of relationships with other people. The JYLS has provided an important opportunity to address the question of how family circumstances and the quality of parenting are associated with a child's or an adolescent's future development, extending well into adulthood. The findings have shown that the family forms a context that plays an important role in shaping and directing the growth of the youth. In addition, during the years of the longitudinal study, the participants have become mothers and fathers themselves; as a result, the JYLS data have also contributed valuable information about parenting as a psychological phenomenon in adult lives and as a psychological construct. This information in combination with other studies will ultimately yield better and more valid findings on parenting.

11

Parental Work and Children's Behavior

The Mediator Roles of Partner Relationship and Parenthood

Ulla Kinnunen and Johanna Rantanen

INTRODUCTION

Research on the relation between work and family has demonstrated that an individual's experiences at work can have far-reaching effects, affecting not only the individuals themselves but other family members as well (see e.g., Perry-Jenkins, Repetti, & Crouter, 2000, for a review). In this chapter, we focus on the children's perspective by trying to shed light on the question of how mothers' or fathers' employment affects their children's well-being. This type of research started by looking for direct effects of parental – and especially maternal – employment on children's development. The empirical question was whether maternal employment was detrimental to children and it was reduced to the direct comparisons of the children of employed and nonemployed mothers, usually without examination of parenting. The results, however, have shown that employment per se is neither facilitative nor detrimental to children's development (see Gottfried, Gottfried, & Bathurst, 2002).

In the 1980s Bronfenbrenner and Crouter (1982) called for researchers to move beyond the traditional deprivation approach, which equates employment with a linear measure of maternal absence from the child, and to focus instead on the quality of work. In addition, attention was shifted from direct effects to indirect effects: A mediational viewpoint was emphasized. Mediation continues to be the trend of current research. This line of research tries to capture the

processes that intervene between parental work (involving work instablity, unemployment, and quality of work) and children's behavior and well-being. The various mediators found thus far in the link between parental work and children's behavior contain parental well-being that is connected with parenthood both directly and through partner relationship; parenthood, in turn, is linked to children's behavior.

Of the mediators, the quality of partner relationship and parenthood especially are reviewed in the present chapter. We begin by reviewing briefly the evidence relating employment and children's behavior via partner relationship and parenting, results that come from studies concerning the research tradition of stressful life events (i.e., unemployment, work instability, income loss). After that we discuss the relationships between the quality of work (i.e., job characteristics) and children's behavior. Finally, we evaluate current research and consider future perspectives on the research area.

Links between work instability and children's behavior

Research since the economic depression of the 1930s indicates that economic stress related to unemployment and income loss has adverse effects on families (Elder, 1974). The relationship between economic stress and family relations has been most thoroughly elaborated in panel studies from the Iowa State project fielded by Conger and associates. Their results, shown by the family economic stress model (e.g., Conger, Rueter, & Conger, 2000), clearly indicate that the marital dyad is one of the critical processes establishing the linkage between employment and children's well-being. According to Conger et al. (2000), severe income loss, for example, in the form of unemployment, leads to economic pressure, which is linked to parents' emotional distress. Emotional distress, indicated by frustration, anger, and anxiety, has an impact on marital interaction: It may increase marital hostility and decrease marital support. Interspousal disagreements and hostility, in turn, have a negative influence on the quality of parenting: If parents receive warmth and support from each other, they are more able to interact warmly with their children, but if they experience hostility, their resources for optimal interaction are

diminished. The quality of parenting, on the other hand, is related to children's behavior and well-being (Conger et al., 2000). For example, problematic child-rearing practices (e.g., rejection, punitive actions, authoritarian parenting) adversely affect children's adjustment (e.g., producing internalizing or externalizing problem behaviors).

Although the process by which economic matters are transmitted to family seems to be well documented, the fact remains that most of the studies have been conducted in the United States. Therefore, a relevant question arises: whether the findings hold true in different cultures and countries, such as Finland, one of the Nordic welfare states where the level of socioeconomic security, in the form of social benefits, is rather high. In addition, the roles of women and men in the area of working life are relatively equal in Finland, as women constitute almost as large a share of the work force as men, and most women are employed full-time (Eurostat, 2000). The economic matters may, therefore, play a relatively equal role in the lives of both genders in Finland, contrary to the countries, like the United States, where the genders differ more in this regard.

Thus, using the data from the Jyväskylä Longitudinal Study of Personality and Social Development (JYLS) (see Chapter 1) we tested whether the model of Conger and colleagues (2000) would function in Finland. Our study was further motivated by the fact that Finland went through a very severe economic crisis in the early 1990s. The recession of 1991–93, in terms of output and employment, was the most severe witnessed by any industrial state since the Second World War (e.g., Honkapohja & Koskela, 2001). For example, unemployment rose from 3.5% in 1990 to 18.4% in 1994. In the context of these socioeconomic changes, links from the employment situation to marital quality were examined in 1995, when the JYLS participants were 36 years old (Kinnunen & Pulkkinen, 1998). The data analysis was restricted to the participants who were either married or cohabiting at age 36, altogether 133 men and 117 women.

Path model results indicated that among the men, unemployment was linked to perceived economic pressure. Economic pressure, in turn, was related to depression and greater hostility in the marriage, both of which were linked to poor marital quality. For the women, poor economic circumstances and in particular an unstable career line, which was characterized by spells of unemployment during the

8-year follow-up from 1987 to 1995, were directly linked to depression, marital hostility, and poor marital quality. These results suggest that uncertainty in life is channeled differently in Finnish women and men. For women, a stable career line during the entire follow-up period formed a basis for financial security and independence and, ultimately, strengthened the women's identities. For men, their current unemployment situation was the basis for both present and anticipated future economic strain, which was negatively reflected in the marital relationship.

In another Finnish study (Kinnunen & Feldt, 2004), couple data ($n = 539$ married or cohabiting couples) collected in 1999 were used. Path model analysis demonstrated that economic stress was experienced through the same mechanism by both partners: Poor economic circumstances, indicated by poor monthly income and unemployment, were linked to economic strain, indicated by difficulties in meeting the current economic needs. Economic strain, in turn, was related to increased psychological distress, which was negatively reflected in marital adjustment.

The couple data enabled additional study regarding how economic stress or strain may be transmitted from one partner to another. This kind of transmission is termed partner or crossover effects. A few crossover effects between partners' experiences were observed. First, wives' psychological distress was negatively related to their husbands' reports of marital adjustment and vice versa. Second, unemployment among men was directly linked to reports of marital adjustment among women: the longer the husband's total spell of unemployment during the past 5 years, the poorer the wife's marital adjustment.

There may be several factors not examined in the study by Kinnunen and Feldt (2004) that may explain the direct link from the husbands' unemployment to the wives' marital adjustment. For example, men's long unemployment may be a sign of the accumulation of problems in social functioning, as Rönkä, Kinnunen, and Pulkkinen (2001) have shown using the JYLS data at ages 27 and 36 from 145 women and 152 men. The accumulation of poor financial standing, poor intimate relationships, and drinking problems was more common among men than women at both ages but related to career instability for both genders. It is possible that long-term

unemployment, especially among men, may predispose them simultaneously to other problems of social functioning (e.g., drinking problems), which is negatively reflected in their wives' evaluations of their marriage.

The whole family economic stress model, including the indicators of parenting behavior and outcomes for children, has also been validated in Finland. The study by Solantaus, Leinonen, and Punamäki (2004) evaluated the influences of economic hardship on child mental health during the nationwide economic recession in Finland. The information was gathered from 527 triads of 12-year-olds and their mothers and fathers. The results confirmed that a reduction in disposable family income constitutes a risk for child mental health through increased economic pressures and negative changes in parental mental health, marital interaction, and parenting quality. In addition, the findings of Leinonen, Solantaus, and Punamäki (2002) have revealed that supportive and nonhostile marital interaction was able to moderate the negative impact of economic hardship on parenting. Thus, a good partner relationship provides a support system for the parents, thus improving parenting abilities.

Altogether, the family economic stress model by Conger and colleagues gained further evidence for its validity in the Finnish social context. In producing negative effects, perceived strain rather than objective circumstances themselves was related to individual, marital, and family well-being. This means, for example, that parents' psychological reactions to job loss and unemployment are critical factors in determining whether job loss will indeed affect family relationships and child behavior.

Links between the quality of work and children's behavior

Partner Relationship and Parenting Behavior as Mediating Factors

In the previous section, the roles of an individual's well-being, partner relationship, and parenthood were emphasized in the process by which stressful life events such as work instability and job and income loss were related to children's well-being. It is unclear,

however, how important the role of the partner relationship is in the process between the quality of parental work and children's well-being. This is because in this type of research, the mediating role of the partner relationship has been ignored, although there is evidence that the quality of one's work is related to one's partner relationship. For example, the study by Mauno and Kinnunen (1999) among 215 Finnish dual-earner couples demonstrated that high time demands at work, poor leadership relations, perceived job insecurity, and work-to-family conflict spilled over into the marital relationship via job exhaustion and stress symptoms for both husbands and wives. Thus, there were no gender differences in the mediation process.

However, the path analyses, based on the JYLS data at age 42, quite interestingly suggested that the mediation process might be different for men and women (Sihvo, personal communication). This analysis included 89 men and 95 women, who at age 42 lived in a partner relationship and were employed. Among men psychological distress and among women work-family conflict functioned as the mediators between job characteristics and marital adjustment. Specifically, for men nontraditional work hours and high time demands at work were linked to psychological distress, which in turn was related to poor marital adjustment and marital hostility. For women, the same variables – nontraditional work hours and high time demands at work – were related to perceived work-to-family conflict, indicated by feelings that work interferes with family life, which in turn was linked to poor marital adjustment. Meanwhile, high job control at work had a direct, positive link to women's marital adjustment.

Altogether, the quality of work, indicated by such job characteristics as work overload or non–day work, seems to play a significant role from the viewpoint of individual and marital functioning. Individual functioning – covering both occupational and overall well-being indicated by job exhaustion and psychological distress, respectively – functions as a mediator in the relationship between job characteristics and marital quality. Thus, strain related to parental work is linked to the quality of partner relationship. Interestingly, although a good partner relationship is the primary support system for parenthood, the studies examining the process by which parents' work experiences (e.g., job characteristics) are linked to children's behavior have emphasized individual well-being and

parenting behavior as mediators. No explicit role has been given to the quality of the partner relationship.

Galambos, Sears, Almeida, and Kolaric (1995) call the indirect influence process between parental work and children's behavior a *three-stage spillover model*. According to the model, feelings of job stress create global stress (Stage 1), and these feelings of stress are negatively reflected in the parent-child interaction through less sensitivity to the child, less involvement with the child, and higher levels of parent-child conflict (Stage 2), which in turn might be associated with a broad array of problematic child behavior, for example, less behavioral independence, lower self-esteem, and less internalized controls (Stage 3).

Although many researchers suggest the mediation of effects from employment to parenting to children's development, not many studies have actually tested the full model statistically, as pointed out by Gottfried et al. (2002). However, there is some evidence to support the model. The model received support from the study by Crouter, Bumpus, Maguire, and McHale (1999) among a sample of 190 dual-earner families with adolescent offspring. The study showed that the negative effects of work pressure on adolescent psychological well-being, indicated by self-worth and depression evaluated by the adolescents themselves, were mediated by parental role overload and parent-adolescent conflict (see also Galambos et al., 1995).

In a Finnish study (Sallinen, Kinnunen, & Rönkä, 2004) based on data on parental work collected from 12- to 16-year-old adolescents, the three-stage spillover model received further support. The results, based on adolescents' reports, showed that when parents, tired after work, became angry with the children easily or were not interested in their affairs, the result was lessened autonomy granting by the parents and increased conflict between parents and adolescents. These reports on the parent-child relationship in turn were related to heightened experiences of depression in adolescents, especially girls. In addition, negative spillover from the fathers' job was related to increased conflict between fathers and adolescents, which in turn was linked to adolescents' negative attitude regarding school, especially in boys. The fact that these findings were based entirely on adolescents' perceptions of both parental work and its consequences may have inflated the observed relationships.

We tested the first two stages of the spillover model using the JYLS data at age 36 (Kinnunen & Pulkkinen, 2001). The analysis among employed men ($n = 80$) and women ($n = 78$), who had 7- to 12-year-old children, showed that high time demands at work, low job control, and high job insecurity were linked to parenting behavior through the negative job-related affect they created. Of the indicators of negative job-related affect, job exhaustion in particular was related to parental stress, as indicated by experiencing child-rearing as a burden or a problem, which in turn hindered child-centered parenting. Hence, our study findings were in line with the spillover model, showing that some job characteristics affecting occupational well-being were indirectly linked to parenting behavior.

Searching Longitudinal Evidence for the Three-Stage Spillover Model

The three-stage spillover model has received some support in previous studies. However, to our knowledge there are no longitudinal studies showing that the model functions over time. Using longitudinal data the direction of the relationships in the model can be tested more reliably. We therefore continued our analysis using the JYLS data gathered in three phases: at Time 1 (age 36), at Time 2 (age 38 or 40, when also one of the participants' 8- to 14-year-old children took part in the study), and at Time 3 (age 42). To be included in the analysis the participant had to have participated in the study at Times 1, 2, and 3, and to be working either at Time 1 or 3, or both. The available sample size was 89 (42 men and 47 women). Of their children who participated in the study 48 were boys and 41 were girls, with ages ranging from 8 to 14 years (mean age 10).

The longitudinal three-stage model tested is shown in Figure 11.1. Of parental work experiences (Stage 1), we focused on job exhaustion, which is one of the leading candidates for creating spillover effects between work and family life. Job exhaustion provides a general measure of the amount of stress a person is experiencing and it is considered the core component of the syndrome of burnout (Maslach & Leiter, 1997). Job exhaustion was assessed by four items from the Maslach Burnout Inventory (Maslach & Jackson, 1986) concerning feelings of fatigue that develop as one's emotional energies

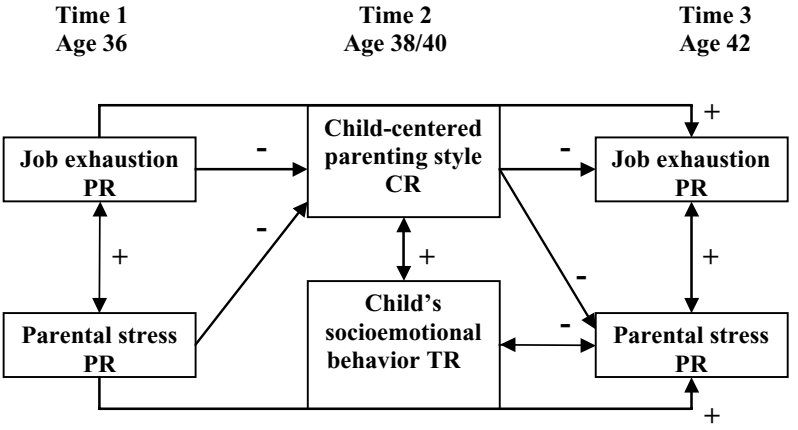

FIGURE 11.1. The hypothesized model on the basis of previous study findings. *Note:* PR = parent report, CR = child report, TR = teacher report.

become drained at work (e.g., "I feel emotionally drained at my work"; 1 = *never*, 5 = *always*; Cronbach's alpha = 0.89 [Time 1], 0.86 [Time 3]).

We approached parenting behavior (Stage 2) from two perspectives. First, we concentrated on parental stress. Stress in the domain of parenthood involves a negative emotional state, dissatisfaction, and tension that are supposed to result from the quality of experiences within the parental role (Abidin, 1990). Parental stress that assessed the degree to which parents reported experiencing the parental role and child rearing as stressful was measured by a 4-item scale (e.g., "I have more problems raising my children than I expected"; 1 = *not like me at all*, 4 = *very much like me*; Cronbach's alpha = 0.67 [Time 1], 0.73 [Time 3]).

Second, we looked at the parent-child interaction, which was conceptualized by a child-centered parenting style (see Pulkkinen, 1982). Child-centered parents consider the child's developmental needs and tasks and provide the child with both emotional support and age-appropriate demands. They also consider the child's opinion and give supervision and guidance to the child. This kind of child-centered parenting style has been demonstrated to promote children's behavioral adjustment, that is, the child does not have either externalizing (e.g., conduct disorder, hyperactivity) or internalizing (e.g., anxiety,

depression) problem behaviors and he or she succeeds well at school (e.g., Baumrind, 1989).

Specifically, we investigated whether job exhaustion and parental stress experienced by the parents at age 36 would predict the parents' low child-centered parenting style later on (at age 38 or 40). Parents' child-centeredness was evaluated by their 8- to 14-year-old children. Child-centered parenting style consisted of two indicators. First, children assessed their parents' knowledge about their friends, whereabouts, and activities through three items (e.g., "Your parents know what you are interested in and where you spend your time"; 1 = *rarely or never*, 4 = *almost always*; alpha = 0.69). Second, children assessed their parents' nurturance by four items reflecting both appreciation and support toward the child as well as encouragement of independence (e.g., "Your parents listen to your opinions"; 1 = *rarely or never*, 4 = *almost always*; alpha = 0.67).

We hypothesized on the basis of the three-stage spillover model that the higher the level of job exhaustion, the higher would be the level of parental stress, and that both job exhaustion and parental stress would predict a lower level of child-centeredness in parenting behavior later on. In addition, we expected that the child-centered parenting style would be positively reflected in the quality of children's behavior (Stage 3), which was evaluated by their teachers with a 37-item Multidimensional Peer Nomination Inventory (MPNI) Teacher Rating Form (Pulkkinen, Kaprio, & Rose, 1999; see Chapter 1). This rating form measures three broad dimensions of social behavior: adaptive behaviors (including subscales for constructiveness, compliance, and social activity; 12 items), externalizing problem behaviors (including subscales for hyperactivity-impulsivity, aggression, and inattention; 17 items), and internalizing problem behaviors (including subscales for depression and social anxiety; 8 items).

We also assumed that the less child-centered the parents (at age 38 or 40), as evaluated by their children, the more likely the parents would be to experience job exhaustion and parental stress at age 42. We based this expectation on the fact that family life (e.g., experiences of parenthood) may have effects on work experiences, although these effects have not been studied as often as the effects of work on family life (see Perry-Jenkins et al., 2000). Finally, we studied whether

the child's behavioral characteristics would have any effects on the parental role experience later on (at age 42) as the models of parenthood expect (e.g., Abidin, 1990; Belsky, 1984). We hypothesized that the more socially adapted the children, according to the teachers, the less parental stress would be reported by the parents later on. Both the experiences of job exhaustion and parental stress were assumed to be rather stable over the 6-year period.

Three-Stage Model Supported

The descriptive results indicated that the mean levels of job exhaustion ($M = 2.42$ and $M = 2.46$) and parental stress ($M = 1.66$ and $M = 1.59$) were stable across the 6-year time interval, and there were no gender differences in these experiences at either age 36 or age 42. In addition, both job exhaustion ($r = .72$, $p < .001$) and parental stress ($r = .56$, $p < .001$) correlated highly across the 6 years. The girls evaluated their parents slightly higher in parental knowledge than the boys ($t = 2.73$, $p < .01$). The teachers evaluated the girls higher in adaptive behaviors ($t = 2.32$, $p < .05$) and having less externalizing problem behaviors ($t = -2.94$, $p < .01$) than the boys.

In order to test the hypothesized model (see Figure 11.1), we conducted a path analysis with the LISREL 8.53 program. The input to the analysis was in the form of the Pearson product-moment correlation matrix and the method of estimation was maximum likelihood (ML). The hypothesized model tested was constructed as follows: (a) job exhaustion and parental stress at Time 1 were set to explain child-centered parenting style (parental knowledge and parental nurturance) at Time 2, as well as job exhaustion and parental stress reported at Time 3; (b) child-centered parenting style at Time 2 was set to explain job exhaustion and parental stress at Time 3; and (c) the children's adaptive behaviors and externalizing and internalizing problem behaviors at Time 2 were set to explain parental stress at Time 3. In addition to these prospective paths, the variables within each time point were allowed to correlate with each other.

The model with all the hypothesized paths (see Figure 11.1) fit well to the data, $\chi^2(11) = 9.52$, $p = 0.57$, root mean square error of approximation (RMSEA) = 0.00, goodness of fit index (GFI) = 0.98, normed fit index (NFI) = 0.94, comparative fit index (CFI) = 1.00.

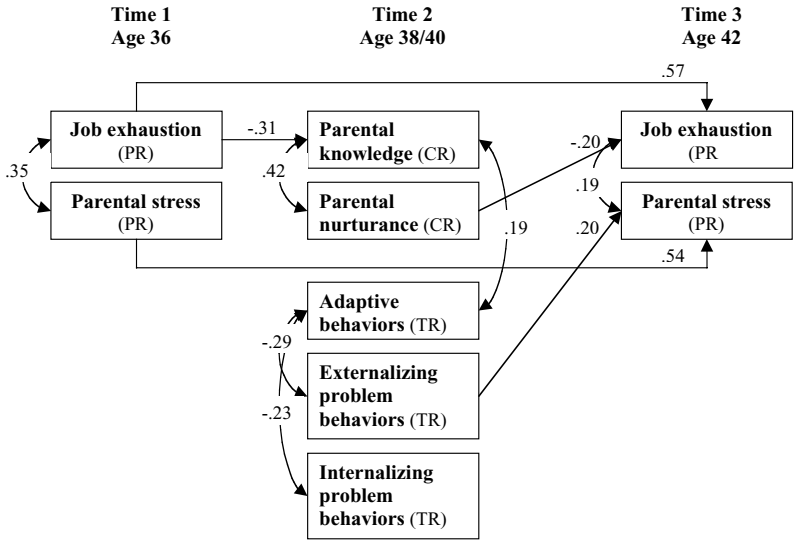

FIGURE 11.2. The final path model showing the links between parents' job exhaustion, parenting behavior, and children's socioemotional behavior. *Note:* PR = parent report, CR = child report, TR = teacher report.

The fit remained good after the nonsignificant prospective paths and simultaneous correlations were removed from the model, $\chi^2(25) = 19.31$, $p = 0.78$, RMSEA = 0.00, GFI = 0.95, NFI = 0.86, CFI = 1.00. The χ^2-difference test proved that the very slight decrease in the model fit, due to the removal of nonsignificant paths and correlations, was not statistically significant, $\chi^2_{\text{diff}}(14) = 9.79$, $p = 0.78$. Furthermore, the Akaike's information criterion, which can be used in the comparison of models, was in favor of the latter, more parsimonious model, $\text{AIC}_{2.\text{Model}} = 59.31 < \text{AIC}_{1.\text{Model}} = 77.52$. Thus, the final model containing only significant paths and correlations is shown in Figure 11.2.

Five significant prospective paths were identified between the three time points. First, a high level of the parents' job exhaustion at Time 1 was linked to a low level of parental knowledge reported by the children at Time 2. Second, a high level of parental nurturance reported by the children at Time 2 was linked to a low level of parents' job exhaustion at Time 3. Third, the child's externalizing problem behaviors assessed by his or her teacher at Time 2 were linked to a high level of parental stress at Time 3. Finally, parents' job exhaustion and parental stress from Time 1 to Time 3 were linked to

themselves. The stability coefficient was 0.57 for job exhaustion and 0.54 for parental stress indicating that these experiences were rather stable across the 6-year time interval. This model explained 36% of the variance in job exhaustion and 33% of the variance in parental stress at Time 3.

The results showed that the parents' job exhaustion was related to their parenting role. First, the more job exhaustion the parents reported, the more they reported simultaneous parental stress. Second, the more job exhaustion reported, the less the parents knew about their children's friends, activities, and whereabouts later on. Therefore, it seems that parents who feel fatigue and exhaustion due to their job – and feel parental stress simultaneously – are not as involved in their children's lives as those parents experiencing less job exhaustion and less parental stress. Particularly, the link from job exhaustion to parental knowledge is significant because it shows that job exhaustion has long-term effects – probably because of its stable nature – on parenting behavior, and its significance is further strengthened as we were able to use different informants; 8- to 14-year-old children made the assessments of their parent's (either mother's of father's) parental knowledge.

Furthermore, parental knowledge and child adaptive behaviors were linked to each other: The more the parents knew about their children's whereabouts, friends, and activities, the more the children showed adaptive behaviors and vice versa. This relationship is also of special importance because it is based on multiple sources: Child outcomes were assessed by the teachers and parenting behavior by the children. However, because of the reciprocal nature of the relationship, it can be interpreted in two ways: On the one hand, parental knowledge promotes child adaptive behaviors and, on the other hand, the more the child displays adaptive behaviors, the more the parents know about the child's friends and activities.

Regarding the assumptions that the less child-centered the parents are (as evaluated by their children at age 38 or 40), the more likely the parents are to experience job exhaustion and parental stress at age 42, only the first one was supported. It turned out that a low level of parental nurturance was linked to a high level of job exhaustion later on, but not to parental stress. However, our longitudinal data confirmed that the relationship between work and family can

be the reverse, that is, family life can have effects on work experiences. Although it has been recognized that work-family relationships are bidirectional, this question has received much less attention compared with the corresponding effects from work to family (see Perry-Jenkins et al., 2000). There seems to exist a chain between experiences in employee and parent roles: Job exhaustion produces less child-centered parenting behavior, which in turn is indicative of a high level of job exhaustion. In addition, our study showed consistently with the models of parenthood (e.g., Abidin, 1990; Belsky, 1984) that the characteristics of the child are linked to parental stress: The more externalizing problem behaviors the child displays according to his or her teacher, the more parental stress there will be later on. The experiences of job exhaustion as well as parental stress turned out to be rather stable across the 6 years, referring to either stable personality tendencies or stable work and family situations. However, we know that change occurred in both participants' working (e.g., job changes) and family (e.g., child's age, family dynamics) lives; therefore, the question may be more about the participants' permanent reactions toward their jobs and parenting role.

Although all stages of the spillover model (see Galambos et al., 1995) received support in our study, the relationship between parenting behavior and child outcomes (Stage 3) remained rather weak. One reason for the weak relationship – besides the fact that it is based on multiple sources – may be because we focused on studying child-centered parenting style (i.e., authoritative behavior) and therefore authoritarian parenting behavior (e.g., physical punishment), which has especially been related to less positive child outcomes (e.g., Gottfried et al., 2002), was not directly examined. Nevertheless, our study indicated a simultaneous and long-term negative spillover between employee and parent roles as well as child outcomes.

New Perspectives Regarding Employment and Children's Well-Being

Current studies have primarily approached the relationship between employment and children's well-being from a negative perspective, using stress and strain as those phenomena by which the different life domains (work and family) may be connected. Work may,

however, also have positive effects on family life. For example, positive job characteristics, such as complexity of work, challenging work, and high job autonomy and control, may promote both the quality of partner relationship and parenthood as suggested by Perry-Jenkins et al. (2000). As Gottfried et al. (2002) have stated, it is time to look at the issue with a fresh and a more positive perspective. One possible starting point could be the role enhancement theory (e.g., Barnett & Hyde, 2001), which suggests that participation in multiple roles provides a greater number of opportunities and resources – such as income, heightened self-esteem, opportunities for social relationships, and the experience of success – to the individual that can be used to promote growth and better functioning in other life domains. From this perspective, men as well as women benefit from multiple roles in terms of mental health, physical health, and relationship health. Thus, the combination of certain roles has a positive, rather than a negative, effect on well-being, and only beyond certain upper limits may overload and distress occur.

Therefore, positive concepts, such as positive spillover and facilitation (see Frone, 2003) come into central focus. They refer to the processes (e.g., skills, emotions, behavior patterns, attitudes) by which participation in one role is made better or easier by virtue of participation in the other role. For example, on the basis of the JYLS data (Kinnunen, Feldt, Rantanen, & Pulkkinen, 2005), the 42-year-old participants reported more positive than negative spillover experiences between work and family. Positive spillover from work-to-family, and from family-to-work was reported by a majority of them (60% and 50%, respectively). One third reported negative work-to-family spillover and only 5% negative family-to-work spillover. Quite interestingly, those parents who had school-age (over 7 years old) children reported mostly positive work-to-family spillover, whereas those who had under school-age (0 to 6 years old) children reported most negative family-to-work spillover. In all, these findings show that work-family interface should be conceptualized more broadly, taking as well the positive perspective into account.

In addition, the previous studies that investigated the work-family interface typically studied the phenomena from the perspective of adults, that is, the study informants have been principally parents. However, distinguished scholars (e.g., Perry-Jenkins et al., 2000) have

recently considered children's own perceptions of their parents' work and family roles to be very important. Galinsky (2000) is one of the few researchers who have studied children's as well as parents' perceptions of parental work. She discovered that parents and children saw parental work differently. Children were sensitive to parents' work-related emotions and often felt strained by parents' tiredness and bad mood after work. The children did not agree, however, that they suffered from a lack of time spent with their parents, as parents themselves assumed.

However, there are study findings that suggest a lack of parental time may be detrimental to children, despite how the children perceive it. For example, in Canadian families with 2- to 11-year-old children ($n = 4, 433$), children whose parents worked nonstandard hours (evenings, nights, or on weekends) were more likely to have emotional or behavioral difficulties, based on their parents' evaluations, which is indicative of child stress (Strazdins, Korda, Lim, Broom, & D'Souza, 2004). There are several potential pathways explaining this relationship, such as evening and night work times may be stressful for parents and may disrupt family routines and reduce parent-child involvement. Unsupervised time may be a risk factor for children's development and behavior. Furthermore, Crouter, Bumpus, Head, and McHale (2001) found that the combination of fathers' long working hours and high overload was consistently associated with less positive father-adolescent relationships. Fathers were seen as less accepting and taking into account less frequently the adolescent perspective when they worked long hours and felt overloaded. These findings suggest that we need to better understand the ways parents' work times and increasing pressure at work affect family interaction and children of the "24-hour economy."

In a Finnish study (Sallinen et al., 2004), in which the experiences of 12- to 16-year-old adolescents were examined, researchers noticed that their mother's job was evaluated more negatively than that of their father. For example, mothers were perceived to become angry and have a bad mood after work more often than fathers, and mothers were perceived more often than fathers as being tired after work. The comparison of adolescents' and parents' perceptions about parental work showed some correspondence. For example, the more adolescents perceived their parents as tired after work, the higher were the

levels of job exhaustion and time demands at work reported by parents themselves. Thus, in future research the child outcomes should be seen from a wider perspective: The children's perceptions of their parents' work should be included.

Finally, the focus in previous studies has been on a global level, that is, the emphasis has been on the processes through which chronic job stress is transmitted to the families. However, we need more intensive studies that examine short-term fluctuations of stress (e.g., irritability, impatience) as well as of positive emotions (e.g., joy, satisfaction) at work and in families. This means using short-term, repeated measure designs on a daily basis. This kind of research (e.g., Repetti & Wood, 1997) can reveal the microprocesses by which stress transmission occurs in daily life, and show in detail how parental work matters for children.

CONCLUSIONS

The process linking parental employment and children's well-being is indirect: It is mediated at least by parents' individual well-being and parenting behavior. This mediation process is confirmed by cross-sectional studies, but longitudinal evidence is still scarce. Our longitudinal analyses using the JYLS data indicated that parents who at Time 1 (at age 36) were exhausted due to their job – and simultaneously reported parental stress – knew less (according to their 8- to 14-year-old children's reports) about their children's friends, activities, and whereabouts at Time 2 (2–4 years later) than those parents experiencing less job exhaustion and less parental stress at age 36. Furthermore, parental knowledge and the child's adaptive behaviors (rated by his or her teacher) were positively related to each other at Time 2. In the future, both long-term and short-term longitudinal studies with large sample sizes are needed to confirm the process of how parental work matters for children's well-being. More attention should also be given to the role of partner relationships in the mediation process between parental work and child well-being, and on the children's perceptions of their parents' work.

12

Grandparents as Resource Factors in the Family

Helena Hurme

INTRODUCTION

Only during the last century has the model of the family in the Western world changed from one in which the generations lived together to one in which they live separated. But has this implied that they are separated psychologically as well? This chapter tries to give an answer to this question, with a special emphasis on grandparents.

Three aspects are under special scrutiny. First, the grandparents' role as a resource factor for their grandchild is elucidated. Second, the relation between the adult generations in the family is analyzed, especially the role of (grand)parents in giving support to their adult children. Finally, possible future trends in grandparenthood are envisaged.

The empirical data in this chapter are taken from the Jyväskylä Longitudinal Study of Personality and Social Development (JYLS; Chapter 1), from data collected in 2001, when the participants were 42 years old. There were 189 cases in which the mother was alive and 46 in which she was dead; 136 cases in which the father was alive and 99 cases in which he was dead. These are used in this chapter.

GRANDPARENTS AS RESOURCE FACTORS FOR THEIR GRANDCHILDREN

Grandparents should not be equated with old people. The average age for becoming a grandparent is 45 to 50 years in the United States (Uhlenberg & Kirby, 1998) and 48 to 50 years in France (Attias-Donfut & Segalen, 2002). The mothers of the now 42-year-old JYLS respondents were between 58 and 85 when they first became grandparents; the fathers between 58 and 86. It is quite probable that the youngest grandparents are still working. In Finland, the mean age for primiparae is close to 30 (Sauli, 2004) and therefore the age for one to become a grandparent has probably risen as well. According to Kartovaara's analysis of Finnish Census data (2001), almost all Finnish children under age 7 years have at least one grandparent alive, and three out of four children under that age have at least three (biological) grandparents alive. Only 3% of Finnish children under age 7 do not have any living grandparent. A third of the teenage children have three or four grandparents.

Tasks and Meanings of Grandparenthood

A central area of research on grandparenthood has been to analyze the tasks and meanings of grandparenthood (Hurme, 1988, 1991; Kivnick, 1982; Mueller & Elder 2003; Neugarten & Weinstein, 1964). First, a central feature of grandparenthood consists of *securing biological continuity*. By helping their offspring, the grandparents secure the transmission of their genes to the next generation (Dubas, 2001). Grandparents also often mention the wish to survive through their grandchildren (Anthony & Benedek, 1970).

Second, grandparents can convey *positive emotions and experiences* to the grandchildren. Anthony and Benedek (1970) stress that the ties to the grandchildren can be close because the grandparents do not have the same obligations toward them as they had toward their children when these were young. Research (e.g., Markides & Krause, 1985) points to the fact that positive experiences with grandchildren further the emotional well-being of the grandparents.

A third feature of grandparenthood consists of *securing social continuity*. Bengtson (1985) sees this as the most important task of grandparents. In fulfilling this task, the grandparents create a bridge to the

past for their grandchildren and at the same time create historical continuity. Tinsley and Parke (1984) call this the "family historian" task of grandparents.

Fourth, the task of grandparents is to *act as support persons* for their grandchildren. Some grandparents take care of their grandchildren while the parents work (Brandis, 2003). However, in some countries, where female employment is common (e.g., in Finland and the Scandinavian countries), a large proportion of the younger grandmothers are employed. This decreases their possibility of taking care of their grandchildren.

Finally, the grandparents may *act as models* for their grandchildren. The grandparents convey knowledge about how to live; they give advice and show how older people act and think.

Grandparent Types

A second element of research on grandparenthood consists of elucidating how grandparents fulfill their task (e.g., Hurme, 1988, 1991; Mueller & Elder, 2003; Neugarten & Weinstein, 1964; Robertson, 1977). On the basis of research, five grandparent types can be discerned.

The first type, the *distant grandparent,* takes part in his or her grandchild's life only occasionally and knows little of the child's whereabouts. Hurme (1991) called this type of grandparent the "dissatisfied grandparent." Grandmothers belonging to this type gave affirmative answers to such questions as "My grandchildren have caused me even big disappointments" or "I have a feeling that my grandchildren visit me only out of duty." This type of grandparent is not very common, however. Only 5.8% of the respondents in the JYLS study reported that their children had a very distant relation to their maternal grandmother and 6.7% to their paternal grandmother. The relation to the maternal grandfather was distant in 14.8% of the cases and to the paternal grandfather in 13.0% of the cases. On the other hand, a distant grandparent can be distant because he or she lives far away (Mueller & Elder, 2003): He or she would participate in the life of the grandchild, but cannot.

The JYLS study showed that, in most cases, grandparents have quite close relations with their grandchildren. The relation between

the maternal grandmother and the grandchild(ren) was rather close in 41% and very close in 6.2% of the cases. The relation between the maternal grandfather and the grandchild(ren) was rather close in 42.1% and very close in 31.6% of the cases. The relations of the adult children to their parents were not related to the quality of the relations between the grandparents and grandchildren. This does of course not rule out the possibility that the parents influence the latter relations in many ways. The material in the JYLS study does not contain possibilities to test this, however.

The second type of grandparent *stresses continuity*. These grandparents tell their grandchild about the past and teach him or her family ways and rituals. Robertson (1977) has called this "symbolic grandparenthood."

Formal grandparents do not get satisfaction from grandparenthood, but meet with their grandchild because "this is what is expected" (Neugarten & Weinstein, 1964). In Mueller and Elder's (2003) study on grandparents with adolescent grandchildren, this type corresponded best with an authority-oriented type. These grandparents consider it their duty to take care of disciplining the grandchild. *Individualized grandparents* want the grandchild to visit them often, think that the grandchild belongs also to them, and like to brag about their grandchildren (Hurme, 1988).

The fifth type of grandparent can be described on the *activity-passivity* dimension. Neugarten and Weinstein's (1964) seminal study contained the type "substitute parent," who participated actively in the care of their grandchildren. This type of grandparent is more common among younger grandparents as it presupposes rather young grandchildren. Mueller and Elder (2003) distinguished two subtypes among active grandparents: the supportive grandparent and the influential grandparent. The distinguishing feature was that the influential one did not take any part in disciplining the grandchild. Mueller and Elder asked what makes a grandparent influential. They stated (p. 414) that these grandparents of adolescents "have very positive evaluations of their grandchild. If they have a grandchild who is doing worse in school, they are likely to step in and become more influential. Their children, the grandchild's parents, try to involve them in their lives. Influential grandparents also report having known at least one of their grandparents when they were young." Hurme

(1991) found that 15% of the grandmothers in her study could be classified as belonging to the active type and 15% to the normative, passive type. The passive grandparents did not participate much in the life of their grandchildren, at least not spontaneously. Participation was mostly limited to birthdays and name days and holidays.

King and Elder (1997) reported that grandparents who knew their own grandparents are significantly more likely to have discussions with their adolescent grandchildren about problems and about the future than grandparents who did not have this family tie. This held especially when grandparents and their children did not get along especially well. Much in the same vein, Werner and Smith (2001) showed in their longitudinal study on Kauai, one of the islands of Hawaii, that grandparents had occupied a central role in the lives of children at risk, those who against the odds had had a positive development. For the boys, grandfathers were among the important male role models. Grandmothers were especially important for teenage mothers.

There were frequent contacts between the grandparents and their grandchildren in the JYLS study. The grandchild met with the maternal grandmother almost daily in 5.4% of the cases, almost weekly in 32.9%, about once a month in 25.5%, several times a year in 29.5%, about once a year in 4.7%, and hardly ever in 4.2% of the cases. The maternal grandfather met the grandchild almost daily in 4.2% of the cases, almost weekly in 24.2%, about once a month in 26.3%, several times a year in 29.5%, about once a year in 11.6% of the cases, and hardly ever in 4.2%.

Although grandparents generally have positive experiences of their role, the role is occasionally connected with difficulties (Attias-Donfut & Ségalen, 2002). First, it may be problematic to keep an optimal distance from the grandchild and his or her family: A grandparent should not be too intruding, but also not too distant. Second, the upbringing of the grandchild causes discussions. About one-third of the French grandparents in Attias-Donfut and Ségalen's (2002) study disagreed on this matter with their child and especially with their son. They found, however, that if a mother and her daughter disagreed on the upbringing of the grandchild, the relation already had been difficult since the daughter's adolescence. A third problem area was caused by the rivalry between maternal and paternal grandparents.

Factors Modifying the Grandparent-Grandchild Bond

There are some differences in how grandmothers and grandfathers carry out their roles. Grandmothers see their grandchild more often than grandfathers and the attachment of grandmothers with their grandchildren is stronger than that of grandfathers (Silverstein & Long, 1998). These differences could not be discerned in the JYLS study, however. In their study on adolescents, van Ranst, Verschuren, and Marcoen (1995) showed that grandfathers more often than grandmothers offered a link to the past and acted both as role models and as distant figures more than grandmothers, whereas grandmothers more often than grandfathers were considered reliable companions, conveyed emotional support, reinforced the value of the adolescent, gave financial support, provided a link to understanding old people, were substitute caregivers, and acted as a mediator between the adolescent and the parents.

Mueller and Elder (2003) found that maternal grandparents are more discipline oriented than paternal grandparents. Grandparents of girls participate more actively in the life of their grandchild than grandparents of boys. Silverstein and Long's (1998) study showed that grandparents of girls are more attached to them than are grandparents of boys. Further, Uhlenberg and Hammill (1998), in a nationally representative sample of 4,600 grandparent-grandchild dyads in the United States, found that the number of grandchild "sets" (i.e., all children of a certain child form one set), the quality of the relationship between the grandparent and the child, and the grandparent's marital status determined the amount of face-to-face contact with the grandchild (with divorced grandfathers meeting especially infrequently).

PARENTAL SUPPORT TO ADULT CHILDREN

Most middle-aged adults like those in the JYLS study have children of their own and are therefore in need of support. Although the number of children in the family has decreased markedly from what it was at the beginning of the 20th century, the average number of children in many Western countries is still around two. In Finland, there has

even been a slight increase: Today, there are 1.83 children per family; 20 years ago there was only 1.69. The rise can be localized to an increase in families with three or more children (Sauli, 2004).

Help and Support to Adult Children From Their Parents

Parental support to families with children is important especially when both parents work. This was the case in about a third of Finnish families with two parents in which the youngest child was under age 3. Both parents worked in 72.1% of the families in which the youngest child was between the ages of 3 and 6 (Sauli, 2004).

One way to divide the research findings pertaining to support between family generations is to use Silverstein and Bengtson's (1997) classification of intergenerational cohesion into (1) functional exchange, consisting of instrumental assistance and help; (2) the opportunity structure, that is, geographical distance and contact between the generations; and (3) affinity, that is, emotional closeness and agreement between generations. In actual practice, these forms of support are often intertwined and difficult to separate. These features have often been analyzed with reference to the ages of the parents and their children as well as the gender of the individuals involved. Furthermore, reciprocity in the relation has been treated in the literature. The above classifications will be followed in this chapter.

Until very recently, there has been much more research on help given to aging parents than on the support they give to their children and grandchildren. Not all of the existing research on adult child-parent relations pertains to adult children who themselves have children, but from the data given in articles, it is often difficult to single out these cases.

Parents may ease the burden of their middle-aged children in several ways by giving them help and support. The help may be in the form of child care, either on a full-time basis or occasionally. The older parents may also offer their children help with household tasks, shopping, or, for instance, renovation. Another type of help consists of giving money or gifts, for example, property. A further form of help consists of providing mental or emotional support or advice.

TABLE 12.1. *Help and Support to Adult Children From Their Parents in the JYLS Study*

	Yes		No		Total	
Type of Help	**f**	**%**	**f**	**%**	**f**	**%**
Household chores, renovation	44	38.9	69	61.1	113	100.0
Child minding	59	54.6	49	45.4	108	100.0
Financial support	47	41.6	66	58.4	113	100.0
Mental support, encouragement, advice	84	74.3	29	27.7	113	100.0

The respondents in the JYLS study were asked to what extent they received various forms of support from their parents (Table 12.1). The results showed that in those cases where at least one of the parents was alive, 38.9% said they received help with household chores or renovation, 54.6% received child care assistance, 41.6% received financial help, and 74.3% received mental support, encouragement, or advice. Thus by far the most common type of support from the parents to their middle-aged children consists of mental or emotional support. For instance, Cooney and Uhlenberg (1992) found that up to the age of 30, advice was the most frequent form of parental support but after that, it declined by about 3% to 5% over each 5-year period. Werner and Smith (2001) showed that 52% of the middle-aged men and 61.8% of the middle-aged women had received emotional support from their parents.

The results in Table 12.1 are very much in line with Ritamies and Fågel's (1998) Finnish results, which showed that the parents are a central source of help to adult children. In their study, the percentage of the participants 40 to 46 years old who were getting money from the parents was almost identical with that of the JYLS study, 41%. Among those 40- to 46-year-old Finns who had taken a loan, 46% had received it from their parents. The parents had given a warranty for a loan in 47% of the cases.

The figures of the JYLS study are rather high when compared with what Zarit and Eggebeen (2002) and Eggebeen (1992) report. They found in the National Survey of Families and Households (NSFH) in

the United States that only 17% of the adult children had received at least $200 as a gift or as a loan during the previous 5 years, whereas 27% of that middle generation had received advice or emotional support. One reason for the differences in these figures for financial support may be that the Finnish population as well as the JYLS sample are rather homogenous in regard to income. (The median income bracket in the JYLS study was between U.S. $2,227 and $2,670 per month in the year 2000. About 25% earned less than U.S. $1,780 a month.) Furthermore, the generations in the JYLS study lived rather close one to another in Finland, 93% of the population had a mobile phone, and 70% of families with children had an Internet connection at home (Sauli, 2004), all of which makes staying in contact easy.

Giving help varies over time and space. During early adulthood, children usually receive more help than they give in return. Lowenstein and colleagues in the so-called OASIS study (2003) found that in Israel, Germany, Great Britain, and Spain, between 11% and 16% of those over age 75 had helped their child in at least some area of life. In Norway, the corresponding figure was 25%.

Another aspect concerns the relation between emotions and helping. Help and support has been seen as one example of gift giving by Komter and Vollebergh (2002). They found that when the recipient was a child, there was the least obligation and most love involved with the gift giving, compared with other recipient groups. In the JYLS study, the small group of respondents who did not get along with their mother especially well or not at all received significantly less help and support from their parents, whereas getting help and support from the parents was not contingent upon the relation to the father (this concerned those respondents both of whose parents were alive).

Zarit and Eggebeen (2002) have made a useful distinction between routine help and help in crises. Zarit and Eggebeen reached the conclusion that routine help is given by over half the parents to their adult children. This is very much in line with the JYLS data, where the question concerned giving help at the moment of the interview, not generally. Cooney and Uhlenberg (1992) found that adult children were about twice as likely to view parents as a potential source of help in case of need as they were to report parents as actual sources

of assistance. Much the same was found by Attias-Donfut (1995): help is mobilized on special occasions, for instance, when the children become adults.

The generation in the middle, like the participants in the JYLS study today, are in a situation where they may have to help both their parents and their children. Levitt, Guacci, and Weber's (1992) study showed that middle-aged daughters (mean age 46.7) gave more support to both their mothers and their daughters than they received. The highest support was from the middle-aged mothers to their daughters.

While receiving help and support from others usually is connected with many advantages, there are also negative sides to it. Receiving support implies the possibility of control of the recipient by the donor. The recipient may also feel indebted to the giver, particularly if he or she cannot reciprocate the help.

Contacts and Geographical Distance Between Adult Children and Their Parents

Geographical distance between family generations may seem to be a trivial dimension, void of any meaning. This is not the case, however. Proximity or propinquity greatly influences other factors of exchange between the generations and is in turn influenced by them. These interrelated aspects of proximity might be called facilitating factors. The general trend is that members of different family generations tend to live closer to each other than one could predict by chance.

Adult children and their parents prefer not to live together or even in close proximity to each other. Rather, the optimal distance between them is 30 minutes (Attias-Donfut, 1995), which might correspond to about 50 kilometers by car. Geographical distance and contacts are determined by both the size of the country and cultural factors. The results from the JYLS study concern Finland. The total area of Finland is about 338,000 square kilometers: Compared to many European countries, distances may be rather long in Finland, because at its most distant points, the country is more than 1,100 kilometers long and 540 kilometers wide. Taking this into account, the data speak to the fact that the family generations choose to live close to one another (Table 12.2).

TABLE 12.2. *Distance to the Mother and the Father in the JYLS Study*

	Distance to Mother		Distance to Father	
	f	%	f	%
Living together	5	2.6	2	1.5
<10 km apart	84	44.4	51	37.5
10–50 km apart	48	25.4	34	25.0
50–200 km apart	17	9.0	19	14.0
>200 km apart	35	18.5	30	22.1
Total	189	100	136	100

In cases in which the mother was alive, almost half of the adult children lived closer than 10 kilometers away from their mother, whereas a quarter lived 10 to 50 kilometers away and 9% lived between 50 and 200 kilometers away. Only about one-fifth lived more than 200 kilometers apart. In those cases where the father was alive, 39% lived less than 10 kilometers away. As in the case of the mother, a quarter lived 10 to 50 kilometers away. Fourteen percent lived 50 to 200 kilometers away and slightly more than a fifth lived more than 200 kilometers away. Thus there was a slight tendency to live closer to the mother than to the father but, on the whole, the generations lived quite close to one another.

In the JYLS sample, the relation between distance to the mother and getting along with her was not significant; for the father, however, the corresponding relation was significant at the .05 level ($\chi^2 = 12.95$, $df = 6$), meaning the worse adult children and father get along, the farther they live from each other. Contacts between the adult generations were rather frequent in the JYLS study. Of the adult children, 1.1% did not have contact at all with their mother and 5.5% had no contact with their father, 8.5% of the respondents had contact with their mother only a few times a year and 17.0% percent had similar contact with their father, 14.8% were in contact with their mother and 21.5% percent with their father at least monthly, 58.7% of the respondents stayed in contact with their mother at least weekly and 45.2% did so with their father, and 16.9% stayed in contact with their mother and 11.1% with their father daily. Thus the contact was somewhat more frequent with the mother than with the father.

The figures for weekly contact can be compared with those of Tomassini et al. (2004). For Finland, they were derived from a population-based sample ($N = 1{,}517$) in Lahti, a middle-sized town like Jyväskylä, the site of the JYLS study. The authors reported the frequency of face-to-face contacts for males and females with their parents who were between 62 and 76 years. The combined figure for males and females showed that 70% met their parents at least weekly; the corresponding figure in the JYLS study was 66%. One reason for the slightly higher numbers in the Tomassini et al. study may have been the rather low level of education of the middle-aged parents in Lahti, with 76.3% possessing a low education. The study by Tomassini et al. showed that in Finland, the odds of adults seeing their father face-to-face decreased with their increasing education, whereas this did not hold for mothers. In this respect, Finland differed from the other countries in the study, namely the Netherlands, Great Britain, and Italy.

Contact frequency has been found to correlate with affect (e.g., Bengtson & Roberts, 1991). This was the case also in the JYLS study. The correlation between contact frequency and getting along with the mother was .53 ($p < .001$); the corresponding correlation for the father was .64 ($p < .001$). Lawton, Silverstein, and Bengtson (1994) found that affection for the mother, but not for the father, determined contact with them.

One of the best-established features in earlier research on intergenerational relations in the family is the fact that women have more contacts with their parents (e.g., Perrig-Chiello & Sturzenegger, 2001; Rossi & Rossi, 1990). This was, however, not the case in the JYLS sample. Finland is a very egalitarian country; it was, for instance, the seventh lowest country/region of 53 on the Masculinity dimension in Hofstede's (1994) study of important cultural dimensions. In the family, this means that "both fathers and mothers deal with facts and feelings" (Hofstede, 1994, p. 96). This might also concern relations with parents.

Usually, there is a significant relation between distance and contact frequency for visiting (e.g., Rossi, 1989). This applied in the JYLS study as well: There was a significant relation between distance and contact frequency (face-to-face, by telephone, letters, etc.) for both

parents, $\chi^2 = 10.71$, $df = 4$, $p < .05$, for the mother and $\chi^2 = 18.23$, $df = 4$, $p < .001$, for the father, with larger distances resulting in fewer contacts. The adult child did not meet the father at all or at the most a few times a year in about 13% of the cases in which the individuals lived less than 10 kilometers apart, whereas 67.9% of these children met him at least once a week, if not daily. Of those children who lived over 50 kilometers away from their father, 39.6% did not meet him at all or just a few times a year, when the corresponding figure for mothers was 19.2%. Despite distance, the frequency of contacts with the mother was frequent. Of those living more than 200 kilometers away from their mother, 66% were in contact at least weekly with her.

The relationship between intergenerational contacts and distance is not a linear one, but contact has been found to drop rather quickly after a certain distance, and it varies according to the type of contact. Hurme (1988) found that 20 kilometers was the threshold after which visits by the maternal grandmother dropped, whereas the threshold was higher for her daughter. Dewit, Wister, and Burch (1988) found a drop after 4 hours' travel in both visiting and telephone contacts by the elderly. In the JYLS study there was a very pronounced and highly significant drop in contact frequency (both face-to-face and by phone) by the adult child with both the mother and the father when the distance was more than 50 kilometers.

The so-called decline rates (Litwak & Kulis, 1987) differ for the various types of help. They are higher when help is in the form of light household chores and smallest for cheering up people (which obviously can be done over the phone). In the JYLS sample (in the cases where both parents were alive), the sum of the help instances from the parents was not significantly related to the distance to them. However, when the different types of help were analyzed separately, the results were in line with Litwak and Kulis's results: There was a significant relation between distance and giving help with household chores both for the mother and the father. For the father, there was a significant relation between distance and helping with child minding as well. Thus, grandmothers seem to be ready to overcome the distance more readily than grandfathers in order to take care of the grandchildren.

Emotional Closeness and Agreement Between Adult Children and Their Parents

Emotional closeness between the generations seems to be the rule. For instance, in both Eastern and Western Germany, 83% to 95% of adults report having close relations with their children and 64% to 88% with their parents (Bengtson & Martin, 2001). Hurme (1988) found similar results in Finland: The mothers rated their relations as better than their daughters from the same dyad. Levitt, Guacci, and Weber (1992) reached the same conclusion for mother-daughter pairs. This is the so-called intergenerational stake hypothesis (e.g., Bengtson & Giarrusso, 1995, p. 88), – that is, parents have more at stake in the relation than their children do.

In general, the mothers and their adult children in the JYLS study got along quite well: 68.8% of those whose mother was alive got along quite well or very well with her. Only 1.6% of the respondents did not get along at all with their mothers, and 4.3% not especially well. In regard to the father, 9% of the adult children did not get along especially well or not at all, but 60.4% got along very well or quite well with him. There was thus a slight tendency to get along better with the mother than with the father.

From a developmental perspective it is interesting that 67.2% said their relationship to their mother had stayed about the same during the previous 5 years and had gotten better in about 26% of the cases. The corresponding figures for the father were 64.9% and 30.6%. This is quite in line with Baruch and Barnett's (1983) study showing that by middle age (35 to 55 years), a child's difficulties with his or her mother had been mostly overcome. Bengtson and Martin (2001) again found that there were fluctuations over time in 40% of the relations between adult children and their parents.

About 60% of the adult children in the JYLS study reported that their own and their mother's attitudes and values about life were at least similar. Only 3.7% said that that they were not at all similar. The corresponding figures for the father were 48.8% and 4.6%.

The respondents in the JYLS study rated their relation to their mother using Bartholomew and Horowitz's (1991) four questions pertaining to adult attachment types. The most common answer pertained to the description "It is relatively easy for me to be her friend.

I do not feel uneasy even when I have to rely on her. I don't worry about being alone or having her not accept me." Agreement with the statement indicates secure attachment, and 60% of the respondents selected the three uppermost categories on a 7-point scale, indicating that the statement suits them quite well, well, or very well. This question also correlates negatively with the other three variables in this measure, that is, fearful, preoccupied, and dismissing attachment. The result gives a picture of quite positive relations of these adult children with their mothers.

Reciprocity Between Adult Children and Their Parents

Reciprocity between the generations in the family means a balance, with neither generation indebted to the other. For instance, Rossi and Rossi (1990) found considerable reciprocity in the relations between adult children and their parents. This balance cannot always be reached simultaneously. Instead, reciprocity has to be seen over an extended time span (e.g., Attias-Donfut, 2001). Antonucci (1990) uses the term "support bank," implying that earlier in the life of the child the parents invest in this bank in order to be able to withdraw support later in life. A decline in support from parents can be discerned after age 30 (Cooney & Uhlenberg, 1992). When the parents age, children give more than they receive (Attias-Donfut, 2001; Ritamies & Fågel, 1998).

In the JYLS study, there were signs of reciprocity in the help to the parents and the help from the parents (for the 113 cases in which both parents were alive). The totality of various forms of help to and from the parents correlated .20 ($p < .05$). When these sums were cross-tabulated, the chi-square value (16.4, $df = 4$) was significant at the .01 level, showing that those children who give much help also receive much. This is quite in line with, for instance, Lee, Netzer, and Coward's (1994) findings regarding a significant correlation between aid given and received between adult children and their parents.

Reciprocity was especially clear for mental and emotional support, $\chi^2 = 18.9$, $df = 1$, $p < .001$. Of all respondents, 47.6% had both given and received mental and social support from their parents, whereas 20% had neither received nor given it. In 14.8% of the cases, the adult child had not received such support, but had given it, and in 17.6%

of the cases the parents had given mental or social support, but this had not been reciprocated.

GRANDPARENTHOOD IN THE FUTURE

If research on generations in the family had been abundant in the beginning of the 20th century, hardly anyone could have predicted how much the circumstances of the generations would have changed during the subsequent 100 or so years. During the last century, the Western world moved toward industrialization and employment outside the home, an increase especially among women. Women were no longer able to take care of their grandchildren to the same extent as before. Urbanization increased the geographical distance between the generations and, at the same time, influenced their mutual support. Later, new ways of staying in contact, such as traveling by car, the telephone, and e-mail, to some extent compensated for this distance. The size of the family decreased, which implied that a single grandparent had fewer grandchildren and was able to concentrate more on an individual grandchild. It is as difficult to predict what intergenerational relations in the family will look like 100 years from now. Some guesses have been made, however (Allen, Blieszner, & Roberto 2000; Bengtson, 2001; Lüscher, 1997; Silverstein, 2002; Uhlenberg & Kirby, 1998; Walker, 1999; Zarit & Eggebeen, 2002).

"The family" has already now changed to the extent that one often has to speak of families in plural. The family no more consists only of a mother, a father, and biological children, and this pattern will probably be strengthened in the future. Several features have changed the family and within the family.

Cohabitation has increased as an alternative to marriage and will probably become even more common. In some countries – for instance, in the Scandinavian countries – about 15% of the parents of school-aged children cohabit instead of being married (Kartovaara & Sauli, 2001). There may be a series of cohabiting relations. In the JYLS study, more than one-third of participants had lived in two or more cohabitation relations. From the child's point of view, he or she may therefore have several grandparent figures.

Divorce has been on an increase in most industrialized countries for decades. Despite this, five out of six Finnish children still live with

both parents (Kartovaara & Sauli, 2001). Often divorce and an ensuing remarriage or cohabitation implies that a grandchild has more than four grandparent figures – both biological grandparents and nonbiological ones. As grandparents divorce and remarry, children may get "new" step-grandparents during late childhood or during adolescence. So far there is little systematic research on step-grandparents and thus there is scant information as to how this may influence child development, but a guess can be made that if the relations with most of these persons are kept up and are positive, the consequences will be beneficial.

The *number of children* per family has decreased from what it was a century ago. The typical Western family today averages slightly fewer than two children. The guess is that family size will further decrease and at least the number of biological children will drop further. This implies that each grandparent can invest more time and energy in a smaller number of grandchildren in the future.

Adoption from developing countries is predicted to increase and with that, the number of adoptive grandchildren. From the child's point of view this may mean that he or she will never have any contact with the biological grandparents and instead the adoptive grandparents become central.

Globalization increases the *geographical distance* between the generations in the family when family members live around the globe. New forms of communication, such as e-mail and mobile phones, become commonplace. Already they are quite widespread (e.g., SeniorWatch, 2005) but not used very often in communication between grandparents and grandchildren (Quadrello et al., 2005). Fears have been espoused that these new forms of communication will further distance the family generations from each other.

Great-grandparenthood will become increasingly important with populations aging (Attias-Donfut & Segalen, 2002). In a French study led by Attias-Donfut, the mean age of the great-grandparents was 74 years. The children in that study had at birth almost as many great-grandparents as grandparents. Additionally, 9% of those great-grandparents took care of the great-grandchildren regularly (Attias-Donfut & Segalen, 1998).

Postponement of childbearing is a fact. The median age of primiparae has increased, for instance, in Finland from 23 years of age in the

1970s to 27 years today (Sauli, 2004), and may probably continue to increase somewhat. This will in turn lead to grandparents being older and probably frailer and not being able to support their children and grandchildren to the same extent as today. The postponement of childbearing may also lead to an increase in childlessness. Of the 45-year-old women in Finland, 16.7% were childless in 2003 compared with 13.8% in 1990. There are predictions that voluntary childlessness may also increase (Sauli, 2004). Both these factors lead to more and more parents not becoming biological grandparents.

When the population ages and, at the same time, the level of education increases, it seems probable that the grandparent generation will stand up for its rights, among them the right to be seen as legal entities and to have their rights as grandparents protected. This is still not the case in many European countries (Italy, Greece, Bulgaria, Poland, and Finland; Brandis, 2003).

There are already signs that among older people family members are being replaced by friends (Allen, Blieszner, & Roberto, 2000). It is quite possible that in the future, biological ties will be less important than today, partly because of new reproduction technology (e.g., because of an increase in donor in vitro fertilization or totally new forms of reproduction that we cannot envisage today).

Two decades ago, Gutmann (1985) predicted that a "grandparents' liberation front" can be expected, that is, grandparents would like so many liberties for themselves that their children and grandchildren would be in a secondary role. No signs of such a movement have as yet been seen. On the contrary, researchers agree that intergenerational family bonds are very positive and strong (e.g., Bengtson, 2001).

PART IV

LIFE COURSE AND HEALTH

This section analyzes paths from an individual's developmental background factors to physical and psychological well-being in adulthood through identity formation, personal control over development, sense of coherence, optimism, education, work, and personality characteristics. These psychosocial factors, which explain psychological well-being in adulthood, are rooted in one's developmental background, that is, school success in early adolescence, child-centered parenting, the parents' occupational status, and one's emotion regulation. Adult physical well-being correlates with psychological well-being but is not directly accounted for by these psychosocial factors, with a few exceptions.

Chapter 13 by Fadjukoff and Pulkkinen analyzes adaptive capacities in terms of identity achievement and personal control over development. These capacities are relatively stable in adulthood. They contribute to adult psychological well-being, which correlates negatively with psychosomatic symptoms. School success in adolescence and the parents' occupational status are associated with identity achievement, which facilitates both social and psychological well-being. As compared to identity, personal control over development is more highly connected to the quality of the individual relationships within the family of origin, that is, child-centered parenting, and it is much more highly related to psychological well-being.

Chapter 14 by Feldt, Mäkikangas, and Aunola also addresses positive psychology, which is oriented to strengths and virtues rather

than weaknesses and suffering, by exploring the constructs of sense of coherence and optimism. These highly related but not identical constructs have roots in child-centered parenting; optimism also has roots in school success and life satisfaction. Both of these constructs are associated with self-reported well-being at age 42, but not with objective health indicators. Sense of coherence is linked more strongly than optimism to health behaviors, indicated by low scores in the alcoholism screening test and smoking.

Chapter 15 by Kokko shows that long-term unemployment is related to psychological distress. This relation can be explained both by selection into long-term unemployment and effects of it. Externalizing problem behaviors at an early school age and the lack of higher education play a role in the selection process. Education resulting in an on-time degree is associated with employment, while no degree is a risk factor for unemployment. Later education resulting in an off-time degree is advantageous in terms of employment in men and for upward social mobility in women.

Chapter 16 by Kivimäki, Virtanen, Elovainio, and Vahtera discusses different models concerning the relationship between psychosocial factors and well-being, such as the job strain model, the effort-reward imbalance model, and the vulnerability model. Psychosocial factors at work may increase vulnerability to certain illnesses. Regarding personality characteristics, hostility that is associated with poor and inadequate coping skills and lower interpersonal support increases reactivity to negative changes in psychosocial work factors. Hostility contributes to increased health problems after controlling for a variety of health risk factors, particularly in lower occupational groups. Childhood aggressive behavior is a risk factor for an insecure labor market position. Thus, lower emotion regulation is directly or indirectly associated with lower well-being.

13

Identity Formation, Personal Control Over Development, and Well-Being

Päivi Fadjukoff and Lea Pulkkinen

INTRODUCTION

Individuals' conceptions of their personal goals have been studied in the psychology literature from different perspectives. In this chapter, the processes and implications of one's orientations and self-definitions were analyzed along two dimensions: one's sense of identity, and the self-percepts of autonomous control over development. Several researchers (e.g., Archer, 1989; Brandtstädter & Baltes-Götz, 1990; Pulkkinen & Rönkä, 1994) have concluded, on the basis of literature reviews and empirical findings, that adaptive capacities are associated with a clear sense of identity and personal control over development. Although any given cultural and historical context confines the possible alternatives, an individual's developmental pathway is largely a result of intentional choices, based on his or her earlier and current self-definitions and identity (Brandtstädter, 2002).

Careful planning and elaboration of an individual's developmental paths is critical for personal development and the attainment of a high quality of life (Brandtstädter, 2002). We expected one's orientations and self-definitions to play a role in transferring the effects of developmental antecedents to later adjustment in life. The positive implications of favorable family circumstances and good school success have been affirmed in several studies (e.g., Magnusson, 1988; Masten & Coatsworth, 1998; Werner & Smith, 2001). Using the JYLS data, Pulkkinen, Nygren, and Kokko (2002) found that

childhood developmental background directly accounted for adult social functioning consisting of external criteria: stability of career line, controlled drinking, and socialization. Even though this factor correlated with psychological functioning comprising self-esteem, psychological well-being, and satisfaction with life, such direct association was not confirmed between childhood antecedents and these internal well-being criteria.

These findings raised a question regarding possible mediators that could explain the connections between developmental background and adult psychological functioning. The role of personal self-definition and goals in the developmental process of psychological functioning was a specific target of the study presented in this chapter. The purpose of the study was threefold. First, we analyzed personal growth in the dimensions of identity and personal control over development after early adulthood, as well as the interrelatedness of these two dimensions. Second, we investigated the implications of favorable family circumstances and good school success in early adolescence for identity achievement and personal control over development in adulthood. Finally, we analyzed whether positive progress in identity achievement or personal control over development contributed to positive outcomes in later personal well-being.

Data on both identity and personal control over development were collected at ages 27, 36, and 42 in the JYLS study, which warranted the comparison of these two measures at each age. The developmental background measures focused on age 14, and adult well-being was measured at age 42. Hence, the longitudinal study extended from early adolescence to middle age in the life span of the participants.

TWO DIMENSIONS OF ADAPTIVE PSYCHOLOGICAL FUNCTIONING

Identity Formation From Adolescence to Adulthood

"Identity is a self-structure – an internal, self-constructed, dynamic organization of drives, abilities, beliefs, and individual history" (Marcia, 1980, 159). Identity is generally referred to as a single or overall concept, but different content areas have to be taken into

account in empirical research approaches. When first introducing the concept, Erikson (1950, 1968) considered occupational and ideological domains essential to identity. Marcia (1966) further divided the ideological domain into political and religious identity subdomains. Later, interpersonal domains were added to the concept of identity (Grotevant, Thorbecke, & Meyer, 1982). The concept of identity therefore contains both ideological and interpersonal aspects. However, no general agreement now exists about what would constitute a specific set of domains that would comprehensively comprise the concept of identity. Instead, the number and area of identity domains vary slightly within numerous studies and methods. As Marcia (2001) noted, the domains have to be meaningful to the individuals studied and have some variability of choice permitted by the particular culture. An individual's identity formation is not uniform but can proceed differently across different domain areas.

James Marcia (1966, 1993a) elaborated the concept of identity in his identity status theory, stating that identity develops through four distinct stages: diffusion, foreclosure, moratorium, and achievement. He described these identity statuses in terms of their position on two dichotomic dimensions: exploration and commitment. Usually, identity development proceeds at a different pace in different domains, depending on the individual's interests and environment.

In identity diffusion (D), an individual does not have firm commitments, nor is he or she actively trying to form them. For instance, he or she has not made decisions and is not yet concerned about occupational preferences, and is uninterested in ideological matters. In foreclosure (F), commitments are made without an exploratory phase, typically by identifying with parents or with other authorities. A person simply tries to follow the paths and lifestyle of someone he or she looks up to without seriously considering other options. A person actively exploring alternative life choices without having yet committed to any has a moratorium (M) identity during this time. In other words, he or she is actively struggling to commit to, for instance, occupational goals, political stands, or intimate relationships. Finally, an identity is achieved (A) when relatively firm commitments are made through a period of exploration. An achieved individual has, for example, deliberately made decisions concerning his or her occupational preferences and lifestyle after considering several options.

Although the strict view of hierarchically ordered stage sequences to identity statuses has been renounced in further research, there is still a reasonably wide consensus about normal development proceeding in terms of a general diffusion–foreclosure–moratorium–achievement sequence. The identity achievement status is clearly the most developmentally sophisticated status, with diffusion being the least sophisticated, as was postulated in Erikson's theory (e.g., Berzonsky & Adams, 1999; Waterman, 1999).

Identity development research has primarily focused on adolescents, although the process neither begins nor ends during the adolescent years. Having reviewed existing published longitudinal investigations of identity status movements from late adolescence through early adulthood, Kroger (2000) suggested that by early adulthood, approximately half the participants in all of these studies had remained foreclosed or diffused across all identity domains. In the present study, we analyzed how identity continued to develop after early adulthood and whether achievement, reached in either early or later adulthood, was associated with favorable outcomes in individual well-being. Specific interest was also focused on adults with consistent identity diffusion.

The Marcian semistructured interview was carried out at ages 27, 36, and 42 as a part of the JYLS study. The interview included five domains through these three age stages: religious beliefs, political ideology, occupational career, intimate relationships, and lifestyle. The opening questions were as follows: "Do you have a personal relationship to religion?" "Do you have a political opinion?" "Do you have a conception of your occupational career?" "Do you have an idea of what you expect from a close relationship?" "Do you have an idea of the lifestyle according to which you would like to live?" In addition, the participants were asked for each domain about how they had acquired their views, for example, from significant others or by personal exploration. Each participant's identity status (diffused, moratorium, foreclosed, or achieved) was assessed for each domain using two criteria: the firmness of personal commitment and the presence (+) or absence (−) of a period of exploration or "crisis." Using these dimensional categorizations, four identity statuses were defined: diffused (− [or past +] exploration, − commitment); moratorium (+ exploration at the moment, − commitment); foreclosed

(− exploration, + commitment); and achievement (+ exploration, + commitment).

The process of identity formation from age 27 to ages 36 and 42 was described in another context (Fadjukoff, Pulkkinen, & Kokko, 2005). Generally, the data implied an increase of commitment with age: There was an increase in foreclosed identity from age 27 to 36 whereas identity achievement increased between the ages of 36 and 42. However, the findings showed great variability across the identity domains at each age level. Although a developmental pattern following the hypothesized sequence of diffusion-foreclosure-moratorium-achievement was the most frequent trajectory for both men and women in most domains, the most usual pattern of development in political identity was regressive toward diffusion. The rates of stability (remaining in the same status category through three measurement points) varied from 9% to 31%, depending on the domain.

For the present analyses, separate scales for each of the identity statuses were created at each measurement point (at ages 27, 36, and 42) on the basis of the number of domains in which the individual was in a particular status, following the procedure used by Pulkkinen and Rönkä (1994). In a five-domain interview, six-point scales (0 to 5) were produced. If an individual was located in the identity achievement category for two domains, in the foreclosure status for two domains, and in the moratorium status for one domain, that person received a score of 2 for the Identity Achievement scale, 2 for the Foreclosure scale, 1 for the Moratorium scale, and 0 for the Diffusion scale. Identity Diffusion and Achievement scores were at each age level highly negatively correlated (from −.55 to −.62), as could be expected as these statuses represented the opposite ends of the developmental identity continuum.

The correlation coefficients between the identity status scales across the measurement points demonstrated differences in the stability level of identity status scores: The scores in Diffusion and Achievement scales were the most stable (ages 27/36, $r = .38$; 36/42, $r = .53$ for Diffusion; ages 27/36, $r = .26$; 36/42, $r = .43$ for Achievement, $p = .000$ for each). The Moratorium Scale demonstrated no stability between the successive measurement points, and Foreclosure was stable only between ages 36 and 42 ($r = .25$, $p = .000$). These correlations indicated that individuals tended to remain in their relative

positions from early to middle adulthood at both poles of the identity status dimension, but the stability through three measurement points was lower in the middle of this axis.

As diffusion and achievement are theoretically the two end points of the identity continuum and were empirically negatively correlated (at age 27, $r = -.55$, age 36, $r = -.56$, age 42, $r = -.62$, $p = .000$ for all), we formed a new Identity Achievement – Diffusion (IA-D) scale for identity at each age level, subtracting the number of diffusions (0–5) from the number of achievement-ratings (0–5). The range of the IA-D scores was from −5 to +5. The means were −0.09 at age 27, 0.77 at age 36, and 1.00 at age 42 with a standard deviation of approximately 2.2. There was a significant increase in identity achievement from age 27 to age 36 as confirmed with the paired samples t test, $t(199) = -4.90$, $p = .000$. A gender difference emerged at age 42, when the mean for women (1.26) was higher than that for the men (0.58), $t(241) = 2.19$, $p = .030$. Cronbach's alpha for this new Identity A-D scale was .71 for age 27, .70 for age 36, and .74 for age 42.

Personal Control over Development

Marcia (1993b) noted in his review of existing literature that identity achieved individuals believe that they can influence and choose the course of their lives and are personally responsible for it, whereas the diffuse individuals see that the influential factors of their lives are mainly external of themselves. The moratorium and foreclosed persons stand between these two viewpoints. Therefore, we expected identity development and personal control over development to be interrelated concepts.

The construct of personal control over development has been described by Brandtstädter (1989, p. 96) as "an individual's sense of control over subjectively important areas of personal development." Brandtstädter (1984, 1989) differentiated cognitive, emotional, and behavioral aspects of personal control over development and their interrelationships. In his model, subjective developmental perspectives and control beliefs (cognitive aspect) are linked with more or less active control efforts (behavioral aspect) and emotional states (emotional aspect). The relationship of perceived control over development to aspects of well-being is largely consistent with models of

learned helplessness and self-efficacy (Brandtstädter & Baltes-Götz, 1990).

In the JYLS study, a Personal Control Inventory, developed by Lea Pulkkinen, was presented to subjects as part of a mailed questionnaire at ages 27, 36, and 42. The inventory consisted of 18 items, based on Brandtstädter's (1984, pp. 18–19) model of the structure and interrelationship of cognitive, actional, and emotional orientations; for instance, "I am able to make my goals come true." Responses were provided based on the following scale: 1 = *strongly disagree*, 2 = *disagree*, 3 = *agree,* and 4 = *strongly agree*. Because the first data were collected in 1986, Brandtstädter's (1989) revised model and scales were not available when these items were formulated.

The Personal Control Inventory was divided into five factors by Pulkkinen and Rönkä (1994) using data gathered at age 27. The same factors were later used by Pulkkinen, Kokkonen, and Mäkiaho (1998): *Self-Confidence* included trust in one's own power and depicted a positive internal control over development, and *Social Support* consisted of thankfulness for social support and satisfaction with one's achievements. The third factor, *Low Self-Worth*, comprised negative moods or depression because of perceived incompetence (negative internal control). The fourth factor, *Accusation of Others*, included attributions of failures to other people (negative external control). And the fifth factor, *Contentment*, covered satisfaction with present achievements without further developmental goals. Construction of the scales, as well as Cronbach's alphas, which ranged from 0.63 to 0.76 at ages 27 and 36, are explained in detail in these studies. At age 42, Cronbach's alphas ranged from 0.67 to 0.77. There were no gender differences in the means or variances of the Personal Control Inventory subscales at any age.

The correlations between the subscale scores across the three measurement points demonstrated stability of personal control dimensions, r varying from .23 to .60, $p = .000$ for each. The mean scores of the subscales for self-confidence ($M = 3.1$), social support ($M = 3.1$), and accusation of others ($M = 2.0$) did not change between ages 27, 36, and 42. The mean scores for low self-worth were 1.97 at age 27, 1.97 at age 36, and 1.88 at age 42. The difference between ages 36 and 42 was confirmed to be significant by the paired samples t test, $t(193) = 2.79$, $p = .006$. Correspondingly, contentment with

present achievements increased from the mean score of 2.11 and 2.39 to 2.56. The differences were significant both between ages 27 and 36, $t(193) = -5.43$, $p = .000$, and between ages 36 and 42, $t(193) = -4.21$, $p = .000$.

For the purposes of the present study, a composite Personal Control over Development measure (PCoD) was constructed by averaging the scores of the subscales. This procedure gave equal weight to each dimension, regardless of the number of items covered by the subscale. The scale was first constructed with all five scales, with reversed scales of Low Self-Worth, Accusation of Others, and Contentment. However, the reliability testing asserted that using the Contentment scale was problematic in the longitudinal setting: Contentment with present achievements seemed to become more adaptive as the participants grew older, correlating positively with Self-Confidence, and negatively with Low Self-Worth and Accusation of Others at ages 36 and 42. It also seemed theoretically valid that a person's satisfaction with present achievements without further developmental goals could be dysfunctional early in life, but adaptive later in life. Due to difficulties in interpreting the role of Contentment in the longitudinal setting, it was excluded from the total PCoD scale. The mean of the scale was 3.1 at each age level with a standard deviation of about 0.3. No gender differences emerged in the means of the scale at any age. Cronbach's alphas for the 14 original items of the four subscales included in the PCoD scale were .72 at age 27, .76 at age 36, and .80 at age 42.

Interrelatedness of Identity and Personal Control Over Development

We explored the links between the IA-D scale and the PCoD Scale with a path model using the Lisrel 8.7 program (Jöreskog & Sörbom, 1996). Multigroup analysis was used to discover possible gender differences. After a listwise exclusion of missing data, the number of participants was 190, of which 100 were women and 90 were men. The Lisrel-model was built by testing alternative models for best fit, using the Maximum Likelihood estimation method. The overall fit of the estimated models was evaluated using a χ^2 test. The requirement of adding a parameter was estimated using modification indices, and the quality of the model was further based on t values (criteria > 1.96)

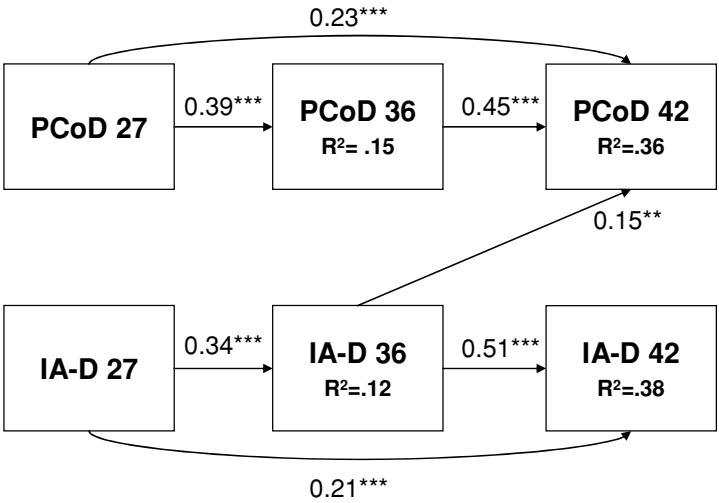

FIGURE 13.1. A path model for Identity Achievement-Diffusion scale (IA-D) and Personal control over Development scale (PCoD) at ages 27, 36, and 42, and their interactions tested across gender. *Note:* $^{**}p < .01$. $^{***}p < .001$.

of the single parameters. As it is recommended that the model fit be evaluated based on several fit indices, the root mean square error of approximation (RMSEA), goodness of fit (GFI), and comparative fit index (CFI) were used as supplementary fit indices. The χ^2 difference test was used for comparing the alternative models.

The linkages between the three measurement points of each variable were first confirmed as being significant for both women and men. In addition to the connections from age 27 to 36, and age 36 to 42, the χ^2 difference test of the successive models confirmed that a simultaneous connection emerged from age 27 to age 42 on both measures (Figure 13.1).

The tentative path model appeared sufficient without further improvements, with both dimensions continuing to develop fully independently of each other. There was a relatively good fit between the presented model and the data, $\chi^2(29) = 39.98$, $p = .084$, RMSEA = .064, GFI = .93, CFI = .94, and there were no gender-dependent differences. However, a nearly significant modification index pointed out a possible connection between the IA-D at 36 and PCoD at 42. This connection was freed and proven significant without a gender difference. The fit was improved according to all used indices,

$\chi^2(28) = 35.87$, $p = .147$, RMSEA = .055, GFI = .94, CFI = .96. The relevance of this connection was further confirmed by comparing the presented path model (Figure 13.1) with the first tentative model using the χ^2 difference test, which showed a significant difference between the models, $\chi^2(1) = 4.11$, $p = .043$. Hence, a strong sense of identity at age 36 preceded a strong sense of personal control over development at age 42 for both men and women.

DEVELOPMENTAL ANTECEDENTS AND WELL-BEING IN ADULTHOOD

Variables

Three developmental background measures from age 14 were included in the analysis. The family background information consisted of two variables: the parents' occupational status in the family of origin, and child-centered parenting. In Finnish society, social class distinctions and income differences are small, resulting partly from a highly progressive taxation system. Therefore, the occupational status of the parents, largely based on their educational level, was selected as an indicator of the family's social status without taking their income level into consideration. The measure was defined using information from both the father's and mother's occupational status, with the higher occupational status of the two used as an indicator for categorization into 1 = blue-collar occupations, 2 = lower white-collar occupations, and 3 = higher white-collar occupations.

The second family background measure, child-centered parenting (Kokko & Pulkkinen, 2000), was related to family atmosphere and parenting practices. It included good parental relationship, good relationship with the father, maternal support and supervision, and lack of physical punishment. The variable was based on participants' recollections (measured at age 27) of parenting practices and the home environment at age 14, and formed by computing an averaged score of five dichotomized variables. A separate analysis with a smaller sample has confirmed a good correspondence between recollections at age 27 and prospective data collected at age 14. Third, the individual's own school success was measured by the grade point average

(GPA) based on school records. It was noted that school success was related to the parents' occupational status: the higher the status, the higher was the child's GPA, $r = .19$, $p = .001$. Girls had a better GPA than boys, $t(344) = 8.11$, $p = .000$.

Adult well-being, defined as participants' perceptions of their psychosocial well-being and physical health, was assessed with several measures at age 42. Gender differences did not emerge in the means of any of these measures.

The Scales of Psychological Well-Being, developed by Ryff (1989), included six components of positive psychological functioning: Self-Acceptance, Personal Growth, Purpose in Life, Positive Relations with Others, Environmental Mastery, and Autonomy. Psychological well-being has been conceptualized broadly in the scales as including people's sense of whether their lives have a purpose, whether they are realizing their given potential, what is the quality of their ties to others, and if they feel in charge of their own lives (Ryff & Keyes, 1995). The short version of the scales consisted of the total of 18 items (3 items per scale) such as "I am quite good at managing the many responsibilities of my daily life," and "Maintaining close relationships has been difficult and frustrating for me" (reversed). The response scale varied from 1 = *strongly disagree* to 4 = *strongly agree*. Cronbach's alpha for the scale was .75.

The Scales of Social Well-Being, constructed by Keyes (1998), consisted of five dimensions of positive social functioning, representing challenges that people face as social beings, namely social integration, social contribution, social coherence, social actualization, and social acceptance. The measure correlates with anomie, perceived external control, perceived neighborhood quality, and the individual's engagement in prosocial community activities (Keyes, 1998). The scale was composed of the mean of 15 items rated on a scale from 1 = *strongly disagree* to 4 = *strongly agree*, such as "People who do a favor expect nothing in return," "I feel close to other people in my community," and "I cannot make sense of what's going on in the world" (reversed). Cronbach's alpha for this scale was .77.

Generativity, the adult's concern for and commitment to guiding and caring for the next generation, was identified by Erikson (1950) as a key developmental task and precondition of psychological well-being in middle age. The concept was later elaborated both

theoretically and empirically (see, e.g., McAdams, & de St. Aubin, 1998; de St. Aubin, McAdams, & Kim, 2004), and its association with well-being has been confirmed. The Generativity Scale developed by Ryff and Heincke (1983) was used in the present study. The scale was composed as a mean of 10 questions, such as "I am concerned about providing guidance and direction to younger people" and "The average person does not have the time to be concerned about the welfare of others" (reversed). Responses for each question were given on a scale from 1 = *strongly disagree* to 4 = *strongly agree*. Cronbach's alpha for the scale was .72.

For assessing physiological health, two measures were used at age 42. Self-rated health was measured by the question, "How would you describe your health now?" with response options ranging from 1 = *very good* to 5 = *very bad*. Psychosomatic symptoms were measured as a sum score of 19 items (e.g., headache, trembling hands, muscular pain) taken from the symptom checklist of Aro (1988). The occurrence of each symptom during the previous six months was rated on a scale from 0 = *never* to 4 = *very often*.

The three measures of psychosocial well-being intercorrelated, with the correlation coefficient ranging from .40 to .54, $p = .000$ for all. Also, the two indicators of physical health intercorrelated significantly, $r = .60$, $p = .000$. Psychosomatic symptoms, $r = -.36$, $p = .000$, and poor self-rated health, $r = -.28$, $p = .000$, correlated negatively with psychological well-being, and psychosomatic symptoms were negatively associated with social well-being, $r = -.20$, $p = .002$.

Antecedents and Outcomes of Identity Achievement

Paths both between developmental background in early adolescence and later identity formation, and between identity formation and later well-being in adulthood, were analyzed with the path model using the Lisrel 8.7 program (Jöreskog & Sörbom, 1996). The model was based on the matrices of polychoric correlations and built by testing alternative models for best fit (Maximum Likelihood). Multigroup modeling was used to mark possible gender differences. Missing data were excluded listwise, and the remaining number of participants was 173: 89 women and 84 men. The estimation procedure and

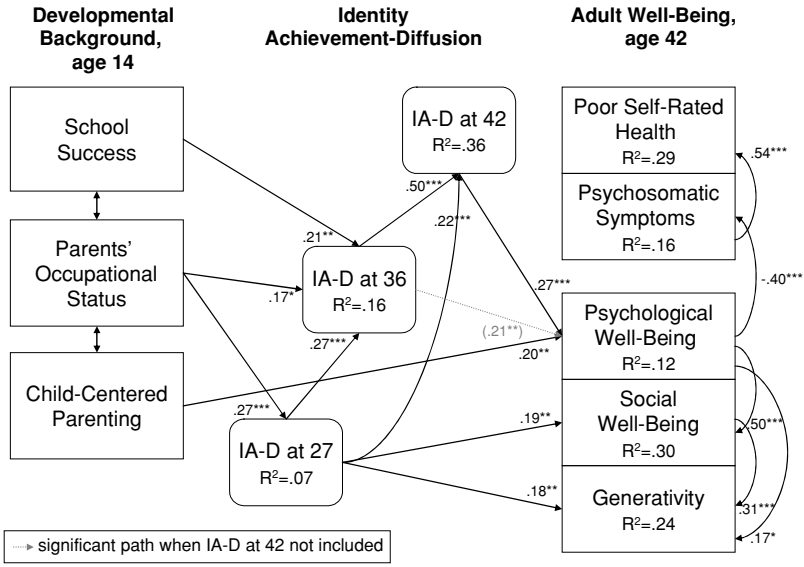

FIGURE 13.2. A path model for developmental antecedents of identity achievement and adult well-being tested across gender. *Note:* $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

evaluation of the model fit was carried out using the same indices as described for Figure 13.1.

The model was structured according to the time span: The developmental background variables (school success, parents' occupational status, and child-centered parenting, all at age 14) were set as explanatory variables, and the identity measure (IA-D scale) as well as adult well-being measures (psychological well-being, social well-being, generativity, self-rated health, and psychosomatic symptoms, all at age 42) were positioned as dependent variables. To confirm the predictive linkages from IA-D to well-being, the model was structured for the IA-D in three ways: (1) Only IA-D at age 27 was included in the model, (2) IA-D at ages 27 and 36 were included, and (3) the whole time span from age 27 to 42 was included in the model. The latter, presented in Figure 13.2, was considered to be the final model. According to all used fit indices, the proposed model fit the data well; $\chi^2(97) = 92.42$, $p = .613$, RMSEA = .000, GFI = .91, CFI = .99. No gender differences emerged.

Success at school was not connected with either IA-D at age 27 or any of the well-being measures in the initial model but was positively associated with identity achievement at age 36 when the latter was included in the model. Higher occupational status of the parents preceded higher levels of IA-D score at age 27, and additionally at age 36 when IA-D at 36 was included. No connections were found between child-centered parenting and the IA-D scale. Nevertheless, a direct association emerged between child-centered parenting at age 14 and psychological well-being in adulthood 28 years later.

Connections between IA-D and well-being at age 42 were found from age 27 onward. The level of identity achievement reached by early adulthood was particularly predictive of social well-being and generativity in early middle age. Identity scores measured at later ages did not add anything to these connections; the links from IA-D at 27 to social well-being and generativity remained the same in all models. When IA-D at age 36 was included, an additional significant link between IA-D at age 36 and psychological well-being was found. The connection was slightly stronger when concurrent identity achievement was considered at age 42. IA-D explained 8% of the variance of psychological well-being. No direct associations existed between either IA-D or the developmental background variables and physical health. Psychological well-being was, however, negatively connected to psychosomatic symptoms, which, in turn, correlated with self-rated health. Significant links also emerged between the indicators of psychosocial well-being.

The results suggested that identity achievement in adulthood was associated with the educational and occupational background of both the parents and the individuals themselves, as school success in early adolescence is known to be connected to later educational and occupational levels. In contrast, the quality of parenting was not related to identity achievement. School success and parent's occupational status were indirectly linked to psychosocial well-being via identity achievement: Identity achievement by age 27 enhanced later well-being in the individual's relations to others whereas identity achievement at age 36 contributed to psychological well-being. The concurrent measure of identity achievement added little to these connections.

Antecedents and Outcomes of Personal Control Over Development

Paths between developmental background and personal control over development to adult well-being were also analyzed with a path model using the Lisrel program (Jöreskog & Sörbom, 1996). The model was based on the matrices of polychoric correlations and built by testing alternative models for best fit (Maximum Likelihood), presupposing the associations between the well-being measures to be like those in Figure 13.2. Multigroup modeling was used to find possible gender differences. Missing data were excluded listwise, and the number of participants in the analysis was 176: 91 women and 85 men. The estimation procedure and evaluation of the model fit was carried out using the same indices as described for Figure 13.1.

To confirm the predictive linkages from personal control over development to well-being, the initial model was structured using only the PCoD measure at age 27: the developmental antecedents at age 14 were set as explanatory variables, and PCoD at age 27 as well as the five well-being measures at age 42 were positioned as dependent variables. In the second phase, the PCoD at age 36 was added; and in the third model the whole time span including PCoD measures at ages 27, 36, and 42 was included. The third model was considered to be the final model (Figure 13.3). The fit indices indicated a close fit of the model to the data; $\chi^2(83) = 100.12$, $p = .097$, RMSEA = .049, GFI = .89 (women), .91 (men), CFI = .96. No significant gender differences were found in the model.

Both child-centered parenting and school success were antecedents of personal control over development at age 27. The PCoD scores measured at later ages were linked to these background variables only indirectly through PCoD at age 27. There were no linkages between the parents' occupational status and the participant's PCoD scores at any age. Neither did the parents' occupational status have any associations with the adult well-being measures. Therefore, the variable was dropped from the model.

In the initial model, PCoD at age 27 directly and significantly explained psychological well-being 15 years later. When the later PCoD scores were added, this association was indirect, passing through PCoD at age 36. The link from PCoD at 36 to psychological

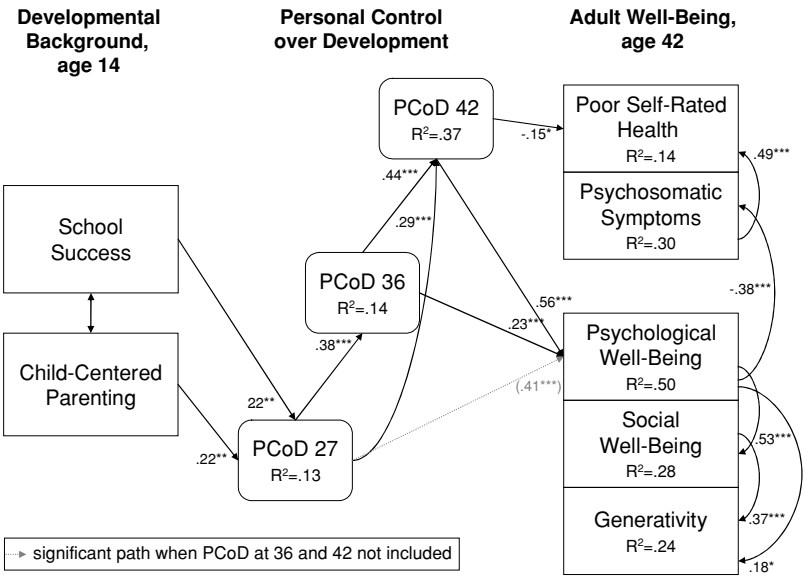

FIGURE 13.3. A path model for developmental antecedents of personal control over development and adult well-being tested across gender.
Note: *p < .05. **p < .01. ***p < .001.

well-being was significant, $\beta = .53$, $p<.001$, when the PCoD measure at age 42 was not yet included in the model. When PCoD at age 42 was included, independent direct links from PCoD at ages 36 and 42 to psychological well-being emerged. PCoD at 42 was also associated with concurrent self-rated health.

In the presented model, personal control over development solely explained 50% of psychological well-being at age 42, which has to be considered a high explanation rate. Psychological well-being was related to all other well-being measures either directly (social well-being, generativity, psychosomatic symptoms) or indirectly (self-rated health, additional link to generativity). Due to intercorrelations between the indicators of well-being, a high sense of personal control over development was associated with overall well-being at age 42.

GROUP COMPARISONS

The variable-oriented approach described above reveals associations on a general level but does not portray individual development.

Therefore, the analyses were supplemented by a person-oriented approach as recommended by Magnusson (e.g., 2001) and Bergman (e.g., 2001). The goal was to compare the antecedents and outcomes of consistent identity diffusion to those of either consistent or increasing achievement.

Identity development is not linear but involves great individual variation. As Adams (Adams, 1999; Berzonsky & Adams, 1999) points out, there are 64 possible patterns for identity development with four status categories and three measurement points for each domain. Therefore, it was not possible to follow the sequences of each developmental pathway separately in the person-oriented analyses. In line with the preceding variable-oriented analyses, we contrasted the participants with consistent diffusion across ages 27, 36, and 42 with their counterparts who either had progressed toward identity achievement or had achieved identity status already at age 27 and maintained it until age 42. Hence, we extracted three distinct identity development groups, each consisting of about 10% of the whole sample.

The Drifters. First, we extracted a group of participants with the most consistent diffuse identity throughout the three measurement points in adulthood. Each had a minimum Diffusion score of 2 out of 5 at each age level, yielding a total Diffusion score from 6 to 12 and a total Achievement score from 0 to 3 (max 15 across three measurements). We named the group "Drifters" based on Josselson's description (1996) of a similar group of women: "Drifters are without commitments and not struggling to make them, either feeling lost or following impulses of the moment." This group comprised 19 participants: 7 women and 12 men.

The Achievers had achieved a more mature identity at age 27 than had most of their peers and remained in the Achievement-category until age 42. These participants had a minimum Achievement score of 2 at each age level, a total Achievement score from 8 to 15, and a total Diffusion score from 0 to 2 (max 15). They had explored and discerned their values and goals in the studied domains during their transition from adolescence to early adulthood, resulting in a well-developed sense of identity. The group included 24 participants, of whom 13 were women and 11 were men.

The Identity Developers were in the achievement status in few domains at age 27 but had progressed toward a largely achieved sense

of identity by the age of 42. Their Achievement score had risen from the level of 0–1 at age 27 to 4–5 at age 42. Hence, this group had clearly progressed on the theoretically hypothesized developmental ladder in their adult years, although not in adolescence as originally expected by the identity theorists. However, unlike the Drifters, their Diffusion scores were low throughout the study. Instead, they had high scores in both Moratorium and Foreclosure at age 27, after which their Achievement score began to rise. This group comprised 19 participants: 9 women and 10 men.

These three groups comprised a total of 62 participants, which was 31.5% of the sample with identity data from all three measurement points. The rest of the participants fell in between these extreme groups – for instance, developing achievement in some domains while staying stable or regressing in others. Their mean in the total Diffusion score was 3.5 (out of 15), and in Moratorium 1.3. Their commitment was frequent: The mean of the total Foreclosure score was 5.5, and 4.6 for Achievement.

Differences between the identity groups in the personal control over development PCoD Scale were studied by one-way ANOVA. Pairwise multiple comparisons were used to test the difference between each pair of means. The grouping effect reached statistical significance only at age 36, $F(2) = 5.43$, $p = .007$, the Drifters scoring lower in PCoD than did the Achievers and Identity Developers.

Differences between the identity groups in the developmental background variables at age 14 were studied by the one-way ANOVA (Table 13.1). Grouping caused significant effects on school success and parents' occupational status. The Drifters were lower than the Achievers both in school success and in their parents' occupational status, and lower than the Identity Developers in the parents' occupational status. The differences between the groups were explicit: 79% of the Drifters, 43% of the Identity Developers, and 29% of the Achievers had parents in blue-collar occupations. None of the Drifters had parents in higher white-collar occupations, whereas 10% of the Identity Developers and 38% of the Achievers came from this group of families. No group differences existed in child-centered parenting, which was consistent with the finding that child-centered parenting was not associated with the IA-D scale.

TABLE 13.1. *Means of Developmental Antecedents at Age 14 and Well-Being Outcomes at Age 42 in Three Distinctive Identity Development Groups; One-Way Analysis of Variance*

	Drifters $N = 19$ **1**	**Identity Developers** $N = 19$ **2**	**Achievers** $N = 24$ **3**	F	P	**Group differences**
School success (GPA)	6.96	7.50	7.65	4.231	.019	3 > 1
Parents' occupational status	1.21	1.68	2.08	8.798	.000	2, 3 > 1
Child-centered parenting	.402	.516	.488	1.165	.319	*n.s.*
Poor self-rated health	2.11	2.11	2.13	0.005	.995	*n.s.*
Psychosomatic symptoms	1.59	1.51	1.49	0.672	.514	*n.s.*
Psychological well-being	2.88	3.19	3.20	7.102	.002	2, 3 > 1
Social well-being	2.53	2.91	3.00	12.427	.000	2, 3 > 1
Generativity	2.91	3.35	3.28	9.942	.000	2, 3 > 1

Group differences also emerged in well-being and health outcomes at age 42 (Table 13.1). The Drifters had poorer psychological and social well-being and lower scores in generativity than did the Identity Developers and the Achievers in all scales. The Achievers did not differ in any of the well-being measures from the Identity Developers. There were no differences between the groups in self-ratings of physical health.

CONCLUSIONS

This chapter addressed (1) the development of identity and personal control over development through adulthood; (2) participants' developmental background in early adolescence; and (3) their associations with adult psychosocial well-being and self-perceptions of health. The study demonstrated relatively strong stability in personal growth in the areas of identity and personal control over development, earlier levels predicting later ones. In identity development, general progression toward identity achievement could also be demonstrated. In addition to the intrinsic predictability of these dimensions, the relative strength of identity achievement at age 36 preceded a strong sense of personal control over development at age 42. Even though women

scored higher than men in identity achievement at age 42, no gender differences emerged in the path model in stability or interrelatedness of these constructs.

Identity development toward achievement was fostered by a high occupational status of parents in the family of origin and by good school success in early adolescence. There were no connections between child-centered parenting and the identity achievement-diffusion scale in adulthood. Similarly, Meeus (personal communication) found in his preliminary overview of several studies that parent-adolescent relations were generally not associated with identity development. Hence, the identity formation process was more influenced by the external social context than by the quality of personal relationships. In a longitudinal perspective, school success can also be seen as a contextual dimension, as good success typically leads to higher education and social status. In a modern society, school success determines the number of options and the type of choices for later life. Education can be seen as a major "investment" individuals make in their identity (Côté & Levine, 2002). The study also demonstrated that the educational level of the parents, evidenced by their occupational status, was also related to the identity status of their offspring. Contrary to this, the parents' occupational status had no significant contribution to the formation of personal control over development and instead was predicted by the quality of parenting and school success. The results suggest that personal control over development was more highly supported by the quality of individual relationships as compared to identity.

Personal control over development and identity achievement-diffusion were both shown to be antecedents of psychological well-being at age 42, and a higher sense of personal control and identity achievement in preceding adulthood promoted more favorable well-being outcomes in middle age at age 42. There was, however, a large difference in the amount of variance of psychological well-being explained: Personal control over development accounted for 50% of well-being, and identity achievement only 8%.

Psychological well-being emerged as a central element in well-being, having strong links to social well-being, generativity, and psychosomatic symptoms, which, in turn, correlated with self-rated health. In addition to the indirect association through psychological

well-being, personal control over development was directly associated with simultaneous self-rated health at age 42. Identity development, instead, anticipated later social well-being and generativity from age 27, well before the age of 42, thus demonstrating how optimal identity development can facilitate an individual's integration in his or her social contexts. Hence, a developmental linkage between the psychosocial stages of identity and generativity (see, e.g., Erikson, 1950; Marcia, 2002) was validated.

An elaboration carried out with smaller extreme identity groups confirmed the findings obtained with a variable-oriented approach. The subgroup with the most consistent identity diffusion, the Drifters, had the lowest school success, and none of them had parents in higher white-collar occupations – a conspicuous contrast to the other groups, the Achievers and the Identity Developers. The Drifters also scored lower than the others in personal control over development at age 36. The Drifters had poorer outcomes than the Identity Developers and Achievers in psychological and social well-being, and in generativity. Hence, it seems that the children who have weak school success and parents with lower educational and occupational status are at risk of staying diffuse in their identity development, which may also influence their later well-being. However, the group of Identity Achievers did not differ in developmental background or adult well-being from the Identity Developer group, demonstrating that early onset of identity achievement was not essential for favorable implications in adulthood.

14

Sense of Coherence and Optimism

A More Positive Approach to Health

Taru Feldt, Anne Mäkikangas, and Kaisa Aunola

INTRODUCTION

The positive psychology movement has taken issue with psychology's exclusive focus on pathology and repairing damage. The three pillars of the research in positive psychology are (a) positive individual traits, (b) positive subjective experiences, and (c) positive institutions and communities (Seligman, 2003). Thus, positive psychology is the study of strengths and virtues rather than weaknesses and suffering. Its focus is on learning how to develop the qualities that allow individuals to flourish.

The three pillars of positive psychology are introduced in this chapter in the context of the Jyväskylä Longitudinal Study of Personality and Social Development (JYLS) data. The positive personality characteristics introduced are a sense of coherence and optimism. Positive subjective experiences in relation to a sense of coherence and optimism include life satisfaction and health, among others. Positive institutions refer to the favorable family and school backgrounds that are thought to be a basis for the successful development of a sense of coherence and optimism.

We begin this chapter by exploring the theoretical definitions of sense of coherence and optimism and introducing results concerning the construct validity of these two personality concepts. Next, we display a theoretical introduction to the development of a sense of coherence and optimism and demonstrate their antecedents from

adolescence to adulthood. Finally, we explore the idea of sense of coherence and optimism as health promoters by displaying their hypothesized channels to health and examining their associations to various health indicators.

SENSE OF COHERENCE AND OPTIMISM – DISTINCT OR IDENTICAL CONSTRUCTS?

The concepts of sense of coherence and optimism are currently very popular in health psychology literature and bear a close resemblance to each other. They are personality dispositions that reflect an individual's positive life beliefs and capacity to respond to stressful situations. In the JYLS study, our purpose was to investigate whether these two concepts are actually distinct constructs or whether they are identical constructs only carrying different names. The JYLS data collected at age 42 was used in resolving this concern.

Sense of Coherence

Sense of coherence, defined originally by Antonovsky (1987), has been posited as a disposition crucial to understanding individual differences in coping with stress. Essentially a tendency toward seeing life as meaningful, comprehensible, and manageable, sense of coherence represents a salutogenic approach to health; the term was coined as the antonym of a pathogenic view of life, which sees life as fearful, disordered, and chaotic. In the spirit of positive psychology, the salutogenic approach seeks to explain health rather than disease and focuses on coping rather than stressors, salutary factors rather than risk factors, and the invulnerable rather than the damaged.

People with a high sense of coherence are said to be protected from stress by their feelings that life events are challenges, occur for a reason, and, even if not under one's personal control, are controlled by some logic. Formally, sense of coherence is defined as "a global orientation that expresses the extent to which one has a pervasive, enduring, though dynamic feeling of confidence that (1) stimuli deriving from one's internal and external environments in the course of living are structured, predictable, and explicable; (2) the resources are available to one to meet the demands posed by these

stimuli; and (3) these demands are challenges, worthy of investment and engagement" (Antonovsky, 1987, p. 19). These three components, termed *sense of comprehensibility*, *manageability*, and *meaningfulness*, are assumed to be highly interrelated. The three components of sense of coherence are included in the Orientation to Life Questionnaire, the instrument that was originally developed to measure sense of coherence (Antonovsky, 1987). The questionnaire exists in two forms; the longer 29-item scale, and the shortened 13-item version derived from the longer version.

The shortened scale was adopted for the JYLS study and participants filled it out during their interview at age 42 ($n = 243$). It measures an individual's dispositional orientation to the past and present but not to the future. The 13-item scale includes five comprehensibility items (e.g., "How often do you have the feeling that you are in an unfamiliar situation and don't know what to do?"), four manageability items (e.g., "How often do you have feelings that you are not sure you can keep under control?"), and four meaningfulness items (e.g., "Do you have the feeling that you don't really care about what goes on around you?"). The respondents were asked to check their level of agreement with the items on a seven-point semantic differential scale with two anchoring phrases (e.g., 1 = *never happened*, 7 = *always happened*). The items were reverse scored so that the higher scores indicated a higher sense of coherence. The reliability (Cronbach's alpha) of the scale in the JYLS data was 0.82.

Optimism

Optimism refers to relatively stable generalized expectancies of positive outcomes (Scheier & Carver, 1985). People with an optimistic life view trust that things will work themselves out, whereas those with pessimistic life expectancies feel that things will end up more or less with a negative outcome. In line with the idea of the expectancy-value model of motivation, people have values of their own that influence the development of personal goals (Carver & Scheier, 2003). In reaching these goals, optimistic people tend to use more adaptive coping strategies, such as active problem solving, whereas pessimistic people more often use maladaptive coping. Optimistic people also make stronger efforts to reach their goals than do pessimists whereas the

pessimistic people are at greater risk of giving up. Thus, optimism affects to a high degree whether individuals pursue or give up on their personal goals as well as how much energy they invest in them.

Optimism is usually measured by the eight-item Life Orientation Test (LOT) (Scheier & Carver, 1985) or by the six-item Life Orientation Test Revised (LOT-R) (Scheier, Carver, & Bridges, 1994). Both forms of the scale refer to present and future life expectancies. In the JYLS study, optimism was measured by the five-item scale at ages 27 ($n = 321$), 36 ($n = 311$), and 42 ($n = 279$) as a part of a mailed Life Situation Questionnaire. The scale includes the following statements referring to the present and future: (1) "I believe that I can influence my development" (1 = *strongly disagree*, 4 = *strongly agree*); (2) "Do you feel that you can affect the changes in your life?" (1 = *not at all*, 4 = *very much*); (3) "I believe things will turn out fine" (1 = *strongly disagree*, 4 = *strongly agree*); (4) "I am able to make my goals come true" (1 = *strongly disagree*, 4 = *strongly agree*); and (5) "Are your expectations of the future, generally speaking . . . ?" (1= *very pessimistic*, 4 = *very optimistic*). The Cronbach's alpha coefficients for the optimism scale were 0.66 at age 27, 0.67 at age 36, and 0.76 at age 42.

A Validation Study

In the JYLS data, the construct validity of sense of coherence and optimism was tested by using the confirmatory factor analysis run by the MPlus statistical package (version 2.13; Muthén & Muthén, 1998–2003). Confirmatory factor analysis is a subset of Structural Equation Modelling (SEM) that is widely used in psychometric research, particularly in validation studies. It is a way of determining whether a sample data set is consistent with a predefined factor structure. Several fit indices are used to assess the plausibility of the theory-driven a priori models, including χ^2-value (nonsignificant values indicate an acceptable model), root mean square error of approximation (RMSEA; values below 0.08 indicate an acceptable model), comparative fit index (CFI; values above 0.90 indicate an acceptable model), and Tucker-Lewis index (TLI; values above 0.90 indicate an acceptable model).

In the first phase of these analyses, the confirmatory factor analysis models (i.e., measurement models) were tested separately for sense

of coherence and optimism at age 42. In constructing the multidimensionality of sense of coherence, a second-order factor model with three first-order factors was specified based on Antonovsky's theoretical considerations and on earlier studies (for a review, see Feldt, Kivimäki, Rantala, & Tolvanen, 2004). In this model, the comprehensibility, manageability, and meaningfulness items were set to their own first-order factors and the high correlations between these factors were explained by a second-order factor. The structure of the five-item optimism scale was investigated by using a one-factor model in which all items were set to the same latent factor.

The results indicated that the second-order factor model with three first-order factors showed a reasonable, although not an outstanding, fit with the JYLS data, $\chi^2(64) = 130.80$, $p < 0.001$, RMSEA = 0.07, CFI = 0.90, TLI = 0.88. After estimating the error covariance between the comprehensibility item 5 ("Has it happened in the past that you were surprised by the behavior of people whom you thought you knew well?" [for item numbers see Figure 14.1 caption]) and manageability item 6 ("Has it happened that people you counted on disappointed you?"), the fit of the model improved, $\chi^2(63) = 103.54$, $p < 0.001$, RMSEA = 0.05, CFI = 0.94, TLI = 0.92. It is notable that this covariance in error terms has also been found in other samples (see Feldt et al., 2004).

The one-factor model for optimism showed an acceptable fit for the data, $\chi^2(5) = 13.46$, $p = 0.02$, RMSEA = 0.08, CFI = 0.97, TLI = 0.93. However, the model revealed high error covariance between items 1 ("I believe that I can influence my development") and 2 ("Do you feel that you can affect the changes in your life?"). These errors were allowed to covary, which substantially improved the model fit, $\chi^2(4) = 3.81$, $p = 0.43$, RMSEA = 0.00, CFI = 1.00, TLI = 1.00.

In the next phase, the confirmatory factor analysis models of sense of coherence and optimism were connected together by use of a structural equation in order to investigate the mutual relationship between the constructs. This model, shown in Figure 14.1, fit the data relatively well, $\chi^2(131) = 215.16$, $p < 0.001$, RMSEA = 0.05, CFI = 0.92, TLI = 0.90.

As shown in Figure 14.1, the results indicated that sense of coherence and optimism were highly associated with each other ($\psi = 0.66$). The items of the scales indeed include high similarities. The manageability component in the sense of coherence scale (i.e., belief that the

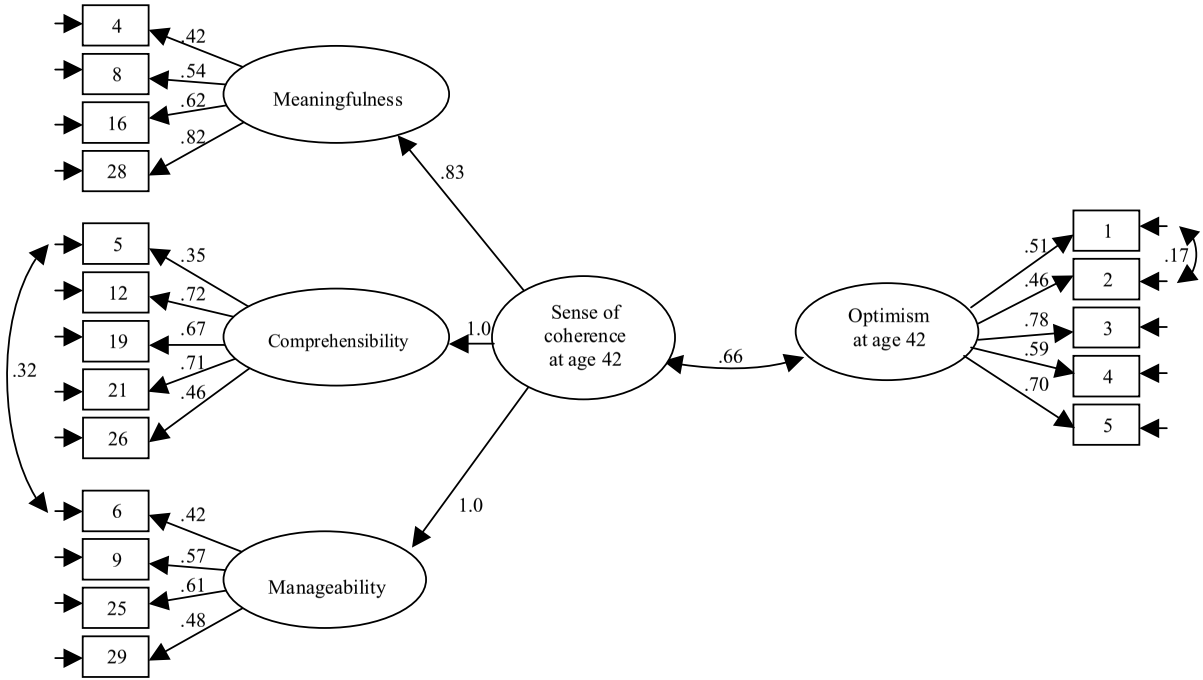

FIGURE 14.1. The factor model of sense of coherence and optimism with standardized parameter estimates, $\chi^2(131) = 215.16$, $p < .001$, RMSEA = .052, CFI = .92, TLI = .90. *Note:* The items of the sense of coherence scale are numbered according to their numbers presented in Antonovsky's (1987) 29-item scale.

resources appropriate for coping successfully with a given stressor are at one's disposal) is conceptually seen in the optimism scale as the "feeling of ability to influence positively one's own life" (see items 1, 2, and 4). In addition, the meaningfulness items in the sense of coherence scale share similarities with the optimistic life beliefs in the optimism scale (see items 3 and 5).

The connection detected between sense of coherence and optimism was not, however, high enough to draw a final conclusion that the concepts could be framed under the rubric of "identical dispositional orientation to life." The good fit of the model, including the measurement models of sense of coherence and optimism (see Figure 14.1), provides a good basis for this conclusion. It is further notable that the model did not produce any cross-loadings between the measurement models of sense of coherence and optimism. In other words, the items of the optimism scale did not load on the sense of coherence factors and vice versa. Fundamentally, the central difference between sense of coherence and optimism exists in regard to the time reference. Sense of coherence is a dispositional orientation that refers to the past and present life (as measured by the 13-item Orientation to Life Questionnaire) whereas our five-item optimism scale refers to the life beliefs related to the present and future. In addition, the aspect of "sense of comprehensibility" (i.e., environmental demands placed on an individual are seen as structured, predictable, and explicable) is emphasized in the 13-item sense of coherence scale whereas this aspect is not included in the optimism scale used in the JYLS study.

DEVELOPMENT OF SENSE OF COHERENCE AND OPTIMISM

Assumptions

Sense of coherence and optimism are considered to be relatively stable dispositions in adulthood. However, the existing literature reports only limited results concerning the stability of sense of coherence and optimism or their antecedent factors. For this reason, we discuss next whether the family (parental socioeconomic status, child-centered parenting) and educational backgrounds (school success, vocational education, career stability) play a role in the level of an adult's sense of coherence and optimism. We also show the JYLS results concerning

the stability of optimism using the data collected at ages 27, 36, and 42. Furthermore, we investigated the extent to which optimism and life satisfaction (both measured at ages 27, 36, and 42), and changes in these factors, would be associated during the study period.

Sense of coherence as a developmental construct is assumed to remain relatively stable throughout life after the formative years, with stabilization occurring at about age 30 (Antonovsky, 1987). Thus, although not a specific personality trait, sense of coherence could thus be regarded as an enduring person- and view-of-life-related characteristic influencing appraisals of meaning ascribed to different situations. Sense of coherence is not, however, assumed to be a rigidly fixed dispositional orientation in adulthood. Some minor modifications in the level of sense of coherence may occur as a result of major life changes. Antonovsky (1987) speculated that unemployment, for example, may cause a considerable weakening in an individual's sense of coherence. However, in later adulthood (after age 30) a person is inclined to return to his or her mean level of sense of coherence, whereas the change may be long-lasting or even permanent among young adults with a less developed sense of coherence.

Previous empirical studies have indeed shown high test-retest stability for sense of coherence in adult people, with stability coefficients ranging from 0.67 to 0.82 (see Feldt et al., 2004). However, the differences hypothesized in the stability of sense of coherence between older (over 30 years) and younger adults (under 30 years) have not been confirmed over a 5-year follow-up period in a sample of Finnish engineers and technical employees: In both age groups, the stability coefficient was exactly the same (0.67; Feldt, Leskinen, Kinnunen, & Ruoppila, 2003).

Antecedents of Sense of Coherence

In the JYLS study, we could not investigate the stability of sense of coherence as it was measured only at age 42. Instead, the results concerning the antecedents of sense of coherence have been reported in a study by Feldt, Kokko, Kinnunen, and Pulkkinen (2005). In their study, data gathered at age 14 (child-centered parenting, school success, parental socioeconomic status), 27 (vocational education), 36 (career stability), and 42 (sense of coherence) were used. The results

based on SEM analysis indicated that child-centered parenting style, which refers to an accepting and emotionally warm parental attitude toward the child combined with inductive guidance and supervision (see Chapter 10), was related directly to an individual's attaining a meaningful, comprehensible, and manageable life orientation in adulthood, that is, a high sense of coherence. The result was in line with Antonovsky's (1987) theory that postulates that experiences of consistency, load balance, and participation in shaping outcomes are central experiences enhancing sense of coherence in childhood and adolescence.

The results further showed that a stable career line (i.e., working stably in one's occupational field) between ages 27 and 36 was related to a high sense of coherence at age 42, whereas an unstable career line (unemployment experiences and frequent changes of jobs) was related to a low sense of coherence. Parental socioeconomic status was not related to sense of coherence at age 42, a finding that can be understood in the cultural context of the present study: Social class differences in Finland, as in other Nordic countries, are rather small compared to many other societies. School success measured by grade point average at age 14 also did not show direct association with adult sense of coherence. All the obtained associations were invariant across gender (Feldt et al., 2005).

Stability of Optimism

Optimism is also assumed to be a stable personality disposition in adulthood (Scheier & Carver, 1985, 1992). The previous studies have shown that over a 1-month follow-up period, the test-retest reliability of optimism measured by the LOT was 0.79 (Scheier & Carver, 1985). To our best knowledge, the only research that has studied the stability of optimism over a longer time period is that done by Mäkikangas, Kinnunen, and Feldt (2004). They found the stability of optimism to be very high (stability coefficient 0.81) over a 1-year follow-up period among 426 Finnish employees with the average age of 45.

In order to examine the stability of optimism in the JYLS data as well as changes in its variance across the three measurement times (ages 27, 36, 42), we carried out a saturated simplex model by using the MPlus statistical package (version 2.13; Muthén & Muthén,

1998–2003). In this model, each of the latent constructs of optimism consisted of one indicator, that is, the observed composite variable of optimism. Our results showed that optimism was very stable across time, particularly from ages 36 to 42. Optimism at age 27 explained 29% of the variance from the optimism at age 36 (standardized estimate = .54, $p < .001$), and optimism at age 36 explained 56% of the variance of optimism at age 42 (standardized estimate = .75, $p < .001$). The results further revealed that the variance of the latent optimism decreased from age 27 (var = .13) to age 36 (var = .10), but increased from ages 36 to 42 (var = .14). In other words, individuals became more homogeneous in regard to optimism from age 27 to 36, but individual differences again increased from age 36 to 42.

Next, we added gender, school success, parental socioeconomic status, and child-centered parenting to the model as covariates. The model construction was started by estimating paths from covariates to optimism at each measurement point. The final model included only statistically significant paths. The results, presented graphically in Figure 14.2, showed that school success at age 14 was associated with optimism at age 27 (standardized estimate = .18, $p < .01$); the better the school success, the higher was the level of optimism at age 27. Furthermore, optimism at age 36 was predicted by school success and child-centered parenting. The higher the level of child-centered parenting (standardized estimate = .16, $p < .05$), and the lower the school success (standardized estimate = −.17, $p < .01$), then the higher was the level of optimism at age 36, after controlling for the level of optimism at age 27. These results suggest that individuals who perceived their parents as child-centered were more likely than others to show an increase in their optimism from age 27 to 36. Similarly, although individuals with high school success at age 14 showed initially higher levels of optimism at age 27 than those with poor school success, they showed less increase in their optimism from age 27 to 36 compared with individuals with low school success. The impact of high school success on optimism at age 36 was mediated through high optimism already at age 27. No impacts of gender or parental socioeconomic status on optimism were found.

Finally, we investigated optimism in relation to life satisfaction that is considered a central pillar of positive psychology. Life satisfaction was measured at ages 27 ($n = 322$), 36 ($n = 311$), and

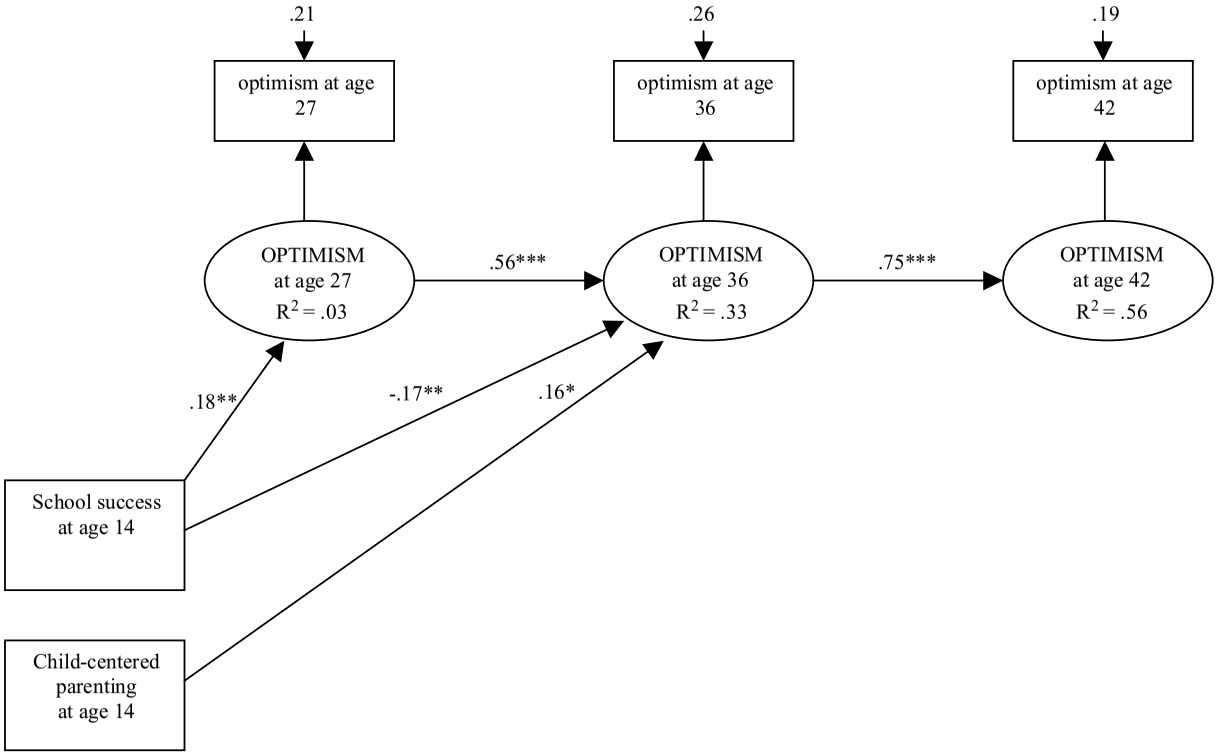

FIGURE 14.2. The stability model of optimism with standardized parameter estimates, $\chi^2(3) = 0.75$, $p = 0.86$, CFI = 1.00, RMSEA = 0.00. *Note:* $^{***} = p < .001$. $^{**} = p < .01$. $^{*} = p < .05$.

42 (n = 279) by a five-item question ["How satisfied are you with your . . . (1) occupational selection, (2) work, (3) leisure, (4) living, and (5) housing"] with a four-point scale (1 = *very unsatisfied* to 4 = *very satisfied*). We used a Latent Growth Curve analysis (LGC) to investigate the extent to which optimism and life satisfaction, and changes in them from age 27 to age 42, would be associated. LGC allows the investigation of interindividual differences in the intraindividual changes in a particular variable of interest over time (i.e., growth trajectories), and also the examination of the predictors of change. This kind of modeling has been a particularly useful method when attempting to describe and explain individual differences in development over time (Duncan, Duncan, Strycker, Li, & Alpert, 1999).

In LGC, the observed variables measured at distinct time points are represented by chronometric common factors representing individual differences over time (Duncan et al., 1999). These common elements are estimated as several growth factors, such as intercept, linear slope, and quadratic slope. The intercept is a constant for any given individual across time; therefore the factor loadings of observed measures are set at one for each wave. Linear slope factor, in turn, describes individual differences in the rate of linear growth (a constant rate of change over all time points). Consequently, factor loadings for linear slope are fixed in ascending order, that is, at the specific values that correspond to a linear time scale (e.g., 0, 1, 2, 3, . . . t). Because in LGC the intercept factor is bound to the time scale of the slope, the centering point (0-loading) affects the interpretation of the intercept. For example, fixing the first loading on the slope factor to 0 determines the intercept as an initial level of the construct. Nonlinear growth can be modeled by adding a quadratic growth component (e.g., 0, 1, 4, . . . t^2) to the model. LGC analyses model both the mean structure (mean level and growth at the sample) and covariance structure (individual variation across the level and growth) in the same analyses.

The LGC analyses were first carried out separately for optimism and life satisfaction. The model testing was started in each case by estimating three growth factors, that is, the initial level, linear growth, and quadratic growth. Because the time points of the measurement points of the JYLS were not equal – that is, there were 9 years between the first and the second measurements and 6 years between the

second and the third – the loadings of the observed variables were set to 0, 1, and 1.5, respectively, on the linear growth factor, and to 0, 1, and 2.25 on quadratic growth factor. The results of the LGC model of optimism at ages 27, 36, and 42 showed that neither the mean nor the variance of the quadratic growth was statistically significant. Consequently, this growth factor was excluded from the final model for optimism. The results for optimism showed that at the mean level, no changes were evident from age 27 to age 42. However, there was significant individual variation in both the level of optimism and the linear rate of growth in it. Thus, there are findable individual trajectories in optimism across time.

Further, the LGM model of life satisfaction was examined. These results suggested that at the mean level, there were no changes in life satisfaction from age 27 to age 36. However, during the later period (from 36 to 42), life satisfaction, on average, increased. The results showed that there was individual variation only in the level of life satisfaction and thus, the changes in it across time were similar for all the investigated JYLS participants. The quadratic trend of life satisfaction obtained at the mean level might have been related to various economic situations in Finland. During the time lag for life satisfaction measurements at ages 27 (year 1987) and 36 (year 1995), Finland was in a deep economic recession (years 1991–1994), a situation that rapidly led to high rates of unemployment, upheaval and changes in work organizations, and overall job insecurity. The consequences of this were seen also among the JYLS participants. In the interview at age 42, 60% of participants reported that the economic recession had had negative impact in their lives (Pulkkinen et al., 2003). Thus, it is reasonable to assume that the increase in life satisfaction from age 36 (year 1995) to 42 (year 2001) can be at least partially explained by the economic recovery in Finland.

In order to investigate the extent to which the developmental dynamics of optimism and life satisfaction were associated, the previous models of optimism and life satisfaction were combined next. These results showed that the levels of optimism and life satisfaction were positively associated: the higher the initial level of optimism, the higher the initial life satisfaction. In addition, the level of life satisfaction predicted the subsequent linear growth of optimism: the higher the level of life satisfaction, the greater the increase in optimism across

three measurements. Because there was no interindividual variation in the linear or quadratic growth of life satisfaction, then optimism, and changes in it, could not impact life satisfaction.

Finally, covariates were included in the previous model to explain the individual variation in the level of life satisfaction and in the level and linear growth of optimism. The final model included only statistically significant paths (Figure 14.3). The results of covariates were similar to those found with simplex models. Thus, child-centered parenting predicted individual variation in the growth of optimism: the higher the perceived child-centered parenting, the greater the increase in optimism during the study period. Second, school success was associated with the level and growth of optimism: the better the school success, the higher the initial status of optimism but the less increase in it, or, conversely, the poorer the school success, the lower the initial level of optimism and the more increase in it.

To summarize, these findings indicate that optimism will become more stable during adulthood. Our previous study showed that optimism was highly stable in middle life (Mäkikangas et al., 2004), and current results confirm this finding by showing that stability from age 36 to age 42 was high. Although optimism is fairly stable, events in life may affect it. An interesting finding was that optimism is affected by life satisfaction. Thus, the satisfaction with all-important areas of life, that is, occupational selection, work, leisure and living, and housing, increases optimism across the life span.

The results further suggested that school success and child-centered parenting are associated with changes in optimism from age 27 to age 36. The effects of child-centered parenting were particularly interesting. Warm and caring relationships with parents at age 14 did not affect the level of optimism in early adulthood, but they were the driving force behind the development of optimism in later adulthood. It is notable that this finding is in line with the study by Feldt et al. (2005), which indicated that child-centered parenting promotes a sense of coherence at age 42. In addition, school success in adolescence was related to level of optimism at age 27, but in later life optimism increased more among those with lower levels of school success. Thus, school success is a significant factor in optimism, but across the life span other factors in life will become more important. This finding is also in line with the study by Feldt et al. (2005)

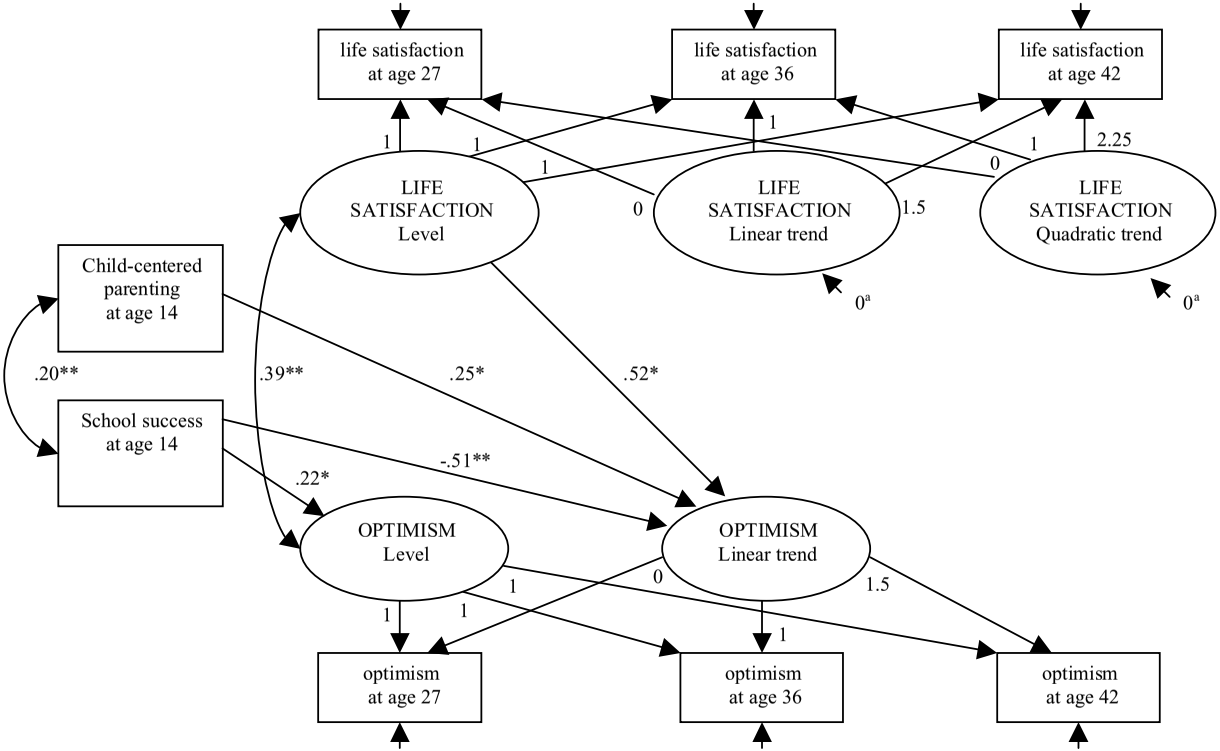

FIGURE 14.3. Latent growth curve model for optimism and life satisfaction with standardized parameter estimates, χ^2 (16) = 21.10, p = 0.05, RMSEA = 0.04, CFI = 0.97, TLI = 0.95. *Note:* [a] = fixed. * = $p < .05$. ** = $p < .01$. *** = $p < .001$.

concerning sense of coherence: School success was not directly related to a sense of coherence at age 42.

SENSE OF COHERENCE AND OPTIMISM AS HEALTH PROMOTERS

The concepts of sense of coherence and optimism have their roots in health psychology. The central hypothesis concerning these concepts is that people scoring high in sense of coherence and optimism tend to enjoy greater health than those scoring low in these personality dispositions (Antonovsky, 1987; Scheier & Carver, 1992). The common idea is that sense of coherence and optimism promote an individual's health through three different channels: (1) physiological link, (2) health behavior, and (3) cognitive appraisal process. Following the hypotheses of these health channels, we examined the health associations of sense of coherence and optimism among JYLS participants at age 42.

Physiological Link

According to Antonovsky (1987), a sense of coherence may have direct physiological health-maintaining consequences in such a way that the perception of the world of stimuli as comprehensible, manageable, and meaningful activates the brain to send messages to other bodily systems that maintain homeostasis. As such, coherent appraisals of environmental demands stimulate an individual's physiological stress reactions less than incoherent life views (e.g., environmental demands are viewed as threats rather than welcome challenges) that increase stress reactions. This hypothesis has been tested in only a few studies, and the results have not supported the association between the level of sense of coherence and stress-related physiological health indicators (e.g., blood pressure; for a review, see Feldt, 2000).

Unlike the sense of coherence theory, the optimism literature does not distinguish in detail the physiological link between optimism and health. There are, however, some empirical findings that show optimistic people report fewer physical symptoms than pessimistic people (Scheier & Carver, 1985, 1992). The research carried out thus

far has focused on self-reported physical health and, therefore, it is unknown whether optimistic people have better health as measured by objective physical health indicators.

The physiological link was studied in the JYLS study utilizing the data from the medical examination at age 42. However, the levels of subjects' sense of coherence and optimism were not related to the risk of metabolic syndrome at age 42 ($r = -.01$, $r = .01$) when the increasing risk of metabolic syndrome was measured by a composite variable comprising high-density lipoprotein, triglycerides, systolic and diastolic blood pressure, plasma glucose, and waist circumference (see Ford, Giles, & Dietz, 2002). The associations were not found with the specific indicators of metabolic syndrome, either.

Health Behaviors

A sense of coherence and optimism are assumed to be related to health behaviors. Antonovsky (1987) argued, for example, that a high-sense-of-coherence person is more likely to avoid delay in seeking treatment, to comply with professional guidance, to seek information relevant to health, and to reject maladaptive behaviors. However, the empirical research concerning the association of sense of coherence and health behavior is still scarce. This concerns also the optimism literature. People with an optimistic orientation are associated with healthy behavioral practices such as eating healthier food and exercising to a greater degree than people with a pessimistic life orientation (see Scheier, Carver, & Bridges, 2001). However, these results have mainly been found among rehabilitation patients. Thus, knowledge about the influence of optimism on health behavior in community-based samples is still sparse.

In the JYLS study, a sense of coherence was found to be more strongly associated with health behaviors than optimism at age 42. For example, participants with a high sense of coherence used less alcohol and were at lower risk for alcoholism than participants with a low sense of coherence as indicated by the alcohol consumption per year ($r = -.16$, $p < .05$) and the alcoholism screening tests CAGE ($r = -.31$, $p < .001$) and MmMAST (Malmö Modification of Minnesota Alcoholism Screening Test; $r = -.23$, $p < .001$). Optimism correlated only with the CAGE score ($r = -.19$, $p < .01$).

The same trend was seen in the case of smoking: A high sense of coherence correlated negatively with smoking ($r = -.18$, $p < .01$), but the corresponding correlation with optimism turned out to be nonsignificant ($r = -.09$, ns.).

Cognitive Appraisal Process

A sense of coherence and optimism refer to personality dispositions that enhance health through their role in generating more positive appraisals of demands. According to Antonovsky (1987), this is the most important channel linking a sense of coherence and health. Following a slight modification of Lazarus's (1966) work, Antonovsky (1987) discussed the coping process in four stages. If in the first stage of appraisal a stimulus has been defined as a stressor, the person with a high sense of coherence is more likely in the second stage of appraisal to define the stressor as benign or even as a welcome challenge. This arouses salutary emotions, such as confidence that the demand will be handled well. The third stage of appraisal relates to the definition of the problem. The person with a high sense of coherence is cognitively and emotionally capable of ordering the nature of the problem and being willing to confront it. The fourth stage is reappraisal. In this stage, a high-sense-of-coherence person is open to feedback and corrective action.

Similar to sense of coherence, optimism's relationship with health has been explored mainly in terms of coping. Scheier and Carver (1985) argued that optimism might work as a sustainer in the coping process. As such, optimistic people aspire persistently to attain their goals and use more adaptive coping strategies (i.e., active problem solving) than pessimistic people. It is notable that in discussing coping, Scheier and Carver (1985) referred to the work of Antonovsky and emphasized the similarities of optimism and a sense of coherence in the coping process.

In the JYLS data, a sense of coherence and optimism were associated with several self-reported health and well-being indicators. Both concepts correlated negatively with depression and psychosomatic symptoms, and positively with psychological well-being and life satisfaction. An interesting finding was that a sense of coherence correlated more strongly than optimism with mental ill-health.

For example, a high sense of coherence seemed to have a stronger negative correlation with Depue's (1987) depression scale ($r = -.64$, $p < .001$) than optimism ($r = -.40$ $p < .001$). A high sense of coherence was also associated more strongly with low scores on Aro's (1988) psychosomatic symptoms checklist ($r = -.55$, $p = < .001$) than optimism ($r = -.40$, $p < .001$). However, the associations of sense of coherence and optimism with psychological well-being as measured by Ryff's (1989) scale were approximately the same (sense of coherence, $r = .46$, $p< .001$; optimism $r = .47$, $p < .001$). Optimism, in turn, was more highly associated with life satisfaction ($r = .54$, $p < .001$) than a sense of coherence ($r = .41$, $p < .001$).

Taken as a whole, a sense of coherence and optimism seemed to be associated strongly with self-rated health, whereas associations with the objective health measures were not evident among the JYLS participants at age 42. Sense of coherence seemed to be a personality disposition related to health behaviors whereas only minor associations were found in the case of optimism. One explanation for this could be that a high level of optimism works as a protective factor in high-risk situations. Thus, serious health threats or the emergence of health problems might cause a condition in which the beneficial effects of optimism reassert themselves. It has been shown, for example, that the treatment of alcoholism is more effective among optimistic people (see Scheier & Carver, 1992; Scheier, Carver, & Bridges, 2001). Overall, optimistic people are interested in their health (Scheier et al., 2001), but it might be that as long as drinking or smoking is not seriously threatening one's health or causing symptoms, optimism does not mitigate these behaviors.

CONCLUSIONS

This chapter discussed the concepts of sense of coherence and optimism, in particular the construct validity of these concepts, their development in adulthood (stability and antecedents), and their associations with health utilizing the JYLS data. The following conclusions can be made on the basis of our results:

1. Sense of coherence and optimism are highly interrelated but not identical constructs.

2. Child-centered parenting was related to high levels of sense of coherence and optimism in adulthood. Parental socioeconomic status, in turn, did not show a direct association with level of sense of coherence and optimism. Optimism stabilized between ages 36 and 42. A high level of life satisfaction was found to be related to the increase in optimism during ages 27, 36, and 42.
3. Sense of coherence was linked more strongly than optimism to health behaviors. Both constructs showed strong associations with self-reported health and well-being indicators, whereas no associations were found with the objective health indicators.

15

Unemployment and Psychological Distress, and Education as a Resource Factor for Employment

Katja Kokko

INTRODUCTION

Establishing a stable position in the work domain is one of the most important developmental tasks of adulthood (Havighurst, 1982; Levinson, Darrow, Klein, Levinson, & McKee, 1978; Levinson, 1996). Unsuccessful resolutions of this task, such as experiences of unemployment, have been linked to several indicators of low psychological, social, and physical functioning. In the area of psychology, the main interest has been in the identified link between unemployment and psychological distress.

In this chapter, two different hypotheses for this observed link between unemployment and distress are discussed: (a) social causation and (b) individual drift. *Social causation* means that unemployment is an agent that causes an increased level of psychological symptoms; *individual drift* implies that prior psychological problems make some individuals vulnerable to subsequent difficulties in the labor market. Findings based on the Jyväskylä Longitudinal Study of Personality and Social Development (JYLS) pertaining to these two hypotheses are also presented. Furthermore, this chapter investigates the early roots of later long-term unemployment and the mechanisms operating between child behavior and later difficulties in the labor market.

Because a lack of further education after comprehensive schooling increases the risk of unemployment, a part of the investigation

reported here concerns whether an educational degree obtained at a later age (from a vocational school, a vocational college, or a university) buffers against further bouts of unemployment. Additionally, the types of individuals who acquire an educational degree at a later age ("off-time") are examined: They are compared in their adult life domains and early background to those who earned their degree "on-time" and to those who never obtained an educational degree – at least, not by the time of the study.

From both an individual and societal viewpoint, it is important to understand career and educational routes in a life-span perspective rooted in childhood. The life-span aspect is only possible when the same participants have been studied before they have had any experiences in the labor market, as is the case in the JYLS.

UNEMPLOYMENT AND PSYCHOLOGICAL DISTRESS

Selection or Causation?

The link between unemployment and psychological distress, such as feelings of depression and anxiety, has been examined since the 1930s (Kokko, 2001). Early studies by Jahoda, Lazarsfeld, and Zeisl (1933/1972) and Bakke (1933) as well as more recent studies (e.g., Hanisch, 1999) have confirmed that unemployment and psychological distress are related: The unemployed, especially the long-term unemployed, report an increased level of psychological symptoms compared to their employed counterparts. This is especially true if the unemployment lasts for a long period of time and results in financial difficulties as well as lowered self-esteem, as shown by the mediator analysis of these links (Kokko & Pulkkinen, 1998). Traditionally, it has been assumed that unemployment is an agent causing these symptoms. However, the direction of the causality quite recently has been challenged. In other words, instead of seeing unemployment as causing distress, researchers have speculated about the possibility that prior psychological symptoms might increase the probability of a person's becoming unemployed (e.g., Rutter, 1994).

These two hypotheses of the relational direction between unemployment and psychological distress are known as the "exposure"

or "social causation" hypothesis (i.e., unemployment causes distress) and the "selection" or "drift" hypothesis (i.e., prior distress predisposes one to unemployment) (Winefield, 1995). A minimum criterion for studying the validity of these two hypotheses is that the data be longitudinal. Mortimer (1994) has classified earlier studies investigating these assumptions into the following three categories: (1) studies that have explained *school-leavers'* later workforce status on the basis of their mental health; (2) studies that have observed potential alterations in originally *employed adults'* well-being following job loss; and (3) studies that have focused on the ability of initially *unemployed adults* to become re-employed or, on the other hand, on factors that explain the continuation of unemployment.

Despite a large number of studies in these three categories, particularly in youth unemployment, researchers still do not completely understand which of the two explanations, causation or drift, is more promising in explaining the reliably observed relation between unemployment and psychological distress. Some of the studies, based on both school-leavers (i.e., students still at secondary school) (Mortimer, 1994) and adult samples, support the causation hypothesis, whereas others support the individual drift hypothesis; still, some of the studies confirm both hypotheses of the relation between unemployment and psychological symptoms (e.g., Winefield, 1995). There is a tendency to argue that so far social causation rather than individual drift seems to be a more prominent explanation for the relation between unemployment and psychological distress (Fryer & Winefield, 1998). That is to say, it is more likely that unemployment leads to an elevated level of psychological distress than that distress prior to unemployment leads to job loss.

However, the existing studies share one major shortcoming: Primarily, they have begun too late, that is, with school-leaver or older samples. There are at least two problems with school-leaver samples: First, even school-leavers may have some idea of their abilities as workers – knowledge acquired from previous experiences in the labor market, for example, from summer jobs (Mortimer, 1994). These experiences may have already affected their psychological well-being and self-esteem. In that case, it is difficult to draw any conclusions of the drift versus causation hypotheses; more reliable conclusions can be achieved by examining the future workers much earlier, before

they have had any experiences in the labor market. Second, school-leaver (also called graduate) samples may underrepresent, as a consequence of school dropout, those youngsters who are at greatest risk for unemployment. School dropouts seem to have a high risk of later unemployment (Caspi, Wright, Moffitt, & Silva, 1998). Early investigation would also make it more unlikely that the sample is biased. In the JYLS, we have studied the individual drift hypothesis on the basis of middle childhood behavior. Furthermore, the causation hypothesis has been tested by controlling for any selection effects into unemployment.

Early Antecedents of Later Unemployment and Its Consequences

In the JYLS, we have studied whether psychological distress in middle childhood makes some individuals vulnerable to later instability in the domain of work. By child distress I refer to problems in emotional and behavioral self-regulation, as defined in the framework of the model of emotional and behavioral regulation (Pulkkinen, 1995). Using a correspondence analysis based on the teacher-rated items for child social behavior at age 8 in the JYLS, we empirically obtained these two dimensions of the model: emotional and behavioral regulation (Kokko, Pulkkinen, & Puustinen, 2000). Of these two dimensions (called "factors" hereafter), a factor titled low self-control of emotions and indexed by physical aggression and emotional lability was associated with long-term unemployment by age 36 (Kokko et al., 2000). Long-term unemployment means unemployment that has lasted for more than 2 years in total between ages 27 to 36. Employment and shorter periods of unemployment were not explained by early low self-control of emotions. Whereas a factor for low self-control of emotions was directly linked to later long-term unemployment, a factor titled behavioral inhibition and indexed by socially passive and anxious behaviors had only weak and indirect links (through low educational attainments) to subsequent problems in the domain of work. These analyses were conducted using a path analysis method (Kokko et al., 2000).

The role of early externalizing problem behavior, such as difficult temperament, aggression, and conduct problems, in selection

into long-term unemployment has also been confirmed in those few previous studies that had begun early enough to investigate participants' individual characteristics *before* any labor market experiences: These studies were conducted in New Zealand (Caspi et al., 1998; Fergusson, Horwood, & Lynskey, 1997). These New Zealand longitudinal studies are based on younger adults than those in the JYLS and, consequently, it is yet to be seen whether unemployment will have harmful effects on their psychological well-being at a later age, after controlling for the early selection effects. Our JYLS findings, based on the path analysis, showed that even after taking into account the higher level of child low self-control of emotions among the long-term unemployed compared to the others, long duration of unemployment further increased psychological symptoms, such as depression and anxiety (Kokko et al., 2000). On the basis of our JYLS findings, we might conclude that both individual drift and social causation operate between unemployment, in particular long-term unemployment, and psychological distress.

Risk Mechanisms Between Early Problem Behavior and Later Long-Term Unemployment

The finding that early externalizing behavior is linked to later long-term unemployment does not indicate anything about the mechanisms behind this association. Caspi and his colleagues (1998) have stressed the importance of gaining an understanding of the processes by which early individual characteristics explain later labor-market outcomes. In the JYLS, we expected to find accumulated problems, particularly related to academic achievement, between early problem behavior and later long-term unemployment.

We used the structural equation model (SEM), consisting of both a measurement model and a path analysis, to analyze the mechanisms through which early aggressive behavior became a risk factor for later serious problems in the domain of work. Our findings showed that child aggression was a link in the cycle of accumulated problems, referred to as a cycle of maladaptation (Kokko & Pulkkinen, 2000). By this cycle we mean that aggression (i.e., hurting another child, kicking objects, attacking, and teasing) at age 8 was related to school maladjustment (i.e., poor school success and motivation,

punishments, and truancy) at age 14, which was further associated with long-term unemployment between ages 27 and 36. In addition to a direct link, adolescent school maladjustment also had indirect links: It preceded both alcohol abuse and lack of occupational alternatives at age 27, which were, in their parts, risk factors for long-term unemployment. This cycle of maladaptation explained 25% of the variance of the long-term unemployment (Kokko & Pulkkinen, 2000).

The explained variance, one-quarter, is high considering that only individual characteristics and academic achievement were included and that a long time span was covered in the JYLS, yet it still implies that not all aggressive children (classified using the 75th percentile as a cut-off point) later experienced long periods of unemployment. To understand how to help aggressive children against later maladjustment, researchers need to obtain information about the protective factors that buffer them against the cycle of maladaptation. We investigated these factors in both the individual and his or her family and found that prosocial behavior (i.e., constructive behavior, high self-control of emotions, good coping capacity, prosocial strategies, and coping with social expectations) at age 8 and child-centered parenting (good parental relationship, good relationship with the father, maternal support, maternal supervision, and lack of physical punishment) at age 14 significantly buffered aggressive children against subsequent long-term unemployment (Kokko & Pulkkinen, 2000).

The probability (estimated using a logistic regression analysis) of becoming a long-term unemployed adult was about 1% among the aggressive children if both prosociality and child-centered parenting were one standard deviation above the values obtained for the average aggressive child; the probability was about 45% if these values were one standard deviation below those of average aggressive children (Kokko & Pulkkinen, 2000). In addition to these protective effects, prosocial abilities and child-centered parenting had significant main effects on long-term unemployment, that is, they were negatively linked to it in the whole JYLS sample studied. Although the average level of prosociality was lower in the aggressive than in other children, its reinforcement, by parents and other significant figures, seems to make an important difference for the later adjustment of the children with aggressive outbursts.

Age of the Unemployed

Few findings on selection into long-term unemployment on the basis of early individual characteristics have focused on unemployment measured in the participants' early 20s (New Zealand studies) or mid-30s (JYLS). From a life-span perspective, it is interesting to wonder whether unemployment experienced by individuals during their 20s, recently referred to as "emergent adulthood" (Arnett, 2000), can also be explained by early behavior. To study this question, we tried to replicate our previous JYLS analysis of selection into long-term unemployment by age 36 on the basis of early social behavior, using long-term unemployment measured at age 27 (referring to unemployment that has lasted for a year or more in total by age 27). We found that long-term unemployment by age 27 was not preceded by social behavior such as aggression and emotional lability at age 8 but was rather explained by low education obtained by age 27 (Kokko, Bergman, & Pulkkinen, 2003). It was low education that was explained by behavioral problems, such as both low self-control of emotions and behavioral inhibition in childhood. This finding was confirmed by the JYLS sample and a sample drawn from a comparable Swedish Individual Development and Adaptation (IDA) longitudinal study (Magnusson & Bergman, 2000).

An obvious explanation for the difference in the unemployment findings at ages 27 and 36 is that at age 27 we studied selection into educational routes rather than selection into unemployment (Kokko et al., 2003). This interpretation is supported by Arnett's (2000) notion of emergent adulthood, which refers to a distinct life phase between adolescence and young adulthood and which characterizes recent 18- to 25-year-old individuals in industrialized societies. Identity exploration and many demographic changes are often experienced in this phase of life, and it is typical that emergent adults have not yet settled down either to work or to family life. The 26–27-year-old JYLS and IDA participants had just passed these years and it is possible that this specific period of life affected our findings, compared to age 36, when the participants were more settled.

Another explanation might be related to the social context of the 27- and 36-year-old JYLS participants (Kokko et al., 2003). In 1986 when the participants were 27 years old, the unemployment rate in Finland

was about 5%, whereas in 1995 when the participants were 36 years old, the respective figure was about 20%. These national figures correspond to those of the JYLS participants. The rise in the unemployment rate in the early 1990s was due to a sudden economic recession in Finland. As a consequence, many individuals who had no previous experiences of unemployment lost their jobs (and, as a result of this, experienced other economic hardships, e.g., a bankruptcy) during the recession. However, most of these individuals had only short periods of unemployment and were re-employed without major problems. For those whose individual characteristics were more unfavorable and who had fewer personal resources, high unemployment and high competition for the few available jobs were more detrimental. Caspi and Moffitt (1991) have claimed that differences in personality characteristics are even accentuated during periods of social change. Regarding the unemployment rate in Finland, in 2001 when the JYLS participants were 42 years old, it had dropped to about 10%.

Continuity in Unemployment and Unemployment's Links to Distress in Adulthood

Considering that a long duration of unemployment (studied after the formal education has been passed) is, in some cases, an indicator of accumulated problems over the life course, it is reasonable to expect it to show continuity from one developmental phase to another one. Short-term unemployment is not preceded by child individual characteristics (Kokko et al., 2000) and can be assumed to be explained by external factors, such as occupational field and fluctuations in the national economy. The unemployment rate varied in Finland and in the JYLS sample during the study points (i.e., at ages 27, 36, and 42) and made it possible for researchers to examine whether long-term unemployment has continuity, assessed before, during, and after the economic recession in 1995 (when participants were age 36).

I studied the continuity of long-term unemployment in three ways: First, the total durations of unemployment experienced by participants at age 27, between ages 27 and 36, and between ages 37 and 42 were calculated and the participants were classified into categories for not long-term unemployed and long-term unemployed (one year or more in total by age 27 and more than 2 years in

total for the remaining two time periods). Table 15.1 shows that for both women and men, there was continuity in the long-term unemployment defined as the total duration of unemployment: Of those women who had experienced long-term unemployment by age 27, 33.3% were long-term unemployed also between ages 27 and 36; a corresponding figure was 4.8% for the not-long-term-unemployed women. The respective figures for men were 27.3% and 7.6%. Of the women who had been long-term unemployed between ages 27 and 36, 33.3% experienced long-term unemployment also between ages 37 and 42 (5.9% of the not-long-term-unemployed). In men, the figures were 38.5% and 4.3%, respectively. Of those women who had been long-term unemployed by age 27, 66.7% experienced long-term unemployment also between ages 37 and 42 (4.2% of the not-long-term-unemployed). The respective figure for men was 42.9% (3.4%). On the basis of these results, it appears that the high national unemployment rate when participants were 36 did not much affect their long-term unemployment: The long-term unemployed at age 36 had had problems in the labor market already at an earlier age; furthermore, they continued to have difficulties after 1995. The continuity of long-term unemployment was particularly prominent from young adulthood to middle age.

Second, the analysis of participants' employment situation at the time of data collection at ages 36 and 42 revealed continuity also in the current long-term unemployment (Table 15.1): For both women and men, 33.3% of the age 36 long-term unemployed participants were long-term unemployed also at age 42; 50% of the long-term unemployed women and 33.3% of the long-term unemployed men were employed; and the rest were short-term unemployed. In comparison, 98.1% of the age 36 employed women and 95.9% of the employed men were also employed at age 42. From short-term unemployment to employment, the respective figures were 86.7% and 66.7%.

Third, the high continuity in long-term unemployment at ages 27 (referring to unemployment experienced by age 27), 36 (between ages 27 and 36), and 42 (between ages 37 and 42) was also confirmed using a group-based semiparametric mixture modeling method (Nagin, 1999, 2005). Using this type of trajectory analysis, it is possible, according to Nagin, to (1) identify distinct subgroups (trajectories) of the characteristic in question among the study population; (2) estimate

TABLE 15.1. *Cross-Tabulation of Long-Term Unemployment Experienced at Different Ages.*

	Women			Men		
	Total duration			Total duration		
Age	Age 27–36	Age 37–42	χ^2	Age 27–36	Age 37–42	χ^2
By age 27	33.3%	66.7%	8.35* (by 27 to 27–36) 33.36*** (by 27 to 37–42)	27.3%	42.9%	8.00* (by 27 to 27–36) 27.58*** (by 27 to 37–42)
Age 27–36		33.3%	6.44[a](37–42)		38.5%	19.26**
		Current situation Age 42			**Current situation** Age 42	
Age 36		33.3%	23.38***		33.3%	31.59***

Note: [a]$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

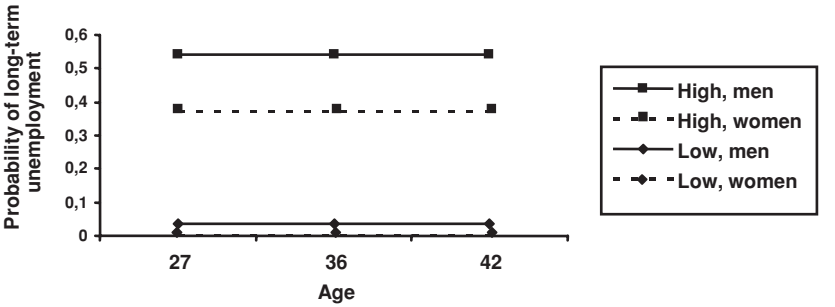

FIGURE 15.1. Trajectories of long-term unemployment at ages 27, 36, and 42 for women and men.

the proportion of the study population following each trajectory; and (3) assign individuals to the trajectory group where they most likely belong. Furthermore, (4) two sets of trajectories can be jointly estimated; (5) predictors of the probabilities of belonging to each trajectory can be investigated; and (6) covariates changing the trajectory shape can be included. In this chapter, the first three options were applied.

Because long-term unemployment was coded into a binary variable, where 0 = *not-long-term unemployed* and 1 = *long-term unemployment*, a logit model was used to estimate the trajectories for long-term unemployment. As suggested by Nagin (1999, 2005), determination of the optimal number of groups and trajectory shapes was made on the basis of the Bayesian information criterion (BIC) index: The model with the maximized BIC was selected. As a general rule, the mean probabilities of the group assignments should be higher than .80 (Nagin, 2005). Different subgroups (trajectories) can have different shapes: cubic, quadratic, linear, or flat.

For both women and men, two trajectories of long-term unemployment from age 27 to 42 with flat shapes best fit the data (Figure 15.1). These trajectories were low and high, and were estimated to include, respectively, 85.2% and 14.8% of the women, and 86.2% and 13.8% of the men. The female mean group assignment for the low trajectory was .95 and for the high trajectory .99 – indicating an excellent model fit to the data. The respective figures for men were .95 and .76, also satisfactory. As shown in Figure 15.1, in both women and men the probability of being long-term unemployed remained close to zero

from age 27 to 42 in the low trajectory. Furthermore, in both genders the probability of being long-term unemployed remained much higher, around 50% in men and 40% in women, in the age period covered.

The analysis of the causal relations between psychological distress and unemployment, both assessed in adulthood, showed that the change from unemployment at age 36 to employment and unemployment statuses at age 42 was linked to level of distress (Kokko & Pulkkinen, 2002). Participants, in particular men, who remained unemployed from age 36 to age 42, had a higher level of depression at age 36 than those who became re-employed. The level of depression further increased from age 36 to age 42 among those who continued to be long-term unemployed, whereas the level of depression did not increase (but neither decreased) among those who were able to re-employ themselves.

UNEMPLOYMENT AND EDUCATIONAL ATTAINMENT

The Educational System in Finland and the Link of Education to Unemployment

Both low educational attainment and alcohol abuse, in addition to early behavioral problems, play important roles in selection into long-term unemployment. In this subsection of the chapter a closer look is taken at the associations between education and long-term unemployment. Special attention is paid to both the *completion* of the educational degree and the *timing* of obtaining this degree. The Finnish educational system in the participants' youth is described below.

In Finland children begin comprehensive school in the year they are 7 years old. It lasts for 9 years, from grade one to grade nine (up to age 16). Thereafter, most adolescents continue in the upper secondary school for 3 years, which qualifies them for university entrance. About one-fifth of the Finnish age cohort enters university, aiming at an M.A. degree in 5 to 6 years. Due to the university entrance exam system, young Finnish women and men commonly spend gap years between school and university. Finnish men are required (nowadays women can choose) to perform a military or community service for about a year between ages 18 and 30. Thus,

Finns are usually about 25–26 years old when they graduate from the university. Most of those higher secondary school students who do not enter the university engage in some type of tertiary education (vocational college, e.g., nursing college), lasting for 2 to 4 years. Compared to the university graduates, they enter the labor market at an earlier age. The youngest entering the labor market are, however, those who do not continue their studies after the 9-year compulsory school or who choose to attend a 2- to 3-year vocational school (e.g., for car mechanics) after the comprehensive school. In the Finnish comprehensive school system, dropouts are rare compared to, for example, the dropout rate in the United States (e.g., Cairns, Cairns, & Neckerman, 1989) and New Zealand (e.g., Caspi et al., 1998). Nowadays about 0.3% of Finnish children do not earn a diploma from the comprehensive school, according to statistics by the Finnish Ministry of Education (http://www.minedu.fi/minedu/education/education_system.html).

In the Finnish culture, it is harmful in terms of a person's later career line if he or she has a low level of occupational education (e.g., Kokko et al., 2000). There are many government-funded programs for adult education with the aim of improving the employability of the unemployed. In this study, the links between unemployment and education were studied using three educational categories: (1) no degree (11.5% of the women and 25.1% of the men); (2) "on-time" degree (75.2% and 69.8%, respectively); and (3) "off-time" degree (13.4% and 5.0%, respectively). A *degree* refers here to graduation from a vocational school, vocational college, or university. There were some gender differences in the distribution, $\chi^2(2) = 15.20, p < .01$: Men were overrepresented in the no degree category (*adjusted standardized residual, ASR* = 3.2) and women in the off-time category (*ASR* = 2.7). On-time and off-time degrees refer to the age 27, by which time Finnish young adults have usually obtained their university or other type of tertiary or vocational educational degrees. If a person had started an educational program but never obtained a degree, he or she was classified in the category of no degree. Furthermore, if someone had obtained both an on-time and off-time degree, he or she was classified according to the first degree, that is, the on-time degree.

The three categories for education were compared to each other regarding long-term unemployment experienced by age 27, between

ages 27 and 36, and between ages 37 and 42, separately for women and men. Cross-tabulation with a χ^2 statistic was used for the comparison, and ASRs were used for the analysis of so-called types and antitypes. The latter type of analysis is based on the difference between expected and observed frequencies: A value greater than 1.96 indicates that in the cell in question there are more individuals than expected by chance (type), whereas a value lower than −1.96 indicates that there are fewer individuals than expected (antitype).

The results showed that education and long-term unemployment were not associated with each other in women, except for a trend observed at age 42, $\chi^2(2) = 5.14$, $p < .10$. At that age, long-term unemployment was linked to having no degree ($ASR = 2.0$). However, in men a statistically significant relationship was obtained at age 27, $\chi^2(2) = 7.71$, $p < .05$, and a trend was observed at age 36, $\chi^2(2) = 4.98$, $p < .10$. At both ages, no educational degree was related to experiencing long periods of unemployment ($ASRs = 2.5$ and 2.1, respectively), whereas an on-time degree was related to no experiences of long-term unemployment ($ASRs = 2.8$ and 2.1, respectively). In men, the on-time degree did not just protect against long-term unemployment; rather it was associated with having *no* experiences of unemployment at the ages in question.

These results indicated that the on-time degree was a resource factor for male employment, whereas the no degree was associated with a higher risk of male long-term unemployment at ages 27 and 36. In women, educational achievements and unemployment were generally not related to each other; that is, later education was not preceded by experiences of long-term unemployment nor does it link to later employment experiences (neither employment nor long-term unemployment).

Adult Correlates of Educational Attainment

Work-Related Correlates of Education

In order to obtain a broad picture of the adult functioning of the individuals who had followed different educational routes, variables were selected from different aspects of adult functioning, such as employment, alcohol use, and family life. The educational categories (no degree, on-time degree, or off-time degree) contained information

about obtaining an educational degree and about its timing – but not about the *level* of education. The comparisons of the respective categories in the level of basic education revealed that it was typical, $\chi^2(2) = 12.99$, $p < .01$; $ASR = 2.3$, that the no-degree women had completed only the comprehensive school (9 years) or had not completed that ($ASR = 3.1$), whereas those women who had obtained their educational degrees on time had typically completed upper secondary school (12 years; $ASR = 3.4$). In men, there were no differences in basic education.

There were no statistically significant differences in the level of occupational education among the on-time and off-time educational categories, but the inspection of the frequencies revealed that the off-time education was mostly from vocational school or colleges: Of the on-time women, 24.0% had gained a degree from vocational school, 47.9% from a vocational college, and 28.1% from a university. The respective figures for the off-time women were 36.8%, 57.9%, and 5.3%. Of the on-time men, 65.0% had obtained their degrees from a vocational school, 19.0% from a vocational college, and 16.0% from a university. For the off-time men, the figures were 66.7%, 33.3%, and 0%, correspondingly.

The educational categories (no, on-time, or off-time degree) were related to the occupational status at age 27, $\chi^2(4) = 27.82$, $p < .001$ for women and $\chi^2(4) = 8.63$, $p < .10$ for men; at age 36 $\chi^2(4) = 16.57$, $p < .01$ for women and $\chi^2(4) = 14.97$, $p < .01$ for men; and at age 42 $\chi^2(4) = 14.77$, $p < .01$ for women and $\chi^2(4) = 11.64$, $p < .05$ for men. A general trend in both genders and at each age was that the no-degree individuals were typically blue-collar workers ($ASRs = 2.3 – 4.1$) and the on-time degree individuals were either lower (observed in only women) or upper white-collar workers ($ASRs = 2.1 – 3.4$). The off-time educational degree was associated with, in only women, an occupational status showing promotion: At age 27, it was typical of those women who had not yet obtained a degree to be in a blue-collar status ($ASR = 2.7$), whereas at ages 36 and 42 (after obtaining a degree) they were typically in a lower white-collar position ($ASRs = 2.5$ and 2.1, respectively).

Although not shown in long-term unemployment, it was more typical than expected by chance for the no-degree and the off-time degree women to have an unstable career line (characterized by bouts

of unemployment and frequent changes of jobs) at age 27, $\chi^2(4) = 36.75$, $p < .001$; *ASRs* = 4.3 and 3.2, respectively. The on-time degree women were typically on a stable career line (indicated by working stably in one's occupational field; *ASR* = 5.2). At age 36, the off-time women typically experienced a changeable career pattern, characterized by a family-centered career, later studies, or a career line that has gradually become unstable, $\chi^2(4) = 21.71$, $p < .001$; *ASR* = 4.5. It was typical of the off-time degree men to have a changeable career line at age 27, $\chi^2(4) = 10.16$, $p < .05$; *ASR* = 2.4, whereas at age 36 the following male types were observed, $\chi^2(4) = 24.70$, $p < .001$: no degree and an unstable career line (*ASR* = 2.0); on-time degree and stable career (*ASR* = 2.4); and off-time degree and changeable career (*ASR* = 4.4). No associations between education and career were observed in either gender at age 42.

To summarize: These results show that in both women and men the off-time education was often acquired from a vocational school; none of the off-time men obtained a university degree. An occupational status was, in both genders, generally higher for the on-time individuals than for the no-degree individuals. The off-time women showed an upward social mobility, from blue-collar to lower white-collar occupation, related to having an educational degree; in men this kind of movement was not observed. The career line of the off-time education women and men was either unstable or changeable at age 27, referring to frequent changes of jobs, periods of unemployment, and/or family-centered career, whereas the on-time participants worked uninterrupted in their own occupational fields.

Other Adult Life Domains and Education

Differences in the educational categories and alcohol use were also studied in adulthood. The variables for alcohol use included frequency of drinking per year (range 0 = *never* to 365 = *every day*) and heavy drinking per week (range 0 = *not once* to 5 = *several times a week*) at ages 27, 36, and 42. In women, there was only one difference (ANOVA with Bonferroni pairwise comparisons): Women who had never obtained an educational degree used alcohol more heavily at age 42 than women who had obtained their educational degrees on time, $F(2,129) = 4.36$, $p < .05$. The same difference existed between male groups but at all studied ages, that is, 27, 36, and 42 (Table 15.2).

TABLE 15.2. *Comparisons of Different Educational Categories in Adult Drinking Variables for Men (N = 160–147).*

	1. No degree		2. On-time degree		3. Off-time degree				
Variable	***M***	***SD***	***M***	***SD***	***M***	***SD***	***df***	***F***	***Bonferroni***
Age 27									
Frequency of drinking	126.46	119.61	93.62	113.54	70.78	98.16	2,157	1.56	
Heavy drinking	3.12	.87	2.44	1.32	2.22	1.72	2,157	4.93**	1 > 2
Age 36									
Frequency of drinking	125.39	116.92	108.77	111.33	123.25	102.51	2,146	0.33	
Heavy drinking	3.08	1.21	2.38	1.48	2.44	1.42	2,150	3.48*	1 > 2
Age 42									
Frequency of drinking	115.73	95.32	140.92	124.65	130.22	148.28	2,144	0.65	
Heavy drinking	3.02	1.19	2.30	1.51	2.44	1.42	2,144	3.77*	1 > 2

Note: $^{*}p < .05$. $^{**}p < .01$.

The comparison of the life situation of the different educational categories was conducted using either cross-tabulation with χ^2 and (anti)types or ANOVA with Bonferroni. As for family life, some statistically significant differences emerged (and only those are reported here) in both intimate relationships and having children: The no-degree women had experienced a divorce (from a marriage or a common-law marriage) more often than the on-time education women, $F(2,122) = 4.98$, $p < .01$. In men, $\chi^2(4) = 11.08$, $p < .05$, it was typical of the no-degree men to be single ($ASR = 2.8$) and of the on-time degree men to be married ($ASR = 2.8$) at age 42. There were no differences in the number of children. However, the female educational categories differed in the age at which they had had children, $\chi^2(2) = 9.93$, $p < .01$. It was typical of both the no-degree ($ASR = 2.1$) and the off-time education women ($ASR = 2.0$) to have had a child before age 20, whereas it was atypical of the on-time women ($ASR = -3.1$). It was typical of the on-time women to have had a child at a later age, that is, between ages 28 and 36, $\chi^2(2) = 6.21$, $p < .05$ ($ASR = 2.0$); during that time period it was atypical of the off-time education women to have had a child ($ASR = -2.4$).

The accumulated problems of adult social functioning seem to differentiate the no-degree and the on-time degree individuals in both genders: The no-degree individuals more often were heavy users of alcohol and had problems in their intimate relationships. Furthermore, in women, early child-bearing was typical of those women who did not acquire any education at a normative age (no-degree and off-time degree women).

Early Antecedents of Educational Attainment

Concerning family background, there was a tendency, $\chi^2(4) = 8.77$, $p < .10$, for the no-degree women to come from a blue-collar ($ASR = 2.1$) background and for the on-time degree women to come from an upper white-collar ($ASR = 2.6$) family background. In men, no significant associations were found, $\chi^2(4) = 5.28$, p n.s. In both women, $F(2,130) = 5.02$, $p < .01$, and men, $F(2,140) = 5.21$, $p < .01$, there was an association between child-centered parenting and education: Women who had obtained their degrees on time had had more child-centered parents than women who had obtained their degrees later. In men, the difference was observed between the categories for on-time

degree and no degree; the former had received more child-centered parenting.

The findings for the child and adolescent variables are shown in Table 15.3. In females, social behavior at age 8 did not differentiate the educational groups, but in school achievement at age 14 there was a statistically significant difference: Having an educational degree by age 27 was related to a better school success than obtaining a degree at a later age. Furthermore, the no-degree and off-time degree females had conduct problems at age 14 more often than the on-time degree females. The antisocial behavior of the off-time females compared to on-time females was shown also by their earlier onset age of drinking. For a subsample (about 40% of the participants) there was available further information about the age-14 drinking behavior: frequency of drinking per year and incidences of heavy drinking. The no-degree and off-time degree females had drunk more often in adolescence than the on-time degree women.

In males, the off-time educational group had been more aggressive at age 8 than the other two groups, as well as less compliant than the on-time male group and less passive than the no-degree male group. The no-degree men had performed more poorly in school and had more conduct problems at age 14; they also started drinking alcohol earlier than the on-time degree males.

These findings imply that females in the on-time education category differed from those in the no-degree and off-time degree categories. The differences started to emerge in adolescence. More antisocial behavioral tendencies were observed among the no-degree and off-time degree than among the on-time degree females. The on-time degree females had a more favorable developmental background, such as more child-centered parents and a higher socioeconomic background than the other two female groups. The male differences existed mainly between the no-degree and the on-time degree groups and started to emerge earlier in childhood. Males with no degrees were more active and less anxious in childhood than males with on-time degrees. In adolescence, they exhibited more conduct problems, started using alcohol at an earlier age, and had poorer school success. Childhood aggressiveness was highest in males who achieved an educational degree off-time.

TABLE 15.3. *Comparisons of Different Educational Categories in Child Variables for Boys (N = 179–169) and Adolescent Variables for Boys and Girls (N = 147–132).*

		1. No degree		2. On-time degree		3. Off-time degree				
Variable		***M***	***SD***	***M***	***SD***	***M***	***SD***	***df***	***F***	***Bonferroni***
Age 8					*Males*					
Aggression		.17	.95	.25	.92	1.08	1.01	2,176	3.66*	3 > 1,2
Constructiveness		−.23	.83	−.08	.91	−.54	.72	2,176	1.51	
Compliance		−.18	.84	−.11	.98	−.74	.89	2,176	1.83	
Anxiety		.30	.96	−.06	.73	−.35	.65	2,176	4.40*	1 > 2, 3[a]
Low self-control		−.11	.96	.09	1.07	.53	1.39	2,176	1.52	
High self-control		−.17	.86	−.05	.97	−.64	1.03	2,176	1.74	
Passivity		.18	.91	−.15	.77	−.33	.79	2,176	3.22*	1 > 2
Activity		−.40	.86	−.01	.99	−.07	1.10	2,176	2.82[a]	2 > 1[a]
Age 14					*Males and Females*					
School success[b]	M	6.70	.65	7.04	.78	6.50	.52	2,166	4.80**	2 > 1
	F	7.35	.59	7.80	.78	7.09	.73	2,144	9.01***	2 > 3, 1[a]
Conduct problems	M	1.37	3.36	−.09	3.04	1.41	3.17	2,170	3.95*	1 > 2
	F	1.08	3.83	−1.28	2.23	.42	3.05	2,143	8.70***	1,3 > 2
Onset age of drinking	M	15.07	1.92	15.48	2.37	14.50	2.00	2,176	1.19*	2 > 1
	F	15.33	2.41	15.89	2.59	14.19	1.98	2,152	4.22*	2 > 3
Frequency of drinking[c,d]	M	1.15	.90	4.60	11.89	10.80	23.04	2,70	1.23	
	F	15.13	23.09	3.32	7.82	3.25	4.20	2,67	4.79	1 > 2,3
Heavy drinking[e]	M	1.00	.50	.94	.69	1.00	1.22	2,69	0.06	
	F	1.33	1.51	.87	.64	1.27	.61	2,62	2.10	

Note: M = male, F = female

[a] $p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

[b] Scale from 4 (low) to 10 (high).

[c] Scale from 0 to 52 (times per year).

[d] Based on a subsample of the participants ($n = 70$).

[e] Scale from 0 (never drunk) to 3 (often drunk).

All age 8 variables and conduct problems at age 14 are standardized variables.

CONCLUSIONS

This chapter showed that long-term unemployment is a life experience that is related to an increased level of psychological distress. This relation can be explained by both selection into long-term unemployment and effects of it. Long-term unemployment can be a part of a cycle of accumulated problems over the course of a person's development in some cases (Kokko & Pulkkinen, 2000). Long-term unemployment, which shows significant continuity over time, further increases the problems observed among those experiencing it, as shown by a heightened level of psychological distress (Kokko et al., 2000). In addition to early problem behavior (e.g., aggression), low educational attainment seems to play an important role in selection into long-term unemployment, particularly among men.

The chapter also focused on the possibly beneficial role of later acquired education on the employment situation as well as on the understanding of the adult functioning and the developmental backgrounds of this group; comparison groups were drawn from those who did not obtain any educational degree or obtained it on time. On the basis of these descriptive findings, it may be concluded that later education in men was somewhat advantageous in terms of later employment: No education was linked to long-term unemployment, but a later degree was not. No significant associations between education and unemployment were observed in women.

In men, the most striking differences in their adult and early functioning were observed between participants who never obtained a degree and those who obtained it on time. The men who had not obtained an educational degree had accumulated problems in their adult functioning, such as problem drinking, lack of an intimate relationship, an unstable career line, and long-term unemployment. These problems seemed to have continuity from childhood and adolescence. However, in women the picture was more complicated: The no-degree women tended to still have problems in their social functioning, such as some indications of alcohol use, instability in their marital relationships and working career, early child-bearing, and a low occupational status. However, the off-time degree women, who had manifested antisocial behavioral tendencies in adolescence, did much better in adulthood, as indicated by, for example, their upward

social mobility in the occupational status. What they had in common with the no-degree women was early child-bearing, which may have delayed their studies; for instance, Rönkä and Pulkkinen (1998) have previously demonstrated that adolescent problem behavior (as indicated in both the no-degree and off-time degree women here) is linked to having a child early.

16

Personality, Work Career, and Health

Mika Kivimäki, Marianna Virtanen, Marko Elovainio, and Jussi Vahtera

INTRODUCTION

Most adults spend a major part of their life working. Work is a principal prerequisite for continuous income opportunities, and work role is related to learning possibilities, recurrent options of belonging to some significant group, and building one's self esteem. Thus, work can represent an important source of well-being. On the other hand, several aspects of work may constitute health risks; and those aspects may vary across workplaces, jobs, and occupations. Physical and chemical hazards identified in studies include, for example, exposure to dust, heat, lead, carbon monoxide, asbestos, and noise. Examples of major psychosocial risk factors include high demands and work overload, low levels of control and support, and lack of employment security and organizational injustice.

There are several different ways in which personality may interact with the work-health relationships (Figure 16.1). First, there is variation in how work affects health between individuals: a similarly stressful work induces greater health problems in some employees than others. Personality is assumed to be one important factor contributing to such variation. Personality is a source of individual differences in appraisal processes, physiological responding, coping, and health behaviors. Thus, certain aspects of personality can render some persons more vulnerable, others more resilient, to the effects of work risk factors.

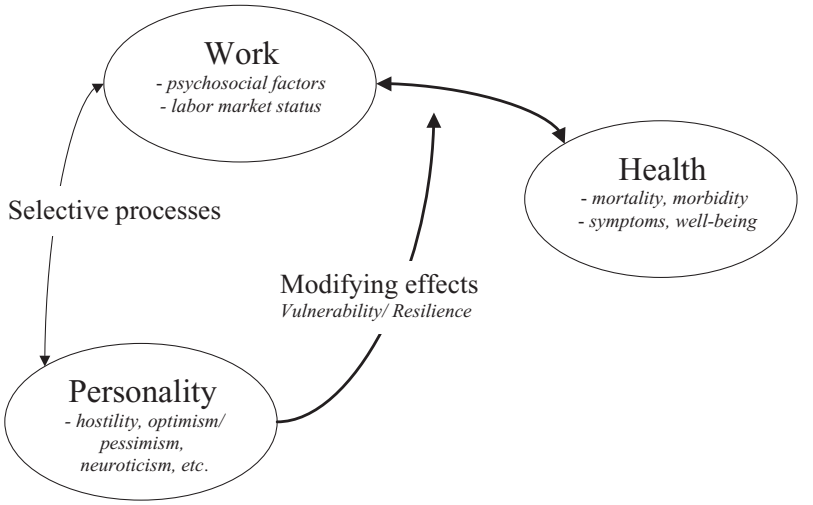

FIGURE 16.1. A schematic model of the relationships between personality, work, and health.

Second, people are not randomly distributed to workplaces, and personality may be one of the numerous selective factors. Certain jobs suit particular personalities and such people might be selected for such jobs and may selectively seek them out. This selection process is a source of differences in work-related risk exposures between personality types and, hence, a potential cause of personality-related variation in health. It is noteworthy, however, that the causality may not only run from personality to work. Personality is subject to changes even in adulthood, and work can influence personality dimensions.

Research has identified several personality traits that may have relevance in terms of health. In the 1950s, Friedman and Rosenman suggested that cardiovascular diseases, the leading cause of mortality in Western countries, are more common among time-pressured, competitive, aggressive, and hostile persons: individuals with what they labeled the type A personality (Friedman & Rosenman, 1959). More recent results indicate that the hostility component in the type A personality may be particularly health damaging (Miller, Smith, Turner, Guijarro, & Hallet, 1996). Various other personality characteristics have been associated with adult health. These include, for example,

optimism, a sense of coherence, neuroticism, trait anxiety, self-esteem, and impulsivity.

In this chapter, we elaborate two issues in a life course perspective (Figure 16.1). First, we provide understanding on the important role of personality in modifying the effects of work on health. We describe how such moderated effects have been detected in the relatively numerous observational and experimental studies published. Second, we discuss personality as a source of selection. In particular, we aim to demonstrate how personality characteristics may directly or indirectly affect selection to healthy or hazardous working conditions. This is largely a neglected issue in research of personality and ill-health. The ongoing Jyväskylä Longitudinal Study of Personality and Social Development (JYLS) study provides a valuable contribution to research on both these issues, as it represents a rare opportunity to prospectively test theoretical models in a life course context.

This chapter does not aim to cover the entire literature on personality in the context of work and health. Instead, we concentrate on one personality trait: hostility. Hostility is one of the most intensively studied personality traits in occupational health psychology and behavioral medicine, and it also provides an excellent case to illustrate predictive associations between personality, work career, and health. In this chapter as in many health studies, hostility is used to describe a broad personality construct involving affect, behavior, and cognition (Miller et al. 1996). Our particular interest relates to the question of whether aggressive behavior in childhood, a behavioral component of hostility, is an early marker of developmental pathways that lead to increased vulnerability and unhealthy work exposures in adulthood. We conclude this chapter by acknowledging major challenges for future studies in the field of personality, work, and health.

IMPACT OF WORK ON HEALTH

Psychosocial Work Environment

There has long been a recognition that the effects of work on the health of employees are not limited to occupational diseases caused by physical and chemical exposures only. A number of diseases have

been related to psychosocial conditions in the workplace, among the most important being coronary heart disease, musculoskeletal disorders, and psychiatric disorders (Elovainio, Kivimäki, & Vahtera, 2002; Hemingway & Marmot, 1999; Kivimäki et al., 2002; Kivimäki, Elovainio, Vahtera, Virtanen, & Stansfeld, 2003; Kuper & Marmot, 2003; Pincus, Burton, Vogel, & Field, 2002; Stansfeld, Fuhrer, Shipley, & Marmot, 1999; Vahtera et al., 2004). While evidence of direct causal effects of psychosocial risk factors on the onset of disease is, in many cases, still uncertain, several studies demonstrate that psychosocial factors can increase vulnerability to certain illnesses including, for example, the common cold (Cohen, Tyrrell, & Smith, 1991; McEwen, 1998). Moreover, stressful psychosocial environments may worsen prognosis and disrupt disease processes among those with existing morbidity. Recurrent, long-term exposure rather than episodic stress is assumed to be a prerequisite for the adverse health effects of psychosocial risk factors (McEwen, 1998).

Among the theoretical models identifying stressful components of the psychosocial environment, the job strain model has received special attention (Karasek, 1979; Karasek & Theorell, 1990). The key element in the model is job control, referring to the possibility for employees to influence their own work and working conditions. The model posits that a combination of low job control at work and high work demands, called job strain, is a health risk for employees. High demands refer to quantitative and qualitative aspects of work such as work overload, high levels of time pressure, and overly difficult tasks.

The effort-reward imbalance model is a more recent theory to complement the job strain model by considering the impact of labor market conditions in addition to the more proximal job conditions (Siegrist, 1996). Thus, the model maintains that low rewards in terms of money, social approval, job security, and career opportunities may pose a health risk, if combined with high effort-work demands. Empirical support for this model has begun to accumulate only recently.

Additionally there is evidence of potential adverse health effects of several specific characteristics of work such as job insecurity, role conflict and ambiguity, monotony, and unfair management.

Unemployment

In addition to the psychosocial work environment, labor market status is an important research area of potential effects of work on health. Most of this research involves comparisons between the employed and unemployed. Unemployment, representing absence of work-related resources and risk factors, is generally considered a highly stressful life event (Bartley, 1994; Dohrenwend, Krasnoff, Askenasy, & Dohrenwend, 1982; Holmes & Rahe, 1967). Holmes and Rahe (1967), for example, found that getting fired from work is an event requiring large changes in life adjustment, exceeded only by death of a spouse or a close family member, divorce, marital separation, marriage, and jail term.

Studies have repeatedly shown a higher prevalence of physical and psychological ill-health and a higher mortality among the unemployed compared with employed people (Kposowa 2001; Leino-Arjas, Liira, Mutanen, Malmivaara, & Matikainen, 1999; Lewis & Sloggett, 1998; Martikainen & Valkonen, 1996; Morris, Cook, & Shaper 1994; Murphy & Athanasou, 1999). In a 5-year follow-up study, unemployment correlated with increased health complaints, after initial psychological health and background factors were controlled (Hammarström & Janlert, 1997). Corresponding findings have been reported for several other health outcomes (for a review, see Bartley, 1994).

However, the association between unemployment and health may also reflect processes other than simple causality. One of them is health-related selection. Several studies show that those who are ill are also more likely to lose their jobs and have a more difficult time regaining employment than those with good health (Claussen, Björndal, & Hjort, 1993; Leino-Arjas et al., 1999). Of special interest is whether personality is also predictive of selection into unemployment.

Temporary Employment

During the past decades, a trend toward more flexible labor markets has characterized changes in the private and public sectors of developed countries (DeGrip, Hoevenberg, & Willems, 1997; Hurrell, 1998; U.S. Bureau of Labor Statistics, 1997). In the EU and United States

the number of temporary employees is rising and currently exceeds the number of unemployed (Benach, Benavides, Platt, Diez-Roux, & Muntaner, 2000; Letourneux, 1998; U.S. Bureau of Labor Statistics, 1997). Temporary job contracts accounted for 13% of paid employment in Europe and for 7% in North America in 2001, for a total of 32 million people in these work arrangements (OECD, 2001).

There is growing evidence that new types of employment may be a potentially crucial public health topic (Benach et al., 2000; Quinlan et al., 2001). For example, a survey of over 15,000 employees of the active population of 15 European countries showed precarious employment to be positively associated with lower job satisfaction and higher levels of fatigue, backache, and muscular pains (as compared with full-time permanent workers) (Benavides, Benach, Diez-Roux, & Roman, 2000). Consistent with this finding, a population-based study in Finland reported higher rates of ill-health among people in unstable employment than those in permanent employment (Virtanen, Liukkonen, Vahtera, Kivimäki, & Koskenvuo, 2003).

A large 12-year follow-up study of municipal workers in Finland showed that men and women with temporary job contracts had 1.2 to 1.6 times higher overall mortality than permanent employees (Kivimäki, Vahtera et al., 2003). Cause-specific analysis showed that temporary employees who did not achieve a permanent contract in municipalities during the follow-up had increased death rates from alcohol-related causes and, in men, smoking-related cancer. Corresponding risks were greater for the unemployed (risk ratios between 3 and 5). A possible interpretation for the findings on mortality is that elevated death rate in temporary employees is partially attributable to adverse behavioral profiles. There may be a clustering of health risks among people who are also characterized by work careers with transitions between periods of temporary work and unemployment. Erosion of income, job insecurity, deficient benefits and on-the-job training, lack of prospects for promotion, and exposure to hazardous work conditions have been suggested as additional potential pathways through which temporary employment can damage health.

However, not all temporary jobs necessarily provide inferior status and high insecurity, and some research has suggested that temporary work benefits workers when it allows them to control their work time, sample a variety of work experiences, and use their

temporary job as a stepping stone into permanent employment (Belous, 1989; Bielenski, 1999; Nätti, 1993; Bauer & Truxillo, 2000; Virtanen, Kivimäki, Elovainio, & Vahtera, 2002).

Recently, the contribution of personality to the association between temporary employment and health has attracted increased attention among researchers.

LIFE COURSE PERSPECTIVE ON THE VULNERABILITY HYPOTHESIS

Personality can be a vulnerability factor or a protective factor if it modifies the association between an exposure and disease when the causal effect of the exposure of interest differs across personality types (Kuh, Ben-Shlomo, Lynch, Hällqvist, & Power, 2003). Among different personality traits, hostility provides an illustrative example of how personality may modify the effects of work on health.

Hostility as a Vulnerability Factor

The definitions of hostility vary considerably. Here, we use the term *hostility* to describe a broad personality construct involving affect, behavior and cognition (Miller et al., 1996). The behavioral component of hostility – aggression – refers to a tendency to engage in overt behaviors such as attacking or hurtful actions. Aggression can be physical, verbal, direct, or indirect. It may include insult, sarcasm, rudeness, and simple opposition. The emotional component of hostility is anger, and it refers to an unpleasant emotion of varying intensity from mild irritation to rage. Some individuals tend to experience this emotion more frequently, more intensively, and for longer periods than others. Finally, the cognitive aspects of hostility consist of negative beliefs about and attitudes toward others, including cynicism, mistrust, and denigration. Taken together, a person scoring high on hostility behaves more aggressively, experiences anger more often and more intensively, and has hostile thoughts more frequently than a person low in hostility.

The vulnerability model of hostility proposes that the higher prevalence and incidence of health problems in chronically hostile individuals are associated with poor and inadequate coping. This

drawback among hostile persons is manifested, for example, in their more limited capacities of benefiting from the available psychosocial resources, lower stress-buffering potential of interpersonal support, and higher frequency of interpersonal conflicts (Appelberg, Romanov, Honkasalo, & Koskenvuo, 1991; Kivimäki, Vahtera, Koskenvuo, Uutela, & Pentti, 1998; Miller et al., 1996; Smith, 1994; Smith & Christensen, 1992).

The vulnerability model has been supported by several field studies (Kivimäki et al., 1998; Vahtera, Kivimäki, Uutela, & Pentti, 2000; Watkins, Ward, Southhard, & Fisher, 1992; Williams, Haney, Lee, Kong, et al., 1980). In a cohort of municipal employees, interpersonal relations did not protect hostile individuals from disease (Vahtera et al., 2000). The rates of absence because of sickness were high in hostile employees irrespective of social support. In contrast, the sickness absence rates of nonhostile employees fell as perceived social support increased. In this study, hostility was measured with self-ratings of proneness to anger, irritability, and argumentativeness (Koskenvuo et al., 1988).

A longitudinal field experiment of the same cohort revealed that hostility was also associated with increased individual reactivity to changes in psychosocial work stressors (Kivimäki et al., 1998). For example, health records did not differ between hostile and nonhostile employees after no or minor organizational downsizing or slight changes in work content, but major negative changes in these psychosocial factors increased health problems more significantly among employees scoring high on hostility. Similarly, high job demands and high job insecurity were associated with a greater increase in health problems in women scoring high on hostility than among their female counterparts with low hostility scores (Table 16.1).

In line with the field research, experimental studies have shown that hostile individuals benefit less from the support available to them and exhibit higher physiological reactivity in stressful social situations than do nonhostile individuals (Christensen et al., 1995; Christensen & Smith, 1993; Kamarck, Annunziato, & Amateau, 1995).

In conclusion, hostile adults seem to be less able than other people to benefit from existing health resources, and they are more likely to be affected by work-related risk factors. These findings provide evidence of the modifying role of personality in the work-health relationship.

TABLE 16.1. *Increased Vulnerability Among Hostile Individuals. Results from multiple Poisson regression analyses. Figures are ratios of medically certified sickness absence rates and their 95% confidence intervals (CI) for high vs. low work stress, as indicated by job demands, downsizing, and job insecurity, among 636 female municipal employees. (Source: Kivimäki et al., 1998)*

	Rate ratio (95% CI) for absence because of sickness		
Work characteristic	**High hostility**	**Low hostility**	***P* for Interaction**
Job demands			< 0.001
Low	1.00 (reference)	1.00 (reference)	
High	1.87 (1.50–2.32)	1.14 (0.97–1.3)	
Job insecurity			< 0.01
Low	1.00 (reference)	1.00 (reference)	
High	1.60 (1.38–1.86)	1.03 (0.83–1.28)	

Is Aggressive Behavior in Childhood a Risk Marker?

Applying a life course perspective may enrich our understanding of the vulnerability model of hostility. Both genetic and environmental influences play a role in the development of hostility and its behavioral component, aggression. Indeed, a number of twin studies have reported evidence of moderate heritability for hostility scales (Cates, Houston, Vavak, Crawford, & Uttley, 1993; Coccaro, Bergeman, Kavoussi, & Seroczynski, 1997; Rose, 1988) and there is also evidence that environmental influences, including adverse circumstances and stresses in childhood and adulthood, contribute to personality differences and dispositional differences in the expression of hostility (Bromet, Parkinson, & Dunn, 1990; Greenglass & Burke, 1997; Karlberg, Krakau, & Unden, 1998; Weidner, Connor, Hollis, & Connor, 1992). Studies suggest a moderate continuity of aggression from childhood and adolescence to adulthood (Pulkkinen & Pitkänen, 1993; Kokko & Pulkkinen, 2005).

In terms of successful prevention, early detection of vulnerability factors is of vital importance. If childhood aggressive behavior is a risk marker of later hostility or other maladaptive life orientations, possibly the associated vulnerability to health problems can be identified in childhood. The JYLS study is able to shed some light on this issue. In this study, aggressive behaviors of participants were assessed at the

TABLE 16.2. *Sample Items Used to Measure Aggressive Behaviors at Age 8 Years in the JYLS study. For more detailed description of the scale, see Kivimäki, Elovainio, Kokko, et al., 2003*

Item
1. Hurts another child when angry, e.g., by hitting, kicking, or throwing something.
2. Kicks pieces of furniture or other objects when angry at something.
3. Attacks somebody without reason.
4. Teases smaller and weaker peers when angry at something.
5. Never quarrels with others. (reversed scored).
6. Is peaceable and patient. (reversed scored).

age of 8 years by teacher ratings (Table 16.2). The relationship between unemployment and health problems was assessed three decades later when participants were age 37. The test of the vulnerability hypothesis in these settings involved determining whether the relationship between unemployment and health problems in adults is dependent on aggression in childhood (Kivimäki et al., 2003).

The combination of high aggressiveness at school age and unemployment in adulthood had an additive effect on poor health in adult men but not in adult women (Kivimäki et al., 2003). Among the unemployed, men with aggressive behaviors in childhood had clearly worse health status in adulthood than did other men. The corresponding difference was smaller or absent among employed men, an indication of the interaction effect of early aggressiveness and employment status. Several studies point out that increased alcohol consumption may partly underlie the adverse influence of unemployment on health (Broman, Hamilton, Hoffman, & Mavaddat, 1995). Similarly, early socioeconomic conditions have been suggested to play a role in the greater risk of disease among hostile individuals. In the JYLS study, the results were adjusted for heavy drinking and for parents' socioeconomic position in order to partial out confounds due to variation in these variables. Results remained largely unchanged, permitting the inference that the role of childhood aggressiveness as a risk marker is robust across health habits and early socioeconomic risk factors.

It is difficult to know whether the absence of support for the vulnerability model among women reflects true gender differences

or methodological limitations in the data. Assessment of women's unemployment is probably more imprecise than measuring unemployment among men. A potential for a gender-related bias relates to "women's hidden unemployment" (Bartell & Bartell, 1985; Leeflang, Klein-Hesselink, & Spruit, 1992), their attributions of being housewives instead of being unemployed. Because of such uncertainties, tests of the vulnerability hypothesis among women should be interpreted more cautiously than those related to men.

In sum, the findings reviewed above demonstrate the importance of understanding contingencies between personality, work, and health in a life course perspective. The observed interactions between childhood aggression and adulthood unemployment among men suggest that increased vulnerability to work-related health problems might be predictable even before a person enters adult work life.

THE SELECTION HYPOTHESIS

People make choices in their social environments, in their friends and partners, and in their employment (Johnson, McGue, Krueger, & Bouchard, 2004). The *FinnTwin* study shows that twins at age 12 choose as their "best friend" classmates those who are similar to themselves (Rose, 2002). Thus, not surprisingly, the friendship choices made by identical twins were more similar than those made by fraternal twins. Friendship selection in early adolescence is influenced by assortative pairing ("we like those who are like ourselves"), analogous to the documented tendency of adults to assortatively mate (Daley & Hammen, 2002; Silventoinen, Kaprio, Lahelma, Viken, & Rose, 2003). Adults also make job and career choices in similar ways, and studies of separated identical twins show evidence of concordant job choices and vocational interests (Lykken, Bouchard, McGue, & Tellegen, 1993).

Thus, the contribution of individual differences and personality to the association between work and health may extend beyond the mechanisms related to vulnerability. The essential idea in the selection hypothesis is that variation in exposure to health risk factors is not randomly distributed nor is it independent of the person's own actions. Personality may be associated with the likelihood with

which many stressful events occur to the individual or to which health-damaging behaviors are adopted or maintained by the person (Foley, Neale, & Kendler, 1996; Kendler et al., 1995). Applied to work settings, personality may be linked to the extent to which a person is exposed to unhealthy work environments. However, it is important to realize that these associations do not justify unhelpful "blame the victim" type policy implications.

In a life course perspective, accumulation with risk clustering may often characterize the selection processes or pathways to health risks (Ben-Shlomo & Kuh, 2002). More specifically, increased likelihood of disease can be considered a result of exposures that accumulate through a number of adverse environmental conditions and health-damaging behaviors rather than due to single events. In this process, certain personality characteristics may be risk markers for clustering or a mediating factor in the accumulation process. There may also be sequences of linked exposures that raise health risks because one bad experience or exposure tends to lead to another and then another, a process referred to as a chain risk model (Kuh et al., 2003; Rutter, 1989). It is noteworthy that there are also protective chains in which the links confer decreased rather than increased risk.

Hostility and Pathways to Unhealthy Work Environments

A recent meta-analysis of existing evidence shows that hostility is associated with increased health problems in adults after a variety of other health risk factors are controlled for (Miller et al., 1996). Part of the adverse health effects of hostility may be explained if hostile individuals were particularly likely to be selected to adverse conditions involving risk to health. What kinds of processes might then contribute to such selection? According to Smith (1994), social relationships are the key element. He hypothesized that hostile states and acts such as mistrust; expectations of hostility from others; and antagonistic, disagreeable, and aggressive behaviors cause interpersonal conflicts and stressful situations. These self-imposed stressors, both at work and in private life, undermine the opportunities of hostile people to access psychosocial resources and support from others, which, in turn, increases their risk for health problems.

Selection to Unemployment and Temporary Employment

It would be tempting to apply Smith's (1994) idea to a life course perspective. For example, it may be hypothesized that early disadvantage and aggressive behaviors in childhood increase the likelihood of unhappy, disruptive relationships and dissociation from attachment. Experienced disturbed relationships may accumulate across developmental phases and thus lead to maladaptive behavioral patterns that persist into adulthood if corrective experiences are lacking, a process resembling the chain risk model.

Indeed, research suggests that emotional and behavioral problems in childhood and adolescence, such as aggression, withdrawal, depression, and anxiety, are associated with subsequent unemployment (Caspi, Wright, Moffitt, & Silva, 1998; Lynn, Hampson, & Magee, 1984; Montgomery, Bartley, Cook, & Wadsworth, 1996). The JYLS study provides a more detailed view for unemployment and temporary employment (Rönkä & Pulkkinen, 1995; Virtanen et al., 2005). High aggressiveness in boys at age 8 predicted problems in school adjustment at age 14. Later components in the chain of risks of aggressive boys were criminal arrests and drinking problems. Early aggressiveness, as a part of low self-control of emotions, also seemed to lead to a cycle of maladjustment, which predicted long-term unemployment (Kokko & Pulkkinen, 2000). Modifying factors, however, were evident because child-centered parenting and pro-social tendencies in aggressive children lowered their probability of becoming long-term unemployed in adulthood (Kokko & Pulkkinen, 2000).

In the JYLS study, findings of achieving a permanent job by middle age (age of 42) provide another example of childhood aggressive behaviors as a marker of selection (Virtanen et al., 2005). Among individuals with a low educational level, childhood aggressive behaviors predicted an unstable and insecure work career, as indicated by the person remaining in a temporary job. However, for people with high educational achievements typically in white-collar occupations, aggressive behaviors in childhood were not associated with temporary employment. This is probably a reflection of more favorable developmental pathways and employment context. Employees with low educational attainment in low socioeconomic positions reported

higher job insecurity than white-collar employees, which may indicate harsher competition for jobs among the lower-level workers.

In fact, a qualitative analysis of temporary blue-collar workers by Smith (1998) shows an example of competition for a permanent position in the organization. In her study, the vast majority of the temporary workers sought permanent employment, which led them to demonstrate deep self-discipline; to work hard, to be loyal and reliable, and not "to be labeled as a trouble maker or a squeaky wheel." In terms of security and status in the occupational hierarchy, white-collar employees usually have a better position than blue-collar workers. For the employees up in the hierarchy, there may be more tolerance for expressions of anger and other negative emotions – for example, criticism toward the work and working environment. For highly educated workers, aggressiveness may, in some cases, even work in their favour and enhance their career development.

Thus, childhood aggressive behaviors seem to be predictive of a transition in the core-periphery structure of the labor market, as indicated by shifts between unemployment, temporary employment, and permanent positions through pathways of maladjustment covering the time period from childhood to adulthood. Conversely, higher compliance and constructiveness are associated with reaching a secure labor market position (Pulkkinen, Ohranen, & Tolvanen, 1999). These findings suggest that early markers of personality can be important predictors of selection into work-related circumstances that increase risk of ill health.

CONCLUSIONS

This chapter has amplified two general models describing the associations between personality, work career, and health in a life course perspective. We illustrated how personality may modify the effects of work on our health. We also described how personality might be related to pathways into healthy or hazardous working conditions. Both these models imply that the life course perspective should be noticed in preventive actions and in attempts to strengthen health resources. In particular, we need more effective strategies to break the vicious cycle between poor individual resources, worsened opportunities in the labor markets, and declining health.

Although research in this field has been active for decades, there is still room for major conceptual and methodological advancement. We would like to point out in particular the following two issues:

First, the vulnerability model and the selection model have received substantial empirical support in relation to hostility, but there are also several other potential models to be tested (Figure 16.1). For example, further research is needed to examine the extent to which work characteristics and work careers promote or inhibit the development of personality during adulthood. Another example of alternative models involves the causality in the relation between work and health. Whereas work has typically been studied as a factor affecting the development of health problems or the course of existing diseases, it is likely that the causality also runs the other way. Health problems and diseases can be assumed to have impact on career opportunities, work performance, and status.

Second, a challenge for future research involves a more systematic view of the personality construct. Much existing research on personality, work, and health has focused on single traits whereas a more comprehensive approach would examine those traits in relation to an individual's other traits. Indeed, Poulton and Caspi (2003) have strongly called for research with more comprehensive measurements of the structure of personality rather than isolated traits. There is increasing agreement about the structure of personality traits at the higher-order level. Such traits include, for example, the following five: extraversion or positive emotionality, neuroticism or negative emotionality, conscientiousness, agreeableness, and openness to experience. There is less agreement about taxonomies on more specific lower-level traits, including trait hostility. However, these lower-level traits may provide better explanatory power for models about the interplay between personality, work career, and health.

It is likely that increased collaboration between personologists, occupational researchers, and health scientists in the future is the way to build a more integrated view that forms a more solid basis for successful interventions and policy.

Summary and Future Directions

Lea Pulkkinen, Jaakko Kaprio, and Richard J. Rose

Readers who have persevered to this concluding chapter, having read the book's introduction and some or all of the substantive presentations in between, can gauge how well the chapters answered the questions posed in the Introduction: Why longitudinal research? Why twin studies? And why conduct them in Finland?

This edited book rests on data sets of truly exceptional informational value. The long-term, ongoing longitudinal study (Jyväskylä Longitudinal Study on Personality and Social Development, JYLS) is one of the few such resources available. It was started with 8-year-old children in 1968, and the latest data were collected in 2001, when the participants were 42 years old. Multiple informants and measures were used on multiple assessment occasions. The sample is representative of the age cohort born in Finland in 1959, using marital status, education, employment, and occupational status as comparison criteria. Comparisons with American, Canadian, and Swedish longitudinal studies have resulted in similar findings, which show that psychological phenomena are generalizable at least within the Western world.

As for the *FinnTwin* (*FT*) studies, one began when participant twins were age 16 (*FT16*) and another at age 12 (*FT12*). Both *FT* studies are population based, and each features essentially exhaustive identification of all twins in five consecutive nationwide birth cohorts. Each achieved nearly 90% participation across repeated waves of assessments. Jointly, about 5,000 twin pairs have been followed across

periods of 5 to 10 years. The baseline assessments of the *FT* twins are age-standardized, unique among research efforts of this magnitude in developmental behavior genetics. In *FinnTwin12*, multi-informant measures were used, and a subset of nearly 1,000 twin families was more intensively studied through peer assessments, in-school questionnaires administered to the twins, and, for each twin, an age- and gender-matched classmate control; structured interviews of the twins' parents, and at age 14, interviews of the twins themselves, were completed. In *FinnTwin16*, genetic epidemiological investigations have assessed twins, nontwin siblings, and parents. Longitudinal data from the two *FinnTwin* studies make evident the dynamic nature of genetic and environmental contributions to developing phenotypes, confirming that genetic effects are not static but unfold across development. Further, the *FT* data document pervasive gene-environment interaction; for example, genetic variance in patterns of adolescent alcohol use are modulated by urban/rural residency or familial religious attitudes, and environmental effects may suppress genetic influences in obesity, although heritability is high for both height and body mass index.

The rich data obtained with the JYLS and *FinnTwin* studies are not fully captured within these pages. Nor could they be. But some sense of the richness and diversity of these data sets has been offered within the scope of the present book as defined by the goal to analyze socioemotional behavior and health longitudinally from middle childhood to middle age. Statistical analyses required for the analysis of longitudinal and twin data are complex, as is evident in some preceding chapters. Developmental processes are marked by mediating and moderating factors, but some consistency can, nonetheless, be observed in the results reported here.

In the JYLS and *FinnTwin12*, the same framework of socioemotional development has been applied. The framework is based on emotional and behavioral regulation. We conclude with a succinct summary of some major findings and a sketch of future directions.

The circumplex model of emotional and behavioral regulation explains that both socially active and passive behavior may be emotionally regulated or dysregulated, and that both low and high control of emotions may be manifested in an active or passive way. The

model defines different socioemotional behaviors. Their associations with behavioral self-control were confirmed with the offspring of the JYLS participants: Teacher-rated self-control was low in externalizing problem behaviors indicated by, for instance, aggression, and in internalizing problem behaviors indicated by, for instance, social anxiety. High self-control of behavior was found in adaptive behaviors indicated by constructiveness and compliance.

Results of the *FinnTwin12* study provide consistent evidence across different contexts (home, school), child status (twin, singleton), informants (peers, teacher, parent, self), and age (12 and 14) of gender differences in socioemotional behavior in early adolescence. Boys exceeded girls in externalizing problem behaviors (aggression, inattention, impulsivity-hyperactivity), while girls scored higher in internalizing problem behaviors (anxiety and depression). Girls were rated more constructive and compliant than boys, but gender differences in social activity were less evident.

Both genetic and environmental effects were found to be significant for socioemotional behavior in boys and girls, but the estimates differed across gender and across subscales of socioemotional behavior assessed by teachers. For aggression, genetic effects were found to be significantly larger for girls than for boys, and in contrast, larger genetic effects were found among boys than girls for depressive symptoms, anxiety, and social activity. Gender modulation of genetic and environmental effects was found neither for other aspects of externalizing problem behaviors (inattention and impulsivity-hyperactivity) nor for adaptive behaviors (constructiveness and compliance).

Different forms of socioemotional behavior are likely to be results of multiple genes, mediated by neurobiological systems in an interaction with cumulative social experiences. Studies by others have shown that aggression and hyperactivity share partly the same genetic etiology, and depressive symptoms and social anxiety share overlapping genetic etiology, but different environmental factors contribute to the expression of these behaviors. Externalizing and internalizing problem behaviors involve problems in emotion regulation. Their comorbidity is associated with recurrent pain in children. Whether externalizing and internalizing problems share the same genetic etiology has not yet been shown in these data.

Socioemotional behaviors assessed in childhood are related to distinct behavioral styles in early and late adolescence as shown in the JYLS. For example, aggressive behavior at age 8 predicts unsupervised activities at age 14 and the style of life of Reveller at age 20. These adolescent behavioral styles were indicated by, for instance, seeking pleasure in gathering together, early heterosexual interaction, and smoking and drinking. Smoking was also associated with the developmental line from anxious behavior in childhood to the Loser style of life in late adolescence. Children with adaptive socioemotional behavior, indicated by constructive and compliant behaviors, were less likely to be regular drinkers or smokers in adolescence. Furthermore, problem behaviors indicating low self-control have been associated with later accidents resulting in physical impairment, long-term unemployment, psychosomatic symptoms, and poor self-rated health. There are mediating factors in these relationships, such as heavy drinking. For self-rated health, the results obtained in the *FinnTwin16* study showed that self-rated health in early adulthood was more influenced by unshared environmental factors than by genetic factors; common environmental factors did not contribute to the phenotypic variance at all, at least not within the Finnish context. Unshared environmental factors may be related to experiences provoked by low self-control. High self-regulation of emotions in childhood, on the other hand, has partially accounted for good social functioning evident in stable careers, socialization, and controlled drinking.

Early initiation of alcohol use is a significant risk factor for continued, heavier use and to the development of alcohol abuse/dependence in mid-adulthood, as shown by the JYLS. Data from the *FinnTwin* studies suggest that initiation of early substance use in adolescence is largely influenced by shared environmental factors. Once substance use is initiated, however, genetic influences account for a significant portion of variance in patterns of smoking and drinking, and genetic effects increase in importance with development. These results have been found in other longitudinal data on adolescent twins in the Netherlands and in Minnesota and Virginia in the United States. In *FT* data, overlap between smoking and drinking was attributed to both genetic and shared environmental factors influencing both phenotypes. There were no significant gender differences in

influences on smoking and drinking at age 16, but *FinnTwin12* data suggested that significant sex effects exist at age 14; there was no evidence of genetic effects on alcohol initiation in males at age 14, but females showed evidence of emerging genetic influence, perhaps due to their more advanced psychosexual maturity at that age.

Differences in genetic effects found for boys and girls during early adolescence may reflect developmental consequences of differences in hormonal levels and pubertal timing. Genetic factors account for most of the variation in pubertal timing in males and females. Common environmental influences play little role in pubertal timing, with the exception of age at menarche in females. A specific familial factor that seems to be important in influencing the age at menarche is father absence. Early maturing girls are more likely to initiate drinking and smoking at a younger age than are late maturing girls, and similar trends have been found in boys. These effects are replicated in *FT* data in within-family comparisons of developmentally discordant siblings. Early maturing girls are also more likely to report engaging in sexual intercourse at an earlier age than late maturers. An adolescent's life circumstances and context (e.g., urban/rural residency) may, however, affect these connections, as the influence of age-at-menarche on drinking was evident only among girls from urban settings.

Children's socioemotional behavior and the developmental lines they provoke are highly associated with parenting behavior. Child-centered parenting characterized by the parents' interest in and control of the child's activities, as well as evidence of trust and warmth, supports the development of adaptive behaviors, whereas the opposite style, called parent-centered parenting, was associated with the development of problem behaviors in children. In the study of the offspring of the JYLS participants, high parental knowledge of the child's daily schedule, whereabouts, and interests was associated with his or her adaptive behavior assessed by teachers. A negative home atmosphere in children's reports was related to high externalizing problem behaviors assessed by the children's teachers. Neither parental knowledge nor family atmosphere explained internalizing problem behaviors in children. Work conditions may be so demanding that they limit the parents' time and energy to take care of their children. The JYLS data showed that job exhaustion was connected to

a low level of knowledge by the parents about their children's schedule and whereabouts two years after job exhaustion was measured. Job exhaustion, on the other hand, was associated with children's low adaptive behaviors assessed by teachers. Children's socioemotional behavior also affects their parents: Children's externalizing problem behaviors were related to parental stress a couple of years later.

Child-centered parenting in early adolescence has long-term effects on children's psychological well-being; these effects are seen even in mid-adulthood. This relationship was both direct and mediated by the sense of personal control over development that was higher in adulthood among individuals who had enjoyed child-centered parenting. Interestingly, child-centered parenting did not account for identity achievement; this was explained by parental occupational status and the individual's own academic success. Furthermore, child-centered parenting significantly associates with optimism in adulthood, and it is, with the child's prosocial skills, a protective factor against long-term unemployment among high-risk children who display externalizing problem behaviors.

Finland experienced a serious economic recession in the middle of the 1990s, when the unemployment rate elevated dramatically. The JYLS results showed that the high national unemployment rate did not have much influence on long-term unemployment among adults who were 36 years old. The long-term unemployed had already had problems in the labor market at an earlier age. Unemployment was associated with psychological distress, and that distress, indicated by depression, increased if unemployment continued. Long periods of unemployment were associated with lack of an educational degree; an on-time completion of education was a resource factor for employment, particularly in men.

Education also both mediated and modified the effects of personality factors on career development. The JYLS results have shown that childhood aggressive behavior is generally a risk factor for low education that is further associated with an unstable working career. The findings have indicated, as well, that among individuals with a low educational level, childhood aggressive behavior predicted an insecure work career, while for those with high educational achievements,

aggressive behaviors in childhood were not associated with temporary employment.

This story is, of course, incomplete. Both the JYLS and the *FinnTwin* studies will continue. As with all longitudinal studies, there will always be more data to collect, more analyses to conduct, more puzzles to resolve.

1. A new wave of data collection is planned for intensively studied participants in the *FinnTwin12* study starting in late 2005, with structured psychiatric interviews, a battery of neuropsychological tests, and collection of DNA from twins and their parents.
2. Participants in the JYLS study will again be assessed as they reach age 50 in 2009, a milestone both for them and for the research team that has followed them from age 8.
3. And both the JYLS and the *FinnTwin* studies will move into the new and challenging direction of molecular genetics, trying to make explicit gene-behavior linkages to enrich our understanding of individual differences in socioemotional behavior and the uniqueness of individual life stories.

These new directions offer testimony to several realities of any long-term longitudinal study: (1) New data collection is almost always undertaken whenever possible, as the lives of the studied participants continue to unfold; and (2) new directions in analyses become possible as new techniques become available; the search for effects of candidate genes and specific gene by specific environment interactions is a clear and promising next step for both of these longitudinal studies.

Progress is being made in identifying specific genetic factors underlying such conditions as alcoholism, nicotine dependence, obesity, and severe psychopathology. Genetic factors also affect traits that increase liability to these medically disabling conditions: These intermediate traits are often called endophenotypes, and the two Finnish longitudinal studies offer excellent possibilities for exploring in more detail the genetic architecture of both endophenotypes and the medical conditions themselves. As specific genes are studied and characterized, more possibilities will arise to examine gene-environment

interactions in the JYLS and *FinnTwin* studies, as these have detailed measures of the environmental conditions, in homes, neighborhoods, and communities, in which participant subjects have grown up and developed lifestyles.

One example of interesting problems to be analyzed with the JYLS and *FinnTwin12* data concerns gender differences in social activity/extraversion and social anxiety/neuroticism. Results in the JYLS study have shown significantly higher continuity in these characteristics across adulthood in males than in females, and results in the *FT12* study have shown significantly higher genetic effects on these characteristics in males than in females. There may be gender differences in genetic modulation of these temperamental dimensions that would explain the findings and that could be detected by the methods of molecular genetics.

Some DNA samples have already been collected in both studies; more samples are planned for *FT12*. Other possible problems that could be analyzed with both data sets concern the development of alcohol dependence among early initiators of the use of alcohol. Early onset age is a high risk for heavy drinking and alcohol dependence in mid-adulthood, but early onset is mostly explained by common environmental factors. Possibly some children are more vulnerable to drinking in the context of specific gene by environment interaction. Intensive study of twin pairs in which the co-twins are *e*xtremely *d*iscordant *a*nd *c*oncordant (EDAC selection) for alcohol exposure in adolescence should prove especially informative.

The analysis of these rich data sets will continue for years to come. We are making plans so that archived data files from the two *FT* studies can be made available to others for secondary analyses and for data pooling, which increasingly is recognized as necessary to obtain adequate power for incisive genetic analyses. The JYLS data have already been made available for secondary analyses via the Finnish Social Science Data Archive maintained at the University of Tampere, Finland (www.fsd.uta.fi).

Over time, record linkage with many of the nationwide medical registries available in Finland will yield outcome information on major diseases and disorders recorded in the health care system. Thus, information on the importance of childhood and adolescent factors in somatic and mental health in adult age, and eventually

old age, will become available as the JYLS and *FinnTwin* cohorts age. The prospect (and promise) of such linkages will make the prospective data collected as early as ages 8, 12, and 16 of ever-increasing value.

The last wave of data collection in *FinnTwin12*, at age 17.5 years, was recently completed; it permits a 5-year follow-up test of the predictive power of peer, parent, and teacher assessments at baseline. Analyses of the predictive utility of adaptive dimensions of behavior, assessed with the Multidimensional Peer Nomination Inventory (MPNI), are especially anticipated. Most behavior-genetic research has focused on maladaptive behavior outcomes, on behavior problems rather than socially adaptive behaviors and their origins. The *FT12* data are, accordingly, of interest: Will the assessments of adaptive behaviors obtained from multiple informants at ages 11 to 12 offer new insights into individual differences in trajectories of adaptive, successful outcomes in late adolescence?

For the JYLS, comparative analyses of longitudinal data are in progress with collaborators from the United States and Great Britain within the Center for Analysis of Pathways (CAPCA) coordinated by the University of Michigan. The purpose is to analyze the longitudinal, interactive impact of contextual and personal factors on how well children negotiate pathways from childhood, through adolescence, through young adulthood, into mature adulthood, and rearing their own children. The analyses concern trajectories of socioemotional development, academic achievement, career success, psychological well-being, and health-related behaviors, particularly, the use of alcohol.

Within the JYLS, structured quantitative data can be complemented by life history data from age 15 to age 42 which allow the analysis of the timing and accumulation of different life events and their impact on social and psychological functioning. Particularly, the antecedents of and conditions for positive development should be better understood. In future studies, it would be valuable to examine possible mediators or pathways operating between early developmental background, subsequent experiences, and psychological and social functioning. Positive development is conceptually unclear; several parallel constructs are used, and conceptual analyses are lacking. The relationship between psychological well-being and distress or

ill-being should also be clarified: Are they two ends of one dimension or are they independent dimensions? A better understanding of the nature and origins of positive psychological functioning should facilitate efforts to create and maintain it.

Finally, a new second tier of collaborative investigators has been trained to take leadership roles in the continuation of these studies. Their promise is, we think, evident in their many contributions to this book, and we close by noting how satisfying, how gratifying, has been the experience of working with them in editing their contributions.

References

Aarnio, M., Kujala, U. M., & Kaprio, J. (1997). Association of health-related behaviors, school type, and health status to physical activity patterns in 16 year old boys and girls. *Scandinavian Journal of Social Medicine, 25,* 156–167.

Abidin, R. R. (1990). *Parenting Stress Index manual*. Charlottesville, VA: Pediatric Psychology Press.

Achenbach, T. M., & Edelbrock, C. S. (1984). Psychopathology of childhood. *Annual Review of Psychology, 35,* 227–256.

Achenbach, T. M., McGonaughy, S. H., & Howell, C. T. (1987). Child/adolescent behavioral and emotional problems: Implications of cross-informant correlations for situational specificity. *Psychological Bulletin, 101,* 213–232.

Adams, G. R. (1999). *The objective measure of ego identity status: A manual on theory and test construction.* University of Guelph, Guelph, Ontario, Canada: Department of Family Relations and Applied Nutrition.

af Klinteberg, B., Schalling, D., & Magnusson, D. (1990). Childhood behavior and adult personality in male and female subjects. *European Journal of Personality, 4,* 57–71.

Allen, K. R., Blieszner, R., & Roberto, K. A. (2000). Families in the middle and later years: A review and critique of research in the 1990s. *Journal of Marriage and Family, 62,* 911–926.

Almqvist, F., Kumpulainen, K., Ikäheimo, K., Linna, S.-L., Henttonen, I., Huikko, E., et al. (1999). Behavioural and emotional symptoms in 8-9-year-old children. *European Child & Adolescent Psychiatry, 8* (Suppl. 4), 7–16.

Alsaker, F. D. (1995). Timing of puberty and reactions to pubertal changes. In M. Rutter (Ed.), *Psychosocial disturbances in young people: Challenges for prevention* (pp. 37–82). Cambridge, UK: Cambridge University Press.

Anthony, E. J., & Benedek, T. (Eds.). (1970). *Parenthood: Its psychology and psychopathology*. Boston: Little, Brown.

Antonovsky, A. (1987). *Unraveling the mystery of health. How people manage stress and stay well*. San Francisco: Jossey-Bass.

Antonucci, T. (1990). Social supports and social relationships. In R. H. Binstock & L. K. George (Eds.), *Handbook of aging and the social sciences* (3rd ed., pp. 205–226). New York: Academic Press.

Appelberg, K., Romanov, K., Honkasalo, M.-L., & Koskenvuo, M. (1991). Interpersonal conflicts at work and psychosocial characteristics of employees. *Social Science and Medicine, 32*, 1051–1056.

Archer, S. L. (1989). Gender differences in identity development: Issues of process, domain and timing. *Journal of Adolescence, 12*, 117–138.

Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist, 55*, 469–480.

Aro, H. (1988). *Stress development and psychosomatic symptoms in adolescence. Study of 14 to 16 year old school children* (Acta Universitatis Tamperensis, Series A, No. 242). Tampere, Finland: University of Tampere.

Arseneault, L., Moffitt, T. E., Caspi, A., Taylor, A., Rijsdijk, F. V., Jaffee, S. R., et al. (2003). Strong genetic effects on cross-situational antisocial behaviour among 5-year-old children according to mothers, teachers, examiner-observers, and twins' self-reports. *Journal of Child Psychology and Psychiatry, 44*, 832–848.

Attias-Donfut, C. (1995). Le double circuit de transmission. [The double circuit of transmission]. In C. Attias-Donfut (Ed.), *Les solidarités entre générations. Vieillesse, famille, état* [The solidarities between generations: Old age, family, and the state] (pp. 41–81). Paris: Nathan.

Attias-Donfut, C. (2001). The dynamics of elderly support: The transmission of solidarity patterns between generations. *Zeitschrift für Gerontologie und Geriatrie, 34*, 9–15.

Attias-Donfut, C., & Segalen, M. (1998). *Grand-parents. La famille à travers les générations*. [Grandparents: The family across generations]. Paris: Odile Jacob.

Attias-Donfut, C., & Segalen, M. (2002). The construction of grandparenthood. *Current Sociology, 50*, 281–294.

Bakke, E. W. (1933). *The unemployed man.* London: Nisbet.

Barker, D. J. P. (1995). Fetal origins of coronary heart disease. *British Medical Journal, 311*, 171–174.

Barker, D. J. P. (1995). The fetal and infant origins of disease. *European Journal of Clinical Investigation, 25*, 457–463.

Barker, D. J., Eriksson, J. G., Forsen, T., & Osmond, C. (2002). Fetal origins of adult diseases: Strength of effects and biological basis. *International Journal of Epidemiology, 31*, 1235–1239.

Barman, S. K., Pulkkinen, L., Kaprio, J., & Rose, R. J. (2004). Inattentiveness, parental smoking, and adolescent smoking initiation. *Addiction, 99*, 1049–1061.

Barnett, R., & Hyde, J. (2001). Women, men, work, and family. An expansionist theory. *American Psychologist, 56*, 781–796.

Bartell, M., & Bartell, R. (1985). An integrative perpective on the psychological response of women and men to unemployment. *Journal of Economic Psychology, 6*, 27–49.

Bartholomew, K., & Horowitz, L. M. (1991). Attachment styles among young adults: A test of a four category model. *Journal of Personality and Social Psychology*, *61*, 226–244.

Bartley, M. (1994). Unemployment and ill health: Understanding the relationship. *Journal of Epidemiology and Community Health, 48*, 333–337.

Baruch, G., & Barnett, R. (1983). Adult daughters' relationship with their mothers. *Journal of Marriage and the Family, 45*, 601–606.

Bauer, T., & Truxillo, D. (2000). Temp-to-permanent employees: A longitudinal study of stress and selection success. *Journal of Occupational Health Psychology, 5*, 337–346.

Baumrind, D. (1971). Current patterns of parental authority. *Developmental Psychology Monograph, 4*, 1–103.

Baumrind, D. (1989). Rearing competent children. In W. Damon (Ed.), *Child development today and tomorrow* (pp. 349–373). San Francisco: Jossey Bass.

Belous R. (1989). *The contingent economy: The growth of the temporary, part-time and subcontracted workforce*. Washington, DC: National Planning Association.

Belsky, J. (1984). The determinants of parenting: A process model. *Child Development, 55*, 83–96.

Belsky, J., & Barends, N. (2002). Personality and parenting. In M. H. Bornstein (Ed.), *Handbook of parenting: Vol. 3. Being and becoming a parent* (2nd ed., pp. 415–438). Mahwah, NJ: Erlbaum.

Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development, 62*, 647–670.

Benach, J., Benavides, F. G., Platt, S., Diez-Roux, A., & Muntaner, C. (2000). The health-damaging potential of new types of flexible employment: A challenge for public health researchers. *American Journal of Public Health, 90*, 1316–1317.

Benavides, F. G., Benach, J., Diez-Roux, A. V., & Roman, C. (2000). How do types of employment relate to health indicators? Findings from the second European survey on working conditions. *Journal of Epidemiology and Community Health, 54*, 494–501.

Bengtson, V. L. (1985). Diversity and symbolism in the grandparental role. In V. Bengtson & J. F. Robertson (Eds.), *Grandparenthood* (pp. 11–25). Beverly Hills, CA: Sage.

Bengtson, V. L. (2001). Beyond the nuclear family: The increasing importance of multigenerational bonds. *Journal of Marriage and Family*, *63*, 1–16.

Bengtson, V., & Giarrusso, R. (1995). Effects à long terme d'un lien filial. Une enquête longitudinale de l'Université de Californie du Sud. [Long-term effects of a filial bond: A longitudinal study at the University of Southern California]. In C. Attias-Donfut (Ed.), *Les solidarities entre generations. Vieillesse, famille, état* (pp. 83–95). Paris: Nathan.

Bengtson, V. L., & Martin, P. (2001). Families and intergenerational relationships in aging societies: Comparing the United States with German-speaking countries. *Zeitschrift für Gerontologie und Geriatrie*, *34*, 207–217.

Bengtson, V. L., & Roberts, R. (1991). Intergenerational solidarity in aging families: An example of formal theory construction. *Journal of Marriage and the Family*, *53*, 856–870.

Ben-Shlomo, Y., & Kuh, D. (2002). A life course approach to chronic disease epidemiology: Conceptual models, empirical challenges, and interdisciplinary perspectives. *International Journal of Epidemiology, 31*, 285–293.

Bergman, L. R. (2001). A person approach in research on adolescence: Some methodological challenges. *Journal of Adolescent Research, 16*, 28–53.

Berzonsky, M. D., & Adams, G. R. (1999). Re-evaluating the identity status paradigm: Still useful after 35 years. Commentary. *Developmental Review, 19*, 557–590.

Biederman, J., Newcorn, J., & Sprich, S. (1991). Comorbidity of attention deficit hyperactivity disorder with conduct, depressive, anxiety, and other disorders. *American Journal of Psychiatry, 148*, 564–577.

Bielenski, H. (1999). New patterns of employment in Europe. In J. E. Ferrie, M. G. Marmot, J. Griffiths, & E. Ziglio (Eds.), *Labour market changes and job insecurity. A challenge for social welfare and health promotion* (European Series No. 81, pp. 11–30). Copenhagen: WHO Regional Publications.

Björkqvist, K., Österman, K., & Lagerspetz, K. M. J. (1994). Sex differences in covert aggression among adults. *Aggressive Behavior, 20*, 27–33.

Block, J. (1971). *Lives through time.* Berkeley, CA: Bancroft.

Bogle, A. C., Reed, T., & Rose, R. J. (1994). Replication of asymmetry of *a-b* ridge count and behavioral discordance in monozygotic twins. *Behavior Genetics, 24*, 65–72 .

Bonanno, G. A. (2001). Emotion self-regulation. In T. J. Mayne & G. A. Bonanno (Eds.), *Emotions: Current issues and future directions* (pp. 251–285). New York: Guilford Press.

Boomsma, D., Busjahn, A., & Peltonen, L. (2002). Classical twin studies and beyond. *Nature Reviews Genetics, 3*, 872–882.

Bornstein, M. H., Cote, L. R., & Venuti, P. (2001). Parenting beliefs and behaviors in northern and southern groups of Italian mothers of young infants. *Journal of Family Psychology, 15*, 663–675.

Botting, N., Powls, A., Cooke, R. W., & Marlow, N. (1997). Attention deficit hyperactivity disorders and other psychiatric outcomes in very low birthweight children at 12 years. *Child Psychology & Psychiatry, 38*, 931–941.

Bouchard, C., Pérusse, L., & LeBlanc, C. (1990). Using MZ twins in experimental research to test for the presence of a genotype-environment interaction effect. *Acta Geneticae Medicae et Gemellologiae, 39*, 85–89.

Bouchard, C., Tremblay, A., Després, J.-P., Nadeau, A., Lupien, P. J., Thériault, G., et al. (1990). The response to long-term overfeeding in identical twins. *New England Journal of Medicine, 322*, 1477–1482.

Brandis, J. (2003). *Grandparents as childcare givers for working mothers. A literature review in Spain and other advanced societies*. Retrieved March 20, 2005, from http://www.gold.ac.uk/research/rtn/pdf/literature-childcare123.pdf

Brandtstädter, J. (1984). Personal and social control over development: Some implications of an action perspective in life-span developmental psychology. In P. B. Baltes & O. G. Brim, Jr. (Eds.), *Life-span development and behavior* (Vol. 6, pp. 1–32). San Diego, CA: Academic Press.

Brandtstädter, J. (1989). Personal self-regulation of development: Cross-sequential analyses of development-related control beliefs and emotions. *Developmental Psychology, 25*, 96–108.

Brandtstädter, J. (2002). Searching for paths to successful development and aging: Integrating developmental and action-theoretical perspectives. In L. Pulkkinen & A. Caspi (Eds.), *Paths to successful development* (pp. 380–402). Cambridge, UK: Cambridge University Press.

Brandtstädter, J., & Baltes-Götz, B. (1990). Personal control over development and quality of life perspectives in adulthood. In P. B. Baltes & M. M. Baltes (Eds.), *Successful aging: Perspectives from behavioural sciences* (pp. 197–224). Cambridge, UK: Cambridge University Press.

Brenner, E. M., & Salovey, P. (1997). Emotion regulation during childhood: Developmental, interpersonal, and individual considerations. In P. Salovey & D. J. Sluyter (Eds.), *Emotional development and emotional intelligence: Educational implications* (pp. 168–192). New York: Basic Books.

Broidy, L. M., Nagin, D. S., Tremblay, R. E., Bates, J. E., Brame, B., Dodge, K. A., et al. (2003). Developmental trajectories of childhood disruptive behaviors and adolescent delinquency: A six-site, cross-national study. *Developmental Psychology, 39*, 222–245.

Broman, C. L., Hamilton, V. L., Hoffman, W. S., & Mavaddat, R. (1995). Race, gender, and the response to stress: Autoworkers' vulnerability to long-term unemployment. *American Journal of Community Psychology, 23*, 813–842.

Bromet, E. J., Parkinson, D. K., & Dunn, L. O. (1990). Long-term mental health consequences of the accident at Three Mile Island. *International Journal of Mental Health, 19*, 48–60.

Bronfenbrenner, U., & Crouter, A. C. (1982). Work and family through time and space. In S. B. Kamerman & C. D. Hayes (Eds.), *Families that work: Children in a changing world* (pp. 39–83). Washington, DC: National Academy Press.

Brooks-Gunn, J., Warren, M. P., Rosso, J., & Gargiulo, J. (1987). Validity of self-report measures of girls' pubertal status. *Child Development, 58*, 829–841.

Brosschot, J. F., & Thayer, J. F. (2004). Worry, perseverative thinking, and health. In I. Nyklicek, L. Temoshok, & A. Vingerhoets (Eds.), *Emotional expression and health. Advances in theory, assessment and clinical applications* (pp. 99–114). New York: Brunner-Routledge.

Bucholz, K. K., Cadoret, R., Cloninger, C. R., Dinwiddie, S. H., Hesselbrock, V. M., Nurnberger, J. I., et al. (1994). A new, semi-structured psychiatric interview for use in genetic linkage studies; A report on the reliability of the SSAGA. *Journal of Studies on Alcohol, 55*, 149–158.

Buss, A. H., & Perry, M. (1992). The Aggression Questionnaire. *Journal of Personality and Social Psychology, 63*, 452–459.

Cairns, R. B., & Cairns, B. D. (1994). *Lifelines and risks: Pathways of youth in our time*. Cambridge, U K: Cambridge University Press.

Cairns, R. B., Cairns, B. D., & Neckerman, H. J. (1989). Early school dropout: Configurations and determinants. *Child Development, 60*, 1437–1452.

Carver, C. S., & Scheier, M. (2003). Optimism. In S. J. Lopez & C. R. Snyder (Eds.), *Positive psychological assessment. A handbook of models and measures* (pp. 75–89). Washington, DC: American Psychological Association.

Caspi, A. (1998). Personality development across the life course. In W. S. E. Damon & N. V. E. Eisenberg (Eds.), *Handbook of child psychology: Social, emotional and personality development* (5th ed.): Vol. 3. *Social, emotional and personality development* (pp. 311–388). New York: Wiley.

Caspi, A., Elder, G. H., Jr., & Bem, D. J. (1987). Moving against the world: Life-course patterns of explosive children. *Developmental Psychology, 23*, 308–313.

Caspi, A., Elder, G. H. Jr., & Bem, D. J. (1988). Moving away from the world: Life-course patterns of shy children. *Developmental Psychology, 24*, 824–831.

Caspi, A., Lynam, D., Moffitt, T. E., & Silva, P. A. (1993). Unraveling girls' delinquency: Biological, dispositional, and contextual contributions to adolescent misbehavior. *Developmental Psychology, 29*, 19–30.

Caspi, A., McClay, J., Moffitt, T. E., Mill, J., Martin, J., Craig, I. W., et al. (2002). Role of genotype in the cycle of violence in maltreated children. *Science, 297*, 851–854.

Caspi, A., & Moffitt, T. (1991). Individual differences are accentuated during periods of social change: The sample case of girls at puberty. *Journal of Personality and Social Psychology, 61*, 157–168.

Caspi, A., Moffitt, T. E., Thornton, A., Freedman, D., Amell, J. W., Harrington, H., et al. (1996). The Life History Calendar: A research and clinical assessment method for collecting retrospective event-history data. *International Journal of Methods in Psychiatric Research, 6*, 101–114.

Caspi, A., Sugden, K., Moffitt, T. E., Taylor, A., Craig, I. W., Harrington, H., et al. (2003). Influence of life stress on depression: Moderation by a polymorphism in the 5-HTT gene. *Science, 301*, 386–389.

Caspi, A., Wright, B. R. E., Moffitt, T. E., & Silva, P. A. (1998). Early failure in the labor market: Childhood and adolescent predictors of unemployment in the transition to adulthood. *American Sociological Review, 63*, 424–451.

Cates, D. S., Houston, B. K., Vavak, C. R., Crawford, M. H., & Uttley, M. (1993). Heritability of hostility-related emotions, attitudes and behaviors. *Journal of Behavioral Medicine, 16*, 237–256.

Cattell, R. B., & Coan, R. W. (1959). Child personality structure as revealed in teachers' ratings. *Journal of Clinical Psychology*, *13*, 315–327.

Cavalli-Sforza, L. L., & Feldman, M. W. (1981). *Cultural transmission and evolution: A quantitative approach*. Princeton, NJ: Princeton University Press.

Cherlin, A. J., Kiernan, K. E., & Chase-Lansdale, P. L. (1995). Parental divorce in childhood and demographic outcomes in young adulthood. *Demography, 32*, 299–318.

Christensen, A. J., Edwards, D. L., Wiebe, J. S., Benotsch, E. G., McKelvey, L., Andrews, M., et al. (1995). Effects of verbal self-disclosure on natural killer cell activity: Moderating influence of cynical hostility. *Psychosomatic Medicine, 58*, 150–155.

Christensen, A. J., & Smith, T. W. (1993). Cynical hostility and cardiovascular reactivity during self-disclosure. *Psychosomatic Medicine, 55*, 193–202.

Christensen, K., Holm, N. V., McGue, M., Corder, L., & Vaupel, J. W. (1999). A Danish population-based twin study on general health in the elderly. *Journal of Aging and Health, 11*, 49–64.

Cicchetti, D., Ackerman, B. P., & Izard, C. E. (1995). Emotions and emotion regulation in developmental psychopathology. *Development and Psychopathology, 7*, 1–10.

Claussen, B., Björndal, A., & Hjort, P. F. (1993). Health and re-employment in a two year follow-up of long term unemployed. *Journal of Epidemiology and Community Health, 47*, 14–18.

Coccaro, E. F., Bergeman, C. S., Kavoussi, R. J., & Seroczynski, A. D. (1997). Heritability of aggression and irritability: A twin study of the Buss-Durkee aggression scales in adult male subjects. *Biological Psychiatry, 41*, 273–284.

Cohen, D. B. (1999). *Stranger in the nest: Do parents really shape their child's personality, intelligence, or character?* New York: Wiley.

Cohen, S., Tyrrell, D. A., & Smith, A. P. (1991). Psychological stress and susceptibility to the common cold. *New England Journal of Medicine, 325*, 606–612.

Cole, P. M., Michel, M. K., & Teti, L. (1994). The development of emotion regulation and dysregulation: A clinical perspective. In N. A. Fox (Ed.), *The development of emotion regulation: Biological and behavioral considerations* (pp. 73–100). Monographs of the Society for Research in Child Development, 59 (2–3, Serial No. 240). Chicago: University of Chicago Press.

Cole, T. J., Bellizzi, M. C., Flegal, K. M., & Dietz, W. H. (2000). Establishing a standard definition for child overweight and obesity worldwide: International survey. *British Medical Journal*, *320*, 1240–1243.

Cole, T. J., Freeman, J. V., & Preece, M. A. (1998). British 1990 growth reference centiles for weight, height, body mass index and head circumference fitted by maximum penalized likelihood. *Statistics in Medicine, 17*, 407–429.

Collins, W. A., Maccoby, E. E., Steinberg, L., Hetherington, E. M., & Bornstein, M. H. (2000). Contemporary research on parenting: The case for nature and nurture. *American Psychologist, 55*, 218–232.

Conger, K. J., Rueter, M. A., & Conger, R. D. (2000). The role of economic pressure in the lives of parents and their adolescents: The family stress model. In L. J. Crockett & R. K. Silbereisen (Eds.), *Negotiating adolescence in times of social change* (pp. 210–223). New York: Cambridge University Press.

Cooney, T. M., & Uhlenberg, P. (1992). Support from parents over the life course: The adult child's perspective. *Social Forces, 71*, 63–68.

Costa, P. T., Jr., & McCrae, R. R. (1985). *The NEO Personality Inventory manual*. Odessa, FL: Psychological Assessment Resources.

Côté, J. E., & Levine, C. G. (2002). *Identity formation, agency, and culture. A social psychological synthesis.* Mahwah, NJ: Lawrence Erlbaum Associates.

Creer, T. L. (2000). Self-management of chronic illness. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 601–629). New York: Academic Press.

Crouter, A. C., Bumpus, M. F., Head, M. R., & McHale, S. M. (2001). Implications of overwork and overload for the quality of men's family relationships. *Journal of Marriage and Family, 63*, 404–416.

Crouter, A. C., Bumpus, M. F., Maguire, M. C., & McHale, S. M. (1999). Linking parents' work pressures and adolescents' well-being: Insights into dynamics in dual-earner families. *Developmental Psychology, 35*, 1453–1461.

Crouter, A. C., & Head, M. R. (2002). Parental monitoring and knowledge of children. In M. H. Bornstein (Ed.), *Handbook of parenting, Vol. 3: Being and becoming a parent* (2nd ed., pp. 461–483). Mahwah, NJ: Erlbaum.

Daley, S. E., & Hammen, C. (2002). Depressive symptoms and close relationships during the transition to adulthood: Perspectives from dysphoric women, their best friends, and their romantic partners. *Journal of Consulting and Clinical Psychology, 70*, 129–141.

Deary, I. J., Scott, S., & Wilson, J. A. (1997). Neuroticism, alexithymia and medically unexplained symptoms. *Personality and Individual Differences, 22*, 551–564.

DeGrip, A., Hoevenberg, J., & Willems, E. (1997). Atypical employment in the European Union. *International Labour Review, 136*, 49–71.

Depue, R. (1987). *General Behavior Inventory*. Cornell University: Department of Psychology.

Derryberry, D., & Rothbart, M. K. (1988). Arousal, affect, and attention as components of temperament. *Journal of Personality and Social Psychology, 55*, 958–966.

de St. Aubin, E., McAdams, D. P., & Kim, T.-C. (2004). *The generative society: Caring for future generations.* Washington, DC: American Psychological Association.

Dewit, D. J., Wister, A. V., & Burch, T. K. (1988). Physical distance and social contact between elders and their adult children. *Research on Aging, 10*, 56–80.

Diaz, R. M., Neal, C. J., & Amaya-Williams, M. (1990). The social origins of self-regulation. In L. C. Moll (Ed.), *Vygotsky and education* (pp. 127–154). New York: Cambridge University Press.

Dick, D. M., Johnson, J. K., Viken, R. J., & Rose, R. J. (2000). Testing between-family associations in within-family comparisons. *Psychological Science, 11*, 409–413.

Dick, D. M., Purcell, S., Viken, R., Kaprio, J., Pulkkinen, L., & Rose, R. J. (2005). Evidence for gene environment interaction associated with parenting practices and adolescent substance use. Manuscript submitted for publication.

Dick, D. M., Rose, R. J., & Kaprio, J. (in press). The next challenge for psychiatric genetics: Characterizing the risk associated with identified genes. *Annals of Clinical Psychiatry*.

Dick, D. M., Rose, R. J., Pulkkinen, L., & Kaprio, J. (2001). Measuring puberty and understanding its impact: A longitudinal study of adolescent twins. *Journal of Youth and Adolescence, 30*, 385–399.

Dick, D. M., Rose, R. J., Viken, R. J., & Kaprio, J. (2000). Pubertal timing and substance use: Associations between and within families across late adolescence. *Developmental Psychology, 36*, 180–189.

Dick, D. M., Rose, R. J., Viken, R. J., Kaprio, J., & Koskenvuo, M. (2001). Exploring gene-environment interactions: Socioregional moderation of alcohol use. *Journal of Abnormal Psychology, 110*, 625–632.

Dohrenwend, B. S., Krasnoff, L., Askenasy, A. R., & Dohrenwend, B. P. (1982). The Psychiatric Epidemiology Research Interview Life Events scale. In L. Goldberger & S. Breznitz (Eds.), *Handbook of stress: Theoretical and clinical aspects* (pp. 332–363). London: Macmillan.

D'Onofrio, B. M., Turkheimer, E. N., Eaves, L. J., Corey, L. A., Berg, K., Solass, M. H., et al. (2003). The role of the children of twins design in elucidating causal relations between parent characteristics and child outcomes. *Journal of Child Psychology and Psychiatry, 44*, 1130–1144.

D'Onofrio, B. M., Turkheimer, E., Emery, R. E., Slutske, W. S., Heath, A. C., Madden, P. A., et al. (in press a). A genetically informed study of marital instability and its association with offspring psychopathology. *Journal of Abnormal Psychology.*

D'Onofrio, B. M., Turkheimer, E., Emery, R. E., Slutske, W. S., Heath, A. C., Madden, P. A., et al. (in press b). A genetically informed study of the processes underlying the association between parental marital instability and offspring life course patterns. *Developmental Psychology.*

Donovan, J. E., Jessor, R., & Costa, F. M. (1993). Structure of health-enhancing behavior in adolescence: A latent-variable approach. *Journal of Health and Social Behavior, 34,* 346–362.

Dubas, J. S. (2001). How gender moderates the grandparent-grandchild relationship. A comparison of kin-keeper and kin-selector theories. *Journal of Family Issues, 22*, 478–492.

Duncan, T. E., Duncan, S. C., Strycker, L. A., Li, F., & Alpert, A. (1999). *An introduction to latent variable growth curve modeling. Concepts, issues, and applications.* Mahwah, NJ: Lawrence Erlbaum Associates.

Eaves, L. J., Silberg, J. L., Meyer, J. M., Maes, H. H., Simonoff, E., Pickles, A., et al. (1997). Genetics and developmental psychopathology: 2. The main effects of genes and environment on behavioral problems in the Virginia Twin Study of Adolescent Behavioral Development. *Journal of Child Psychology and Psychiatry, 38*, 965–980.

Eggebeen, D. (1992). From generation unto generation: Parent-child support in aging American families. *Generations, 16*, 45–50.

Eisenberg, N. (1998). Introduction. In W. Damon (Series Ed.) & N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (5th ed., pp. 1–24). New York: Wiley.

Eisenberg, N., Cameron, E., Tryon, K., & Dodez, R. (1981). Socialization of prosocial behavior in the preschool classroom. *Developmental Psychology, 17*, 773–782.

Eisenberg, N., & Fabes, R. (1998). Prosocial development. In W. Damon (Series Ed.) & N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social, emotional and personality development* (5th ed., pp. 701–778). New York: Wiley.

Eisenberg, N., Fabes, R. A., Guthrie, I. K., & Reiser, M. (2000). Dispositional emotionality and regulation: Their role in predicting quality of social functioning. *Journal of Personality and Social Psychology, 78,* 136–157.

Eisenberg, N., Fabes, R. A., Guthrie, I. K., & Reiser, M. (2002). The role of emotionality and regulation in children's social competence and adjustment. In L. Pulkkinen & A. Caspi (Eds.), *Paths to successful development. Personality in the life course* (pp. 46–70). Cambridge, UK: Cambridge University Press.

Eisenberg, N., Fabes, R. A., & Losoya, S. (1997). Emotional responding: regulation, social correlates, and socialization. In P. Salovey & D. J. Sluyter (Eds.), *Emotional development and emotional intelligence: Educational implications* (pp. 129–163). New York: Basic Books.

Eisenberg, N., Pasternack, J. F., Cameron, E., & Tryon, K. (1984). The relation of quantity and mode of prosocial behavior to moral cognitions and social style. *Child Development, 55*, 1479–1485.

Elder, G. H., Jr. (1974). *Children of the Great Depression*. Chicago: University of Chicago Press.

Eley, T. C. (1999). Behavioral genetics as a tool for developmental psychology: Anxiety and depression in children and adolescents. *Clinical Child and Family Psychology Review, 2*, 21–36.

Eley, T. C., Lichtenstein, P., & Moffitt, T. E. (2003). A longitudinal behavior genetic analysis of the etiology of aggressive and nonaggressive antisocial behavior. *Development and Psychopathology, 15*, 383–402.

Eley, T. C., Lichtenstein, P., & Stevenson, J. (1999). Sex differences in the etiology of aggressive and nonaggressive antisocial behavior: Results from two twin studies. *Child Development, 70*, 155–168.

Eley, T. C., & Stevenson, J. (1999). Exploring the covariation between anxiety and depression. *Journal of Child Psychology and Psychiatry, 40*, 1272–1283.

Elovainio, M., Kivimäki, M., & Vahtera, J. (2002). Organizational justice: Evidence of a new psychosocial predictor of health. *American Journal of Public Health, 92*, 105–108.

Erber, R. (1996). The self-regulation of moods. In L. L. Martin & A. Tesser (Eds.), *Striving and feeling: Interactions among goals, affect, and self-regulation* (pp. 251–275). Mahwah, NJ: Lawrence Erlbaum Associates.

Eriksen, H. G., Olff, M., & Ursin, H. (1997). The CODE: A revised battery for coping and defense and its relations to subjective health. *Scandinavian Journal of Psychology, 38*, 175–182.

Erikson, E. H. (1950). *Childhood and society.* New York: Norton.

Erikson, E. H. (1968). *Identity, youth and crisis.* New York: Norton.

Eriksson, C. J. P., Kaprio, J., Pulkkinen, L., & Rose, R. J. (2005). Testosterone and alcohol use among adolescent male twins: Testing between-family associations in within-family comparisons. *Behavior Genetics, 35*, 359–368.

Eriksson, J., Forsen, T., Osmond, C., & Barker, D. (2003). Obesity from cradle to grave. *International Journal of Obesity and Related Metabolic Disorders, 27*, 722–727.

Eurostat. (2000). *The social situation in the European Union 2000.* Luxembourg: European Commission.

Everson, S. A., Maty, S. C., Lynch, J. W., & Kaplan, G. A. (2002). Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *Journal of Psychosomatic Research, 53*, 891–895.

Ewing, J. A. (1984). Detecting alcoholism: The CAGE questionnaire. *Journal of the American Medical Association, 252*, 1905–1907.

Extremera, N., & Fernández-Berrocal, P. (2002). Relation of perceived emotional intelligence and health-related quality of life of middle-aged women. *Psychological Reports, 91*, 47–59.

Eysenck, H. J., & Eysenck, M. W. (1963). *The Eysenck Personality Inventory*. London: University of London Press.

Eysenck, H. J., & Eysenck, S. B. G. (1975). *Manual of the Eysenck Personality Questionnaire*. London: Hodder and Stoughton.

Fadjukoff, P., Pulkkinen, L., & Kokko, K. (2005). Identity processes in adulthood: Diverging domains. *Identity: An International Journal of Theory and Research, 5*, 1–20.

Farrington, D. P. (1988). Studying changes within individuals: The causes of offending. In M. Rutter (Ed.), *The power of longitudinal data: Studies of risk and protective factors for psychosocial disorders* (pp. 158–183). Cambridge, UK: Cambridge University Press.

Farrington, D. P. (1991). Childhood aggression and adult violence: Early precursors and later life outcomes. In K. H. Rubin & D. Pepler (Eds.), *The development and treatment of childhood aggression* (pp. 169–188). Hillsdale, NJ: Lawrence Erlbaum.

Feldman, L. A. (1995). Valence arousal and arousal focus: Individual differences in the structure of affective experience. *Journal of Personality and Social Psychology, 69*, 153–166.

Feldt, T. (2000). *Sense of coherence: Structure, stability and health promoting role in working life*. (Jyväskylä Studies in Education, Psychology and Social Research, No. 158). Jyväskylä, Finland: University of Jyväskylä.

Feldt, T., Kivimäki, M., Rantala, A., & Tolvanen, A. (2004). Sense of coherence and work characteristics: A cross-lagged structural equation model among managers. *Journal of Occupational and Organizational Psychology, 77*, 323–342.

Feldt, T., Kokko, K., Kinnunen, U., & Pulkkinen, L. (2005). The role of family of origin and career background in the development of sense of coherence. *European Psychologist, 10*, 298–308.

Feldt, T., Leskinen, E., Kinnunen, U., & Ruoppila, I. (2003). The stability of sense of coherence: Comparing two age groups in a 5-year follow-up study. *Personality and Individual Differences, 35*, 1151–1165.

Fergusson, D. M., Horwood, L. J., & Lynskey, M. T. (1997). The effects of unemployment on psychiatric illness during young adulthood. *Psychological Medicine, 27*, 371–381.

Foley, D. L., Neale, M. C., & Kendler, K. S. (1996). A longitudinal study of stressful life events assessed at interview with an epidemiological sample of adult twins: The basis of individual variation in event exposure. *Psychological Medicine, 26*, 1239–1252.

Ford, E. S., Giles, W. H., & Dietz, W. H. (2002). Prevalence of the metabolic syndrome among US adults. Findings from the Third National Health and Nutrition Examination Survey. *Journal of the American Medical Association, 287*, 356–359.

Friedman, M., & Rosenman, R. (1959). Association of specific overt behavior pattern with blood and cardiovascular findings. *Journal of the American Medical Association, 12*, 1286–1296.

Friedman, M., & Rosenman, R. H. (1974). *Type A behavior and your heart*. New York: Knopf.

Frisancho, A. R. (2000). Prenatal compared with parental origins of adolescent fatness. *American Journal of Clinical Nutrition, 72*, 1186–1190.

Frone, M. R. (2003). Work-family balance. In J. C. Quick & L. E. Tetric (Eds.), *Handbook of occupational health psychology* (pp. 143–162). Washington, DC: American Psychological Association.

Fryer, D., & Winefield, A. H. (1998). Employment stress and unemployment distress as two varieties of labour market induced psychological strain: An explanatory framework. *Australian Journal of Social Research, 5*, 3–18.

Fulker, D. W. (1988). Path analysis of genetic and cultural transmission in human behavior. In B. S.Weir, M. M. Goodman, E. J. Eisen, & G. Namkoong (Eds.), *Proceedings of the second international conference on quantitative genetics* (pp. 318–340). Sunderland, MA: Sinauer Associates.

Galambos, N., Sears, H. A., Almeida, D. M., & Kolaric, G. C. (1995). Parents' work overload and problem behavior in young adolescents. *Journal of Research on Adolescence, 5*, 201–223.

Galinsky, E. (2000). *Ask the children*. New York: Quill.

Garber, J., & Dodge, K. (1991). *The development of emotion regulation and dysregulation.* New York: Cambridge University Press.

Ge, X., Conger, R. D., & Elder, G. H., Jr. (1996). Coming of age too early: Pubertal influences on girls' vulnerability to psychological distress. *Child Development, 67*, 3386–3400.

Gerris, J. R. M., Vermulst, A. A., van Boxtel, D. A. A. M., Janssens, J. M. A. M., van Zutphen, R. A. H., & Felling, A. J. A., (1993). *Parenting in Dutch families: A representative description of Dutch family life in terms of validated concepts representing characteristics of parents, children, the family as a system and parental socio-cultural value orientations.* University of Nijmegen, the Netherlands: Institute of Family Studies.

Gertow, K., Pietiläinen, K. H., Yki-Järvinen, H., Kaprio, J., Rissanen, A., Eriksson, P., et al. (2004). Expression of fatty-acid-handling proteins in human adipose tissue in relation to obesity and insulin resistance. *Diabetologia, 47*, 1118–1125.

Geurts, S. (2000). *SWING: Survey Work-home Interaction – NijmeGen*. Nijmegen, the Netherlands: University of Nijmegen.

Gilmore, A. B. C., McKee, M., & Rose, R. (2002). Determinants of and inequalities in self-perceived health in Ukraine. *Social Science and Medicine, 55*, 2177–2188.

Gjone, H., Stevenson, J., Sundet, J. M., & Eilertsen, D. E. (1996). Changes in heritability across increasing levels of behavior problems in young twins. *Behavior Genetics, 26*, 419–426.

Goldberg, D. P. (1972). *The detection of psychiatric illnesses by questionnaire*. London: Oxford University Press.

Golden, W. L. (1981). Reproductive histories in a Norwegian twin population: Evaluation of the maternal effect in early spontaneous abortion. *Acta Geneticae Medicae et Gemellologiae, 30*, 91–165.

Goldman, S. L., Kraemer, D. T., & Salovey, P. (1996). Beliefs about mood moderate the relationship of stress to illness and symptom reporting. *Journal of Psychosomatic Research, 41,* 115–128.

Gottesman, I. I., & Hanson, D. R. (2005). Human development: Biological and genetic processes. *Annual Review of Psychology, 56,* 263–286.

Gottfredson, L. S. (2004). Intelligence: Is it the epidemiologists' elusive "fundamental cause" of social class inequalities in health? *Journal of Personality and Social Psychology, 86,* 174–199.

Gottfried, A. E., Gottfried, A. W., & Bathurst, K. (2002). Maternal and dual-earner employment status and parenting. In M. H. Bornstein (Ed.), *Handbook of parenting: Vol. 2. Biology and Ecology of Parenting* (pp. 207–229). London: Lawrence Erlbaum.

Graber, J. A., Brooks-Gunn, J., & Warren, M. P. (1995). The antecedents of menarcheal age: Heredity, family environment, and stressful life events. *Child Development, 66,* 346–359.

Grant, B. F., & Dawson, D. A. (1997). Age at onset of alcohol use and its association with *DSM-IV* alcohol abuse and dependence: Results from the National Longitudinal Alcohol Epidemiological Survey. *Journal of Substance Abuse, 9,* 103–110.

Greenglass, E. R., & Burke, R. J. (1997, September). *Hospital restructuring, anger and hostility in nurses*. Paper presented at the 11th Conference of the European Health Psychology Society, Bordeaux, France.

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology, 74,* 224–237.

Gross, J. J. (1999a). Emotion and emotion regulation. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp. 525–552). New York: Guilford Press.

Gross, J. J. (1999b). Emotion regulation: Past, present, future. *Cognition and Emotion, 13,* 551–573.

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85,* 348–362.

Grotevant, H. D., Thorbecke, W., & Meyer, M. L. (1982). An extension of Marcia's Identity Status Interview into the interpersonal domain. *Journal of Research in Personality, 28,* 436–452.

Gutmann, D. L. (1985). Deculturation and the American grandparent. In V. L. Bengtson & J. F. Robertson (Eds.), *Grandparenthood* (pp. 173–181). London: Sage.

Haapasalo, J. (1990). *Eysenckin persoonallisuuskyselyn ja Zuckermanin elämyshakuisuus-asteikon faktorirakenteet ja pisteitys Suomessa* [Eysenck Personality Questionnaire and Zuckerman Sensation Seeking Scale: Factor structure and scoring in Finland] (Reports No. 311). University of Jyväskylä, Finland, Department of Psychology.

Hämäläinen, M., & Pulkkinen, L. (1996). Problem behavior as a precursor of male criminality. *Development and Psychopathology, 8*, 443–455.

Hammarström, A., & Janlert, U. (1997). Nervous and depressive symptoms in a longitudinal study of youth unemployment. *Journal of Adolescence, 20*, 293–306.

Hanisch, K. A. (1999). Job loss and unemployment research from 1994 to 1998: A review and recommendations for research and intervention. *Journal of Vocational Behavior, 55*, 188–220.

Hannukainen, J. C., Kujala, U. M., Toikka, J., Heinonen, O. J., Kapanen, J., Vahlberg, T., et al. (2005). Cardiac structure and function in monozygotic twin pairs discordant for physical fitness. *Journal of Applied Physiology, 99*, 535–541.

Happonen, M., Pulkkinen, L., Kaprio, J., Van der Meere, J., Viken, R. J., & Rose, R. J. (2002). The heritability of depressive symptoms: Multiple informant and multiple measures. *Journal of Child Psychology and Psychiatry, 43*, 471–479.

Harris, J. R. (1998). *The nurture assumption: Why children turn out the way they do*. New York: Free Press.

Harris, J. R., Pedersen, N. L., McClearn, G. E., Plomin, R., & Nesselroade, J. R. (1992). Age differences in genetic and environmental influences for health from the Swedish adoption/twin study of aging. *Journal of Gerontology, 47*, P213-P220.

Havighurst, R. J. (1982). *Developmental tasks and education.* New York: Longman. (Original work published 1948)

Hay, D. F. (1994). Prosocial development. *Journal of Child Psychology and Psychiatry, 35*, 29–71.

Heidrich, J., Liese, A. D., Löwel, H., & Keil, U. (2002). Self-rated health and its relation to all-cause and cardiovascular mortality in southern Germany: Results from the MONICA Augsburg Cohort Study 1984–1995. *Annals of Epidemiology, 12*, 338–345.

Heistaro, S., Jousilahti, P., Lahelma, E., Vartiainen, E., & Puska, P. (2001). Self-rated health and mortality: A long term prospective study in eastern Finland. *Journal of Epidemiology and Community Health, 55*, 227–232.

Helmers, K. F., & Mente, A. (1999). Alexithymia and health behaviors in healthy male volunteers. *Journal of Psychosomatic Research, 47*, 635–645.

Hemingway, H., & Marmot, M. (1999). Evidence based cardiology: Psychosocial factors in the aetiology and prognosis of coronary heart disease. Systematic review of prospective cohort studies. *British Medical Journal, 318*, 1460–1467.

Herman-Stahl, M. A., Stemmler, M., & Petersen, A. C. (1995). Approach and avoidant coping: Implications for adolescent mental health. *Journal of Youth and Adolescence, 24*, 649–665.

Hill, J. O., Wyatt, H. R., Reed, G. W., & Peters, J. C. (2003). Obesity and the environment: Where do we go from here? *Science, 299*, 853–855.

Hoff, E., Laursen, B., & Tardif, T. (2002). Socioeconomic status and parenting. In M. H. Bornstein (Ed.), *Handbook of parenting: Vol. 2. Biology and ecology of parenting* (2nd ed., pp. 231–252). Mahwah, NJ: Erlbaum.

Hofstede, G. (1994). *Cultures and organizations.* London: HarperCollins.

Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research, 11*, 213–218.

Honkapohja, S., & Koskela, E. (2001). The economic crisis of the 1990s in Finland. In J. Kalela, J. Kiander, U. Kivikuru, H. A. Loikkanen, & J. Simpura (Eds.), *Down from the heavens, up from the ashes* (pp. 52–101). Helsinki: Government Institute for Economic Research.

Hopp, R. J., Bewtra, A. K., Watt, G. D., Nair, M. M., & Townley, R. G. (1984). Genetic analysis of allergic disease in twins. *Journal of Allergy and Clinical Immunology, 73*, 265–270.

Hunt, C. B., & Rowe, D. C. (2003). Genetic and shared environmental influences on adolescents' timing of first sexual intercourse: The moderating effect of time spent with a sibling. In J. L. Rodgers & H.-P. Kohler (Eds.), *The biodemography of human reproduction and fertility* (pp.161–185). Boston: Kluwer.

Hurme, H. (1988). *Child, mother and grandmother. Intergenerational interaction in Finnish families* (Jyväskylä Studies in Education, Psychology and Social Research, No. 64). Jyväskylä, Finland: University of Jyväskylä.

Hurme, H. (1991). The grandparent role in Finland. In P. K. Smith (Ed.), *The psychology of grandparenthood* (pp. 19–31). London: Routledge.

Hurrell, J. J. (1998). Editorial. *American Journal of Public Health, 88*, 1012–1013.

Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health and Social Behavior, 38*, 21–37.

Idler, E. L., & Kasl, S. V. (1995). Self-ratings of health: Do they also predict change in functional ability? *Journal of Gerontology, 50B*, S344–S353.

Jacobson, K. C., & Crockett, L. J. (2000). Parental monitoring and adolescent adjustment: An ecological perspective. *Journal of Research on Adolescence, 10*, 65–97.

Jaffee, S. R., Caspi, A., Moffitt, T. E., Dodge, K. A., Rutter, M., Taylor, A., et al. (2005). Nature X nurture: Genetic vulnerabilities interact with physical maltreatment to promote conduct problems. *Development and Psychopathology, 17*, 67–84.

Jahoda, M., Lazarsfeld, P. F., & Zeisl, H. (1972). *Marienthal: The sociography of an unemployed community.* London: Tavistock. (Original work published 1933)

Jain, A., Belsky, J., & Crnic, K. (1996). Beyond fathering behaviors: Types of dads. *Journal of Family Psychology, 10*, 431–442.

Jensen, P. S., Martin, D., & Cantwell, D. P. (1997). Comorbidity in ADHD: Implications for research, practice, and DSM-V. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*, 1065–1079.

Johnson, W., McGue, M., Krueger, R. F., & Bouchard, T. J., Jr. (2004). Marriage and personality: A genetic analysis. *Journal of Personality and Social Psychology, 86*, 285–294.

Jolliffe, D. (2004). Extent of overweight among U.S. children and adolescents from 1971 to 2000. *International Journal of Obesity and Related Metabolic Disorders, 28*, 4–9.

Jöreskog, K. G., & Sörbom, C. (1996). *Prelis 2: User's reference guide* (3rd ed.). Chicago: Scientific Software International.

Jöreskog, K. G., & Sörbom, D. (1996). *Lisrel 8: User's reference guide.* Chicago: Scientific Software International.

Jöreskog, K. G., Sörbom, D., du Toit, S., & du Toit, M. (1999). *Lisrel 8: New statistical features.* Chicago: Scientific Software International.

Josselson, R. (1996). *Revising herself: The story of women's identity from college to midlife*. New York: Oxford University Press.

Junger-Tas, J., Terlouw, J.-G., & Klein, M. W. (Eds.). (1994). *Delinquent behavior among young people in the Western world. First results of the international self-report delinquency study*. Amsterdam: Kugler Publications.

Juujärvi, P., Kaartinen, J., Laitinen, T., Vanninen, E., & Pulkkinen, L. (in press). Effects of physical provocations on heart rate reactivity and reactive aggression in children. *Aggressive Behavior.*

Juujärvi, P., Kaartinen, J., Vanninen, E., Laitinen, T., & Pulkkinen, L. (in press). Controlling the intensity of reactive aggression through cognitive evaluation of proactive aggression cues. *Cognition & Emotion.*

Kagan, J. (1971). *Change and continuity in infancy*. New York: Wiley.

Kamarck, T. W., Annunziato, B., & Amateau, L. M. (1995). Affiliation moderates the effects of social threat on stress-related cardiovascular responses: Boundary conditions for a laboratory model of social support. *Psychosomatic Medicine, 57*, 183–194.

Kannisto, K., Pietiläinen, K. H., Ehrenborg, E., Rissanen, A., Kaprio, J., Hamsten, A., et al. (2004). Overexpression of 11 beta-hydroxysteroid dehydrogenase-1 in adipose tissue is associated with acquired obesity and features of insulin resistance: Studies in young adult monozygotic twins. *Journal of Clinical Endocrinology and Metabolism, 89*, 4414–4421.

Kaprio, J., & Koskenvuo, M. (2002). Genetic and environmental factors in complex diseases: The older Finnish Twin Cohort. *Twin Research, 5*, 358–365.

Kaprio, J., Koskenvuo, M., & Rose, R. J. (1990). Population-based twin registries: Illustrative applications in genetic epidemiology and behavioral genetics from the Finnish Twin Cohort Study. *Acta Geneticae Medicae et Gemellologiae, 39*, 427–439.

Kaprio, J., Pulkkinen, L., & Rose, R. J. (2002). Genetic and environmental factors in health-related behaviors: Studies on Finnish twins and twin families. *Twin Research, 5*, 366–371.

Kaprio, J., Rimpelä, A., Winter, T., Viken, R. J., Rimpelä, M., & Rose, R. J. (1995). Common genetic influences on BMI and age at menarche. *Human Biology, 67*, 739–753.

Kaprio, J., Sarna, S., Koskenvuo, M., & Rantasalo, I. (1978). The Finnish Twin registry: Formation and compilation, questionnaire study, zygosity determination procedures, and research program. In W. E. Nance (Ed.), *Twin research: Part B. Biology and epidemiology* (pp. 179–184). New York: Alan R. Liss.

Karasek, R., & Theorell, T. (1990). *Stress, productivity and reconstruction of working life*. New York: Basic Books.

Karasek, R. A. (1979). Job demands, job decision latitude and mental strain: Implications for job redesign. *Administrative Science Quarterly, 24*, 285–307.

Karlberg, L., Krakau, I., & Unden, A.-L. (1998). Type A behavior intervention in primary health care reduces hostility and time pressure: A study in Sweden. *Social Sciences and Medicine, 46*, 397–402.

Kartovaara, L. (2001). Children's grandparents. In L. Kartovaara & H. Sauli (Eds.), *Children in Finland*. (pp. 20–29). (Population. 2001:9). Helsinki: Statistics Finland.

Kartovaara, L., & Sauli, H. (2001). *Children in Finland*. (Population. 2001:9). Helsinki: Statistics Finland.

Katz, I. M., & Campbell, J. D. (1994). Ambivalence over emotional expression and well-being: Nomothetic and idiographic tests of the stress-buffering hypothesis. *Journal of Personality and Social Psychology, 67*, 513–524.

Kauhanen, J., Kaplan, G. A., Cohen, R. D., Julkunen, J., & Salonen, J. T. (1996). Alexithymia and risk of death in middle-aged men. *Journal of Psychosomatic Research, 41*, 541–549.

Kautiainen, S., Rimpelä, A., Vikat, A., & Virtanen, S. M. (2002). Secular trends in overweight and obesity among Finnish adolescents in 1977–1999. *International Journal of Obesity and Related Metabolic Disorders*, 26, 544–552.

Keiley, M. K., Bates, J., Dodge, K., & Petit, G. (2000). A cross domain analysis: Externalizing and internalizing behaviors during 8 years of childhood. *Journal of Abnormal Child Psychology, 28*, 161–179.

Kendall, P. C., & Wilcox, L. E. (1979). Self-control in children: Development of a rating scale. *Journal of Consulting and Clinical Psychology, 47*, 1020–1029.

Kendler, K. S. (1997). Social support: A genetic-epidemiological analysis. *American Journal of Psychiatry*, *154*, 1398–1404.

Kendler, K. S., Kessler, R. C., Walters, E. E., MacLean, C., Neale, M. C., Heath, A. C., et al. (1995). Stressful life events, genetic liability, and onset of an episode of major depression in women. *American Journal of Psychiatry, 152*, 833–842.

Keski-Rahkonen, A., Bulik, C. M., Neale, B. M., Rose, R. J., Rissanen, A., & Kaprio, J. (2005). Body dissatisfaction and drive for thinness in young adult twins. *International Journal of Eating Disorders, 37*, 188–199.

Keski-Rahkonen, A., Viken, R. J., Kaprio, J., Rissanen, A., & Rose, R. J. (2004). Genetic and environmental factors in breakfast eating patterns. *Behavior Genetics, 34*, 503–514.

Keyes, C. L. M. (1998). Social well-being. *Social Psychology Quarterly, 61*, 121–140.

Keys, A. B. (1980). *Seven countries: A multivariate analysis of death and coronary heart disease*. Cambridge, MA: Harvard University Press.

King, L. A. (1998). Ambivalence over emotional expression and reading emotions in situations and faces. *Journal of Personality and Social Psychology, 74*, 753–762.

King, L. A., & Emmons, R. A. (1990). Conflict over emotional expression: Psychological and physical correlates. *Journal of Personality and Social Psychology, 58*, 864–877.

King L. A., & Emmons R. A. (1991). Psychological, physical, and interpersonal correlates of emotional expressiveness, conflict, and control. *European Journal of Personality*, *5*, 131–150.

King, L. A., Emmons, R. A., & Woodley, S. (1992). The structure of inhibition. *Journal of Research in Personality, 26*, 85–102.

King, V., & Elder, G. H. (1997). The legacy of grandparenting: Childhood experiences with grandparents and current involvement with grandchildren. *Journal of Marriage and Family*, *59*, 848–859.

Kinnunen, M.-L., Kokkonen, M., Kaprio, J., & Pulkkinen, L. (2005). The associations of emotion regulation and dysregulation with the metabolic syndrome factor. *Journal of Psychosomatic Research, 58*, (513–521).

Kinnunen, M.-L., & Pulkkinen, L. (2002, August). *Alcohol use and the metabolic syndrome*. Paper presented at the XIII Medical Symposium of Yrjö Jahnsson Foundation, Porvoo, Finland.

Kinnunen, U., & Feldt, T. (2004). Economic stress and marital adjustment among couples: Analyses at the dyadic level. *European Journal of Social Psychology, 34*, 519–532.

Kinnunen, U., Feldt, T., Rantanen, J., & Pulkkinen, L. (2005). Työn ja perheen vuorovaikutus: menetelmä kielteisen ja myönteisen vuorovaikutuksen tutkimiseen. [A measure for studying negative and positive spillover between work and family.] *Psykologia, 40*, 43–52.

Kinnunen, U., & Pulkkinen, L. (1998). Linking economic stress to marital quality among Finnish marital couples. *Journal of Family Issues, 19*, 705–724.

Kinnunen, U., & Pulkkinen, L. (2001). Linking job characteristics to parenting behavior via job-related affect. In J. R. M. Gerris (Ed.), *Dynamics of parenting* (pp. 233–249). Leuven, Belgium: Garant Publishers.

Kinnunen, U., & Pulkkinen, L. (2003). Childhood socioemotional characteristics as antecedents of marital stability and quality. *European Psychologist*, *8*, 223–237.

Kivimäki, M., Elovainio, M., Kokko, K., Pulkkinen, L., Kortteinen, M., & Tuomikoski, H. (2003). Hostility, unemployment and health status: Testing three theoretical models. *Social Science and Medicine, 56*, 2139–2152.

Kivimäki, M., Elovainio, M., Vahtera, J., Virtanen, M., & Stansfeld, S. A. (2003). Association between organisational inequity and incidence of psychiatric disorders in female employees. *Psychological Medicine, 33*, 319–326.

Kivimäki, M., Kinnunen, M.-L., Pitkänen, T., Vahtera, J., Elovainio, M., & Pulkkinen, L. (2004). Contribution of early and adult factors to socioeconomic variation in blood pressure: 34-year follow-up study of school children. *Psychosomatic Medicine, 66*, 184–189.

Kivimäki, M., Leino-Arjas, P., Luukkonen, R., Riihimäki, H., Vahtera, J., & Kirjonen, J. (2002). Work stress and risk of cardiovascular mortality: Prospective cohort study of industrial employees. *British Medical Journal, 325*, 857–860.

Kivimäki, M., Vahtera, J., Koskenvuo, M., Uutela, A., & Pentti, J. (1998). Response of hostile individuals to stressful changes in their working lives: Test of a psychosocial vulnerability model. *Psychological Medicine, 28*, 903–913.

Kivimäki, M., Vahtera, J., Virtanen, M., Elovainio, M., Pentti, J., & Ferrie, J. E. (2003). Temporary employment and risk of overall and cause-specific mortality. *American Journal of Epidemiology, 158*, 663–668.

Kivnick, H. Q. (1982). *The meaning of grandparenthood*. Ann Arbor, MI: UMI Research Press.

Knight, G. P., Fabes, R. A., & Higgins, D. A. (1996). Concerns about drawing causal inferences from meta-analyses: An example in the study of gender differences in aggression. *Psychological Bulletin, 119*, 410–421.

Kokko, K. (2001). *Antecedents and consequences of long-term unemployment* (Jyväskylä Studies in Education, Psychology and Social Research, No. 183). Jyväskylä, Finland: University of Jyväskylä.

Kokko, K., Bergman, L. R., & Pulkkinen, L. (2003). Child personality characteristics and selection into long-term unemployment in Finnish and Swedish longitudinal samples. *International Journal of Behavioral Development, 27*, 134–144.

Kokko, K., & Pulkkinen, L. (1998). Unemployment and psychological distress: Mediator effects. *Journal of Adult Development, 5*, 205–217.

Kokko, K., & Pulkkinen, L. (2000). Aggression in childhood and long-term unemployment in adulthood: A cycle of maladaptation and some protective factors. *Developmental Psychology, 36*, 463–472.

Kokko, K., & Pulkkinen, L. (2002, August). *Length and recency of unemployment and psychological distress in adulthood.* Paper presented at the XVIIth Biennial International Society for the Study of Behavioural Development Meeting, Ottawa, Canada.

Kokko, K., & Pulkkinen, L. (2005). Stability of aggressive behavior from childhood to middle age in women and men. *Aggressive Behavior, 31*, 485–497.

Kokko, K., Pulkkinen, L., & Puustinen, M. (2000). Selection into long-term unemployment and its psychological consequences. *International Journal of Behavioral Development*, *24*, 310–320.

Kokkonen, M., Kinnunen T., & Pulkkinen L. (2002). Direct and indirect effects of adolescent self-control of emotions and behavioral expression on adult health outcomes. *Psychology and Health, 17*, 657–670.

Komter, A. E., & Vollebergh, W. A. M. (2002). Solidarity in Dutch families. Family ties under stress. *Journal of Family Issues, 23*, 171–188.

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology, 18,* 199–214.

Koskenvuo, M., Kaprio, J., Rose, R. J., Kesäniemi, A., Sarna, S., Heikkilä, K., et al. (1988). Hostility as a risk factor for mortality and ischemic heart disease in men. *Psychosomatic Medicine, 50*, 330–340.

Kovacs, M. (1992). *Children's Depression Inventory CDI.* Manual. North Tonawanda, NY: Multi-Health Systems.

Kowner, R. (2001). Psychological perspective on human developmental stability and fluctuating asymmetry: Source, application and implication. *British Journal of Psychology, 92*, 447–469.

Kposowa, A. J. (2001). Unemployment and suicide: A cohort analysis of social factors predicting suicide in the US National Longitudinal Mortality Study. *Psychological Medicine, 31*, 127–138.

Kristenson, H., & Trell, E. (1982). Indicators of alcohol consumption: Comparisons between a questionnaire (Mm-MAST), interviews and gammaglutamyl transferase (GGT) in a health survey of middle-aged males. *British Journal of Addiction, 77*, 297–304.

Kroger, J. (2000). *Identity development: Adolescence through adulthood.* Thousand Oaks: Sage Publications.

Kuh, D., Ben-Shlomo, Y., Lynch, J., Hällqvist, J., & Power, C. (2003). Life course epidemiology. *Journal of Epidemiology and Community Health, 57*, 778–783.

Kunst, A., Bos, V., Lahelma, E., Bartley, M., Cardano, M., Dalstra, J., et al. (2005). Trends in socio-economic inequalities in self assessed health in 10 European countries. *International Journal of Epidemiology, 34*, 295–305.

Kunst, A. E., Groenhof, F., Andersen, O., Borgan, J. K., Costa, C., Desplanques, G., et al. (1999). Occupational class and ischemic heart disease mortality in the United States and 11 European countries. *American Journal of Public Health, 89*, 47–53.

Kuper, H., & Marmot, M. (2003). Job strain, job demands, decision latitude, and risk of coronary heart disease within the Whitehall II study. *Journal of Epidemiology and Community Health, 57*, 147–153.

Laaksonen, M., Roos, E., Rahkonen, O., Martikainen, P., & Lahelma, E. (2005). Influence of material and behavioural factors on occupational class differences in health. *Journal of Epidemiology and Community Health, 59*, 163–169.

Lagerspetz, K. M. J., Björkqvist, K., & Peltonen, T. (1988). Is indirect aggression typical of females? Gender differences in aggressiveness in 11- to 12-year-old children. *Aggressive Behavior, 14*, 403–414.

Laghai, A., & Stephen, J. (2000). Attitudes towards emotional expression: Factor structure, convergent validity and associations with personality. *British Journal of Medical Psychology, 73*, 381–384.

Lahelma, E., Arber, S., Rahkonen, O., & Silventoinen, K. (2000). Widening or narrowing inequalities in health? Comparing Britain and Finland from the 1980s to 1990s. *Sociology, Health and Illness, 22*, 110–136.

Lahelma, E., Martikainen, P., Laaksonen, M., & Aittomäki, A. (2004). Pathways between socioeconomic determinants of health. *Journal of Epidemiology and Community Heath, 58*, 327–332.

Lahelma, E., Martikainen, P., Rahkonen, O., Roos, E., & Saastamoinen, P. (2005). Occupational class inequalities across key domains of health: Results from the Helsinki Health Study. *European Journal of Public Health, 15*, 504–510.

Lahti-Koski, M., Vartiainen, E., Mannisto, S., & Pietinen, P. (2000). Age, education and occupation as determinants of trends in body mass index in Finland from 1982 to 1997. *International Journal of Obesity and Related Metabolic Disorders, 24*, 1669–1676.

Lamblak, C. B., & Rosebloom, T. J. (Guest Eds.). (2001). The fetal origins hypothesis. *Twin Research 4*(5) (whole) Special Issue.

Larsen, R. J. (2000). Toward a science of mood regulation. *Psychological Inquiry, 3*, 129–141.

Laue, L., Chan, W. Y., Hsueh, A. J., Kudo, M., Hsu, S. Y., Wu, S. M., et al. (1995). Genetic heterogeneity of constitutively activating mutations of the human luteinizing hormone receptor in familial male-limited precocious puberty. *Proceedings of the National Academy of Sciences U S A, 92*, 1906–1910.

Laursen, B., Pulkkinen, L., & Adams, R. (2002). The antecedents and correlates of agreeableness in adulthood. *Developmental Psychology, 38*, 591–603.

Lawton, L., Silverstein, M., & Bengtson, V. (1994). Affection, social contact, and geographic distance between adult children and their parents. *Journal of Marriage and the Family, 56*, 56–68.

Lazarus, R. (1966). *Psychological stress and coping process*. New York: Springer.

Lee, G. R., Netzer, J. K., & Coward, R. T. (1994). Filial responsibility expectations and patterns of intergenerational assistance. *Journal of Marriage and the Family, 56*, 559–565.

Leeflang, R. L. I., Klein-Hesselink, D. J., & Spruit, I. P. (1992). Health effects of unemployment – II. Men and women. *Social Science and Medicine, 34*, 351–363.

Lehtovaara, A. (1938). *Psychologische Zwillingsuntersuchungen* (Annales Academiae Scientiarum Fennicae Ser. B, Tom. XXXIX). Helsinki: Finnish Academy of Science and Letters.

Leino-Arjas, P., Liira, J., Mutanen, P., Malmivaara, A., & Matikainen, E. (1999). Predictors and consequences of unemployment among construction workers: Prospective cohort study. *British Medical Journal, 319*, 600–605.

Leinonen, J., Solantaus, T., & Punamäki, R.-L. (2002). The specific mediating paths between economic hardship and quality of parenting. *International Journal of Behavioural Development, 26*, 423–435.

Letourneux,V. (1998). *Precarious employment and working conditions in the European Union*. Luxembourg: Office of Official Publications of the European Community.

Levinson, D. J. (1996). *The seasons of a woman's life.* New York: Knopf.

Levinson, D. J., Darrow, C. N., Klein, E. B., Levinson, M. H., & McKee, B. (1978). *The seasons of a man's life.* New York: Knopf.

Levitt, M. J., Guacci, N., & Weber, R. A. (1992). Intergenerational support, relationship quality, and well-being: A bicultural analysis. *Journal of Family Issues, 13*, 465–481.

Lewin, L. M., Hops, H., Davis, B., & Dishion, T. J. (1993). Multimethod comparison of similarity in school adjustment of siblings and unrelated children. *Developmental Psychology, 29*, 963–969.

Lewis, G., & Sloggett, A. (1998). Suicide, deprivation, and unemployment: Record linkage study. *British Medical Journal, 317*, 1283–1286.

Lissner, L., Johansson, S. E., Qvist, J., Rossner, S., & Wolk, A. (2000). Social mapping of the obesity epidemic in Sweden. *International Journal of Obesity and Related Metabolic Disorders, 24*, 801–805.

Litwak, E., & Kulis, S. (1987). Technology, proximity, and measures of kin support. *Journal of Marriage and the Family, 49*, 649–661.

Loeber, R., Drinkwater, M., Yin, Y., Anderson, S. J., Schmidt, L. D., & Crawford, A. (2000). Stability of family interaction from ages 6 to 18. *Journal of Abnormal Child Psychology, 28,* 353–369.

Loos, R., Derom, C., Vlietnick, R., & Derom, R. (1998). The East Flanders Prospective Twin Survey (Belgium): A population-based register. *Twin Research, 1*, 167–175.

Lowenstein, A., Katz, R., Mehlhausen-Hassoen, D., & Prilutzky, D. (2003). Une comparaison transnationale de la solidarité intergénérationelle. [An international comparison of intergenerational solidarity]. *Retraite et Société, 38*, 52–74.

Lumley, M. A., Stettner, L., & Wehmer, F. (1996). How are alexithymia and physical illness linked? A review and critique of pathways. *Journal of Psychosomatic Research, 41*, 505–518.

Lundberg, O., & Manderbacka, K. (1996). Assessing reliability of a measure of self-rated health. *Scandinavian Journal of Social Medicine, 24*, 218–224.

Lüscher, K. (1997). Postmoderne Herausforderungen an die Generationsbeziehungen. [Postmodern demands on intergenerational relations]. In L. Krappmann & A. Lepenies (Eds.), *Alt und Jung – Spannung und Solidarität*

zwischen Generationen [Old and young – Tension and solidarity between generations] (pp. 32–48). Frankfurt a. M., Germany: Campus.

Lüscher, K., Pajung-Bilger, B., Lettke, F., Böhmer, S., & Rasner, A. (2000). *Generationen ambivalenzen operationalisieren: Instrumente*. Konstanz, Germany: Universität Konstanz.

Lykken, D. T., Bouchard, T. J., Jr., McGue, M., & Tellegen, A. (1993). Heritability of interests: A twin study. *Journal of Applied Psychology, 78*, 649–661.

Lynch, M., & Walsh, B. (1998). *Genetics and analysis of quantitative traits*. Sunderland, MA, USA: Sinauer Associates.

Lynn, R., Hampson, S., & Magee, M. (1984). Home background, intelligence, personality and education as predictors of unemployment in young people. *Personality and Individual Differences, 5*, 549–557.

Maccoby, E. E., & Jacklin, C. N. (1980). Sex differences in aggression: A rejoinder and reprise. *Child Development, 51*, 964–980.

Maccoby, E. E., & Martin, J. A. (1983). Socialization in the context of the family: Parent-child interaction. In P. H. Mussen (Series Ed.) & E. M. Hetherington (Vol. Ed.), *Handbook of child psychology*: *Vol. 4. Socialization, personality, and social development* (4th ed., pp. 1–101). New York: Wiley.

Macintyre, S. (1997). The Black Report and beyond: What are the issues? *Social Science and Medicine, 44*, 723–745.

Mackenbach, J. P., Bos, V., Andersen, O., Cardano, M., Costa, G., Harding, S., et al. (2003). Widening socioeconomic inequalities in mortality in six Western European countries: The EU Working Group on Socioeconomic Inequalities in Health. *International Journal of Epidemiology, 32*, 830–837.

Mackenbach, J. P., Kunst, A. E., Cavelaars, A. E. J. M., Groenhof, F., & Geurts, J. J. M. (1997). Socioeconomic inequalities in morbidity and mortality in western Europe: The EU Working Group on Socioeconomic Inequalities in Health. *Lancet, 349*, 1655–1659.

Magnusson, D. (1988). *Individual development from an interactional perspective: Longitudinal study in paths through life* (Vol. 1). Hillsdale, NJ: Erlbaum.

Magnusson, D. (1998). The logic and implications of a person-oriented approach. In R. B. Cairns, L. R. Bergman, & J. Kagan (Eds.), *Methods and models for studying the individual* (pp. 33–63). Thousand Oaks, CA: Sage.

Magnusson, D. (2001). The holistic-interactionistic paradigm: Some directions for empirical developmental research. *European Psychologist, 6*, 153–162.

Magnusson, D., & Bergman, L. R. (1990). A pattern approach to the study of pathways from childhood to adulthood. In L. N. Robins & M. Rutter (Eds.), *Straight and devious pathways from childhood to adulthood* (pp. 101–115). Cambridge, UK: Cambridge University Press.

Magnusson, D., & Bergman, L. R. (2000). Individual development and adaptation: The IDA program. In C.-G. Janson (Ed.), *Seven Swedish longitudinal studies* (pp. 115–139). Stockholm: Swedish Council for Planning and Coordination of Research.

Mäkikangas, A., Kinnunen, U., & Feldt, T. (2004). Self-esteem, dispositional optimism, and health: Evidence from cross-lagged data on employees. *Journal of Research in Personality, 38*, 556–575.

Manderbacka, K. (1998). Examining what self-rated health question is understood to mean by respondents. *Scandinavian Journal of Social Medicine, 26*, 145–153.

Manderbacka, K., Kåreholt, I., Martikainen, P., & Lundberg, O. (2003). The effect of point of reference on the association between self-rated health and mortality. *Social Science and Medicine, 56*, 1447–1452.

Manderbacka, K., Lahelma, E., & Martikainen, P. (1998). Examining the continuity of self-rated health. *International Journal of Epidemiology, 27*, 208–213.

Männikkö, K., & Pulkkinen, L. (2001). Parenting and personality styles. A long-term longitudinal approach. In J. R. M. Gerris (Ed.), *Dynamics of parenting* (pp. 179–195). Leuven, Belgium: Garant-Uitgevers.

Marcia, J. E. (1966). Development and validation of ego-identity status. *Journal of Personality and Social Psychology, 3*, 551–558.

Marcia, J. E. (1980). Identity in adolescence. In J. Adelson (Ed.), *Handbook of adolescent psychology* (pp. 159–187). New York: Wiley.

Marcia, J. E. (1993a). The ego identity status approach to ego identity. In J. E. Marcia, A. S. Waterman, D. R. Matteson, S. L. Archer, & J. L. Orlofsky (Eds.), *Ego identity: A handbook for psychosocial research* (pp. 3–21). New York: Springer-Verlag.

Marcia, J. E. (1993b). The status of the statuses: Research review. In J. E. Marcia, A. S. Waterman, D. R. Matteson, S. L. Archer, & J. L. Orlofsky (Eds.), *Ego identity: A handbook for psychosocial research* (pp. 23–40). New York: Springer-Verlag.

Marcia, J. E. (2001). A commentary on Seth Schwartz's review on identity theory and research. *Identity: An International Journal of Theory and Research, 1*, 59–65.

Marcia, J. E. (2002). Identity and psychosocial development in adulthood. *Identity: An International Journal of Theory and Research, 2*, 7–28.

Markides, K., & Krause, N. (1985). Intergenerational solidarity and psychological well-being among older Mexican Americans. *Journal of Gerontology, 40*, 390–392.

Martikainen, P., Aromaa, A., Heliövaara, M., Klaukka, T., Knekt, P., Maatela, J., et al. (1999). Reliability of perceived health by sex and age. *Social Science and Medicine, 48*, 1117–1122.

Martikainen, P. T., & Valkonen, T. (1996). Excess mortality of unemployed men and women during a period of rapidly increasing unemployment. *Lancet, 348*, 909–912.

Martin, N. G., Boomsma, D. I., & Machin, G. (1997). A twin-pronged attack on complex traits. *Nature Genetics, 17*, 387–392.

Martin, S. E., Clements, M. L., & Crnic, K. A. (2002). Maternal emotions during mother-toddler interaction: Parenting in affective context. *Parenting: Science and Practice, 2*, 105–126.

Maslach, C., & Jackson, S. (1986). *MBI: Maslach Burnout Inventory* (2nd ed.). Palo Alto, CA: Consulting Psychologists Press.

Maslach, C., & Leiter, M. P. (1997). *The truth about burnout*. San Francisco: Jossey-Bass.

Masten, A. S., & Coatsworth, J. D. (1995). Competence, resilience, and psychopathology. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology: Vol. 2. Risk, disorder and adaptation* (pp. 715–752). New York: Wiley.

Masten, A. S., & Coatsworth, J. D. (1998). The development of competence in favorable and unfavorable environments: Lessons from research on successful children. *American Psychologist, 53*, 205–220.

Mauno, S., & Kinnunen, U. (1999). The effects of job stressors on marital satisfaction in Finnish dual-earner couples. *Journal of Organizational Behavior, 26*, 879–895.

Mayer, J. D., & Salovey, P. (1995). Emotional intelligence and the construction and regulation of feelings. *Applied and Preventive Psychology, 4*, 197–208.

Mayer, J. D., & Stevens, A. A. (1994). An emerging understanding of the reflecting (meta-) experience of mood. *Journal of Research in Personality, 28*, 351–373.

McAdams, D. P., & de St. Aubin, E. (Eds.). (1998). *Generativity and adult development: How and why we care for the next generation.* Washington, DC: American Psychological Association.

McConaughy, S. H., & Achenbach, T. M. (1994). Comorbidity of empirically based syndromes in matched general population and clinical samples. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 35*, 1141–1157.

McEwen, B. S. (1998). Protective and damaging effects of stress mediators. *New England Journal of Medicine, 338*, 171–179.

McGroder, S. (2000). Parenting among low-income, African-American single mothers with preschool-age children: Patterns, predictors, and developmental correlates. *Child Development, 71*, 752–771.

McGue, M., & Bouchard, T. J., Jr. (1998). Genetic and environmental influences on human behavioral differences. *Annual Review of Neuroscience, 21*, 1–24.

McGue, M., & Lykken, D. T. (1992). Genetic influence on risk of divorce. *Psychological Science, 3*, 368–373.

Metsäpelto, R.-L., & Pulkkinen, L. (2003). Personality traits and parenting: Neuroticism, extraversion, and openness to experience as discriminative factors. *European Journal of Personality, 17*, 59–78.

Metsäpelto, R.-L., & Pulkkinen, L. (2004). Vanhempien kasvatustyylit ja psykososiaalinen toimintakyky. [Parenting styles and parents' psychosocial functioning]. *Psykologia, 3*, 212–221.

Metsäpelto, R.-L., & Pulkkinen, L. (2005). The moderating effect of extraversion on the relation between self-reported and observed parenting. *Journal of Applied Developmental Psychology, 26*, 371–384.

Metsäpelto, R.-L., Pulkkinen, L., & Poikkeus, A.-M. (2001). A search for parenting style: A cross-situational analysis of parental behavior. *Genetic, Social, and General Psychology Monographs, 127*, 169–192.

Miilunpalo, S., Vuori, I., Oja, P., Pasanen, M., & Urponen, H. (1997). Self-rated health status as a health measure: The predictive value of self-reported health status on the use of physician services and on mortality in the working-age population. *Journal of Clinical Epidemiology, 50*, 517–528.

Mikkilä, V., Lahti-Koski, M., Pietinen, P., Virtanen, S. M., & Rimpelä, M. (2003). Associates of obesity and weight dissatisfaction among Finnish adolescents. *Public Health Nutrition, 6*, 49–56.

Miller, T. Q., Smith, T. W., Turner, C. W., Guijarro, M. L., & Hallet, A. (1996). A meta-analytic review of research on hostility and physical health. *Psychological Bulletin, 119*, 322–348.

Ministry of Education. (2005). Education. The Finnish education system. Retrieved March 24, 2005, from http://www.minedu.fi/minedu/education/education_system.html

Moffitt, T. E., Caspi, A., Belsky, J., & Silva, P. A. (1992). Childhood experience and the onset of menarche: A test of a sociobiological model. *Child Development, 63*, 47–58.

Montgomery, S. M., Bartley, M. J., Cook, D. G., & Wadsworth, M. E. J. (1996). Health and social precursors of unemployment in young men in Great Britain. *Journal of Epidemiology and Community Health, 50*, 415–422.

Morris, J. K., Cook, D. G., & Shaper, A. G. (1994). Loss of employment and mortality. *British Medical Journal, 308*, 1135–1139.

Mortimer, J. T. (1994). Individual differences as precursors of youth unemployment. In A. C. Petersen & J. T. Mortimer (Eds.), *Youth unemployment and society* (pp. 172–198). Cambridge, UK: Cambridge University Press.

Mueller, M., & Elder, G. H., Jr. (2003). Family contingencies across the generations: Grandparent-grandchild relationships in holistic perspective. *Journal of Marriage and Family, 65*, 404–417.

Murphy, G. C., & Athanasou, J. A. (1999). The effect of unemployment on mental health. *Journal of Occupational and Organizational Psychology, 72*, 83–99.

Mustanski, B. S., Viken, R. J., Kaprio, J., Pulkkinen, L., & Rose, R. J. (2004). Genetic and environmental influences on pubertal development: Longitudinal data from Finnish twins at ages 11 and 14. *Developmental Psychology, 40*, 1188–1198 .

Mustanski, B. S., Viken, R. J., Kaprio, J., & Rose, R. J. (2003). Genetic influences on the association between personality risk factors and alcohol use and abuse. *Journal of Abnormal Psychology, 112*, 282–289.

Mustonen, A. (1997). *Media violence and its audience* (Jyväskylä Studies in Education, Psychology, and Social Research, No. 135). Jyväskylä, Finland: University of Jyväskylä.

Muthén, L. K., & Muthén, B. O. (1998–2003). *Mplus user's guide.* Los Angeles, CA: Muthén & Muthén.

Nadder, T. S., Silberg, J. L., Eaves, L. J., Maes, H. H., & Meyer, J. M. (1998). Genetic effects on ADHD symptomatology in 7- to 13- year-old twins: Results from a telephone survey. *Behavior Genetics, 28*, 83–99.

Nagin, D. (1999). Analyzing developmental trajectories: A semi-parametric, group-based approach. *Psychological Methods, 4*, 139–177.

Nagin, D. S. (2005). *Group-based modeling of development.* Cambridge, MA: Harvard University Press.

Nance, W. E., Corey, L. A., Rose, R. J., & Eaves, L. J. (1981). Relevance of the marriages of twins to the causal analysis of nonrandom mating. In L. Gedda, P. Parisi, & W. E. Nance (Eds.), *Twin research 3: Intelligence, personality and development* (pp. 61–71). New York: Alan R. Liss.

Nätti, J. (1993). Temporary employment in the Nordic countries: A 'trap' or a 'bridge'? *Work, Employment and Society, 7*, 451–464.

Neale, M. C. (1994). *Mx: Statistical modeling* [Computer software]. Richmond, VA: Department of Psychiatry, Virginia Commonwealth University.

Neale, M. C., Boker, S. M., Xie, G., & Maes, H. H. (1999). *Mx: Statistical modeling* (5th ed.). Richmond, VA: Department of Psychiatry, Virginia Commonwealth University.

Neale, M. C., Boker, S. M., Xie, G., & Maes, H. H. (2004). *Mx: Statistical modeling* (6th ed.). Richmond, VA: Department of Psychiatry, Virginia Commonwealth University.

Neale, M. C., & Cardon, L. R. (1992). *Methodology for genetic studies of twins and families*. Dordrecht, The Netherlands: Kluwer Academic.

Neale, M. C., & Maes, H. H. M. (2004). *Methodology for genetic studies of twins and families*. Dordrecht, The Netherlands: Kluwer Academic.

Neale, M. C., & Mcardle, J. J. (2000). Structured latent growth curves for twin data. *Twin Research, 3*, 165–177.

Neugarten, B. L., & Weinstein, K. J. (1964). The changing American grandparent. *Journal of Marriage and the Family, 26*, 199–204.

NICHD Early Child Care Research Network. (2004). Trajectories of physical aggression from toddlerhood to middle childhood. *Monographs of the Society for Research in Child Development, 69*, No. 4, Serial No. 278.

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*, 504–511.

Nolen-Hoeksema, S., & Girgus, J. S. (1994). The emergence of gender differences in depression during adolescence. *Psychological Bulletin, 115*, 424–443.

Nurmi, J.-E., Salmela-Aro, K., & Haavisto, T. (1995). The Strategy and Attribution Questionnaire: Psychometric properties. *European Journal of Psychological Assessment, 11*, 108–121.

O'Connor, T. G., Caspi, A., DeFries, J. C., & Plomin, R. (2003). Genotype-environment interaction in children's adjustment to parental separation. *Journal of Child Psychology and Psychiatry, 44*, 849–856.

O'Connor, T. G., Neiderhiser, J. M., Reiss, D., Hetherington, E. M., & Plomin, R. (1998). Genetic contributions to continuity, change, and co-occurrence of antisocial and depressive symptoms in adolescence. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 39*, 323–336.

O'Connor, T. G., Thorpe, K., Dunn, J., & Goldberg, J. (1999). Parental divorce and adjustment in childhood: Findings from a community sample. *Journal of Child Psychology and Psychiatry, 40*, 777–789.

OECD (2001). Retrieved January 13, 2004, from http://www1.oecd.org/scripts/cde/members/lfsdataauthenticate.asp

Paavola, M., Vartiainen, E., & Haukkala, A. (2004). Smoking from adolescence to adulthood: The effects of parental and own socioeconomic status. *European Journal of Public Health*, 14, 417–421.

Pagan, J. L., Dick, D. M., Pulkkinen, L., Viken, R. J., Kaprio, J., & Rose, R. J. (2005, May). *Peer reports provide better prediction of adolescent substance use initiation than parent and teacher reports*. Paper presented at the 17th Annual Meeting of the American Psychological Society, Los Angeles, USA.

Paivio, S. C., & Laurent, C. (2001). Empathy and emotion regulation: Reprocessing memories of child abuse. *Journal of Clinical Psychology, 57*, 213–226.

Palosuo, H., Uutela, A., Zhuravleva, I., & Lakomova, N. (1998). Social patterning of ill health in Helsinki and Moscow: Results from a comparative survey in 1991. *Social Science and Medicine, 46*, 1121–1136.

Pandey, R., Gupta, M., & Upadhyaya, S. N. (2000). Perceived social support and health in high and low alexithymics. *Journal of Personality and Clinical Studies, 16*, 137–142.

Parkinson, B., & Totterdell, P. (1999). Classifying affect-regulation strategies. *Cognition and Emotion, 13*, 277–303.

Partanen, J., Bruun, K., & Markkanen, T. (1966). *Inheritance of drinking behavior: A study on intelligence, personality, and use of alcohol of adult twins* (The Finnish Foundation for Alcohol Studies, Vol. 14). Helsinki: Almqvist & Wiksell.

Peltonen, L., Palotie, A., & Lange, K. (2000). Use of population isolates for mapping complex traits. *Nature Reviews, 1*, 182–190.

Pennebaker, J. W. (1997). Writing about emotional experiences as a therapeutic process. *Psychological Science, 8*, 162–166.

Perrig-Chiello, P., & Sturzenegger, M. (2001). Social relations and filial maturity in middle-aged adults: Contextual conditions and psychological determinants. *Zeitschrift für Gerontologie und Geriatrie, 34*, 21–27.

Perry-Jenkins, M., Repetti, R. L., & Crouter, A. C. (2000). Work and family in the 1990s. *Journal of Marriage and the Family, 62*, 981–998.

Petersen, A. C., Crockett, L., Richards, M., & Boxer, A. (1988). A self-report measure of pubertal status: Reliability, validity, and initial norms. *Journal of Youth and Adolescence, 17*, 117–133.

Petersen, A. C., Tobin-Richards, M., & Boxer, A. M. (1983). Puberty: Its measurement and its meaning. *Journal of Early Adolescence, 3*, 47–62.

Pietiläinen, K. H., Kaprio, J., Räsänen, M., Rissanen, A., & Rose, R. J. (2002). Genetic and environmental influences on the tracking of body size from birth to early adulthood. *Obesity Research, 10*, 875–884.

Pietiläinen, K. H., Kaprio, J., Räsänen, M., Winter, T., Rissanen, A., & Rose, R. J. (2001). Tracking of body size from birth to late adolescence – contributions of birth length, weight, duration of gestation, parents' body size, and twinship. *American Journal of Epidemiology*, 154, 21–29.

Pietiläinen, K. H., Kaprio, J., Rissanen, A., Winter, T., Rimpelä, A., Viken, R. J., et al. (1999). Distribution and heritability of BMI in Finnish adolescents aged 16y and 17y: A study of 4884 twins and 2509 singletons. *International Journal of Obesity, 23*, 107–115.

Pietiläinen, K. H., Rissanen, A., Kaprio, J., Mäkimattila, S., Häkkinen, A. M., Westerbacka, J., et al. (2005). Acquired obesity is associated with increased liver fat, intra-abdominal fat, and insulin resistance in young adult monozygotic twins. *American Journal of Physiology. Endocrinology and Metabolism, 288*, E768–E774.

Pietiläinen, K. H., Rissanen, A., Laamanen, M., Lindholm, A. K., Markkula, H., Yki-Järvinen, H., et al. (2004). Growth patterns in young adult monozygotic twin pairs discordant and concordant for obesity. *Twin Research, 7*, 421–429.

Pike, A., Reiss, D., Hetherington, E. M., & Plomin, R. (1996). Using MZ differences in the search for nonshared environmental effects. *Journal of Child Psychology and Psychiatry, 37*, 695–704.

Pincus, T., Burton, A. K., Vogel, S., & Field, A. P. (2002). A systematic review of psychological factors as predictors of chronicity/disability in prospective cohorts of low back pain. *Spine, 27*, E109–E120.

Pitkänen, L. (1969). *A descriptive model of aggression and nonaggression with applications to children's behavior* (Jyväskylä Studies in Education, Psychology and Social Research, No. 19). Jyväskylä, Finland: University of Jyväskylä.

Pitkänen, T., Lyyra, A.-L., & Pulkkinen, L. (2005). Age of onset of drinking and the use of alcohol in adulthood: A follow-up study from age 8–42 for females and males. *Addiction, 100*, 652–661.

Plomin, R., DeFries, J. C., McClearn, G. E., & Rutter, M. (1997). *Behavioral Genetics* (3rd ed.). New York: Freeman.

Plomin, R., DeFries, J. C., Craig, I. W., & McGuffin, P. (2003). *Behavioral genetics in the postgenomic era*. Washington, DC: American Psychological Association.

Plomin, R., & Spinath, F. M. (2004). Intelligence: Genetics, genes, and genomics. *Journal of Personality and Social Psychology, 86*, 112–129.

Pocket world in figures; 2005 edition. (2005). London: Profile Books, in association with *The Economist*.

Posthuma, D., Beem, A. L., De Geus, E. J., van Baal, G. C., von Hjelmborg, J. B., Iachine, I., et al. (2003). Theory and practice in quantitative genetics. *Twin Research, 6*, 361–376.

Poulton, R., & Caspi, A. (2003). Commentary: Personality and the socio-economic health gradient. *International Journal of Epidemiology, 57*, 975–977.

Power, C., & Jefferis, B. J. (2002). Fetal environment and subsequent obesity: A study of maternal smoking. *International Journal of Epidemiology, 31*, 413–419.

Prescott, C. A., & Kendler, K. S. (1999). Age at first drink and risk for alcoholism: A noncausal association. *Alcoholism: Clinical and Experimental Research, 23*, 101–107.

Price, T. S., Simonoff, E., Asherson, P., Curran, S., Kuntsi, J., Waldman, I., et al. (2005). Continuity and change in preschool ADHD symptoms: Longitudinal genetic analysis with contrast effects. *Behavior Genetics, 35*, 121–132.

Pulkkinen, L. (1982). Self-control and continuity from childhood to late adolescence. In P. B. Baltes & O. G. Brim, Jr. (Eds.), *Life-span development and behavior: Vol.4* (pp. 63–105). New York: Academic Press.

Pulkkinen, L. (1983a). The search for alternatives to aggression. In A. P. Goldstein & M. Segall (Eds.), *Aggression in global perspective* (pp. 104–144). New York: Pergamon Press.

Pulkkinen, L. (1983b). Youthful smoking and drinking in a longitudinal perspective. *Journal of Youth and Adolescence, 12*, 253–283.

Pulkkinen, L. (1987). Offensive and defensive aggression in humans: A longitudinal perspective. *Aggressive Behavior, 13*, 197–212.

Pulkkinen, L. (1988a). A two-dimensional model as a framework for interindividual differences in social behaviour. In D. H. Saklofske & S. B. G. Eysenck (Eds.), *Individual differences in children and adolescents: International perspectives* (pp. 27–37). London: Hodder & Stoughton.

Pulkkinen, L. (1988b). Delinquent development: Theoretical and empirical considerations. In M. Rutter (Ed.), *The power of longitudinal data: Studies of risk and protective factors for psychosocial disorders* (pp. 184–199). Cambridge, UK: Cambridge University Press.

Pulkkinen, L. (1990). Young adults' health and its antecedents in evolving life-styles. In K. Hurrelmann & F. Lösel (Eds.), *Health hazards in adolescence* (pp. 67–90). Berlin, Germany: de Gruyter.

Pulkkinen, L. (1992). The path to adulthood for aggressively inclined girls. In K. Björkqvist & P. Niemelä (Eds.), *Of mice and women: Aspects of female aggression* (pp. 113–121). New York: Academic Press.

Pulkkinen, L. (1995). Behavioral precursors to accidents and resulting physical impairment. *Child Development, 66*, 1660–1679.

Pulkkinen, L. (1996a). Proactive and reactive aggression in early adolescence as precursors to anti- and prosocial behavior in young adults. *Aggressive Behavior, 22*, 241–257.

Pulkkinen, L. (1996b). Female and male personality styles: A typological and developmental analysis. *Journal of Personality and Social Psychology, 70*, 1288–1306.

Pulkkinen, L. (1998). Levels of longitudinal data differing in complexity and the study of continuity in personality characteristics. In R. B. Cairns, L. R. Bergman, & J. Kagan (Eds.), *Methods and models for studying the individual* (pp. 161–184). Thousand Oaks, CA: Sage.

Pulkkinen, L. (2001). Reveller or striver? How childhood self-control predicts adult social behavior. In A. C. Bohart & D. J. Stipek (Eds.), *Constructive and destructive behavior: Implications for family, school, and society* (pp. 167–185). Washington, DC: American Psychological Association.

Pulkkinen, L. (2004). A longitudinal study on social development as an impetus for school reform towards an integrated school day. *European Psychologist, 9*, 125–141.

Pulkkinen, L., Feldt, T., & Kokko, K. (2005). Personality in young adulthood and functioning in middle age. In S. L. Willis & M. Martin (Eds.), *Middle adulthood: A lifespan perspective* (pp. 99–141). Thousand Oaks, CA: Sage.

Pulkkinen, L., Fyrsten, S., Kinnunen, U., Kinnunen, M.-L., Pitkänen, T., & Kokko, K. (2003). *40 + Erään ikäluokan selviytymistarina* [40 + A successful transition to middle adulthood in a cohort of Finns] (Reports, No. 349). University of Jyväskylä, Finland: Department of Psychology.

Pulkkinen, L., Kaprio, J., & Rose, R. J. (1999). Peers, teachers and parents as assessors of the behavioural and emotional problems of twins and their adjustment: The Multidimensional Peer Nomination Inventory. *Twin Research, 2*, 274–285.

Pulkkinen, L., Kokkonen, M., & Mäkiaho, A. (1998). Positive affectivity, self-mastery, and a sense of failure as predictors of self-assessed health. *European Psychologist, 3*, 133–142.

Pulkkinen, L., Nygren, H., & Kokko, K. (2002). Successful development: Childhood antecedents of adaptive psychosocial functioning in adulthood. *Journal of Adult Development, 9*, 251–265.

Pulkkinen, L., Ohranen, M., & Tolvanen, A. (1999). Personality antecedents of career orientation and stability among women compared to men. *Journal of Vocational Behaviour, 54*, 37–58.

Pulkkinen, L., & Pitkänen, T. (1993). Continuities in aggressive behavior from childhood to adulthood. *Aggressive Behavior, 19*, 249–263.

Pulkkinen, L., & Pitkänen, T. (1994). A prospective study of the precursors to problem drinking in young adulthood. *Journal of Studies on Alcohol, 55*, 578–587.

Pulkkinen, L., & Rönkä, A. (1994). Personal control over development, identity formation, and future orientation as components of life orientation: A developmental approach. *Developmental Psychology, 2*, 260–271.

Pulkkinen, L., & Tremblay, R. E. (1992). Patterns of boys' social adjustment in two cultures and at different ages: A longitudinal perspective. *International Journal of Behavioural Development, 15*, 527–553.

Pulkkinen, L., Vaalamo, I., Hietala, R., Kaprio, J., & Rose, R. J. (2003). Peer reports of adaptive behavior in twins and singletons: Is twinship a risk or an advantage? *Twin Research, 6*, 106–118.

Pulver, A., Allik, J., Pulkkinen, L., & Hämäläinen, M. (1995). A Big Five Personality Inventory in two non-Indo-European languages. *European Journal of Personality, 9*, 109–124.

Purcell, S. (2002). Variance components models for gene-environment interaction in twin analysis. *Twin Research, 5*, 554–571.

Quadrello, T., Hurme, H., Menzinger, F., Smith, P. K., Veisson, M., Vidal, S., & Westerback, S. (2005). Grandparents' use of new communication technologies in a European perspective. *European Journal of Ageing, 2*, 200–207.

Quinlan, M., Mayhew, C., & Bole, P. (2001). The global expansion of precarious employment, work disorganization, and consequences for occupational health: A review of recent literature. *International Journal of Health Services, 31*, 335–414.

Rahkonen, O., Arber, S., Lahelma, E., Martikainen, P., & Silventoinen, K. (2000). Understanding income inequalities in health among men and women in Britain and Finland. *International Journal of Health Services, 30*, 27–47.

Reilly, J. I., & Gottesman, I. I. (2001). Developmental instability in MZ twins concordant and discordant for schizophrenia. *Twin Research, 4*, 283.

Repetti, R. L., & Wood, J. (1997). Effects of daily stress at work on mothers' interaction with preschoolers. *Journal of Family Psychology, 11*, 90–108.

Reynolds, C. A., Baker, L. A., & Pedersen, N. L. (1996). Models of spouse similarity: Applications to fluid ability measured in twins and their spouses. *Behavior Genetics, 26*, 73–88.

Ritamies, M., & Fågel, S. (1998). *Aikuiset avunsaajina*. [Adults as recipients of help] (Väestöntutkimuslaitos, D 33). Helsinki, Finland: Väestöliitto.

Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin, 126*, 3–25.

Roberts, G. C., Block, J. H., & Block, J. (1984). Continuity and change in parents' child-rearing practices. *Child Development, 55*, 586–597.

Robertson, J. (1977). Grandmotherhood: A study of role conceptions. *Journal of Marriage and the Family, 39*, 165–174.

Romeis, J. C., Scherrer, J. F., Xian, H., Eisen, S. A., Bucholz, K., Heath, A. C., et al. (2000). Heritability of self-reported health. *Health Services Research, 35*, 995–1010.

Rönkä, A. (1999). *The accumulation of problems of social Functioning: Outer, inner, and behavioral strands* (Jyväskylä Studies in Education, Psychology and Social Research, No. 148). Jyväskylä, Finland: University of Jyväskylä.

Rönkä, A., Kinnunen, U., & Pulkkinen, L. (2000). The accumulation of problems of social functioning as a long-term process: Women and men compared. *International Journal of Behavioral Development, 24*, 442–450.

Rönkä, A., Kinnunen, U., & Pulkkinen, L. (2001). Continuity in problems of social functioning in adulthood: A cumulative perspective. *Journal of Adult Development, 8*, 161–171.

Rönkä, A., & Pulkkinen, L. (1995). Accumulation of problems in social functioning in young adulthood: A developmental approach. *Journal of Personality and Social Psychology, 69*, 381–391.

Rönkä, A., & Pulkkinen, L. (1998). Work involvement and timing of motherhood in the accumulation of problems in social functioning in young women. *Journal of Research on Adolescence, 8*, 221–239.

Rose, R. J. (1988). Genetic and environmental variance in content dimensions of the MMPI. *Journal of Personality and Social Psychology, 55*, 302–311.

Rose, R. J. (1995). Genes and human behavior. *Annual Review of Psychology, 46*, 625–654.

Rose, R. J. (1998). A developmental behavioral-genetic perspective on alcoholism risk. *Alcohol Health & Research World*, *22*, 131–143.

Rose, R. J. (2002). How do adolescents select their friends? A behavior-genetic perspective. In L. Pulkkinen & A. Caspi (Eds.), *Paths to successful development. Personality in the life course* (pp. 106–125). Cambridge, UK: Cambridge University Press.

Rose, R. J. (2004). Commentary: Developmental research as impetus for school reform. *European Psychologist, 9*, 143–144.

Rose, R. J. (2005). Prenatal programming of behavior: A twin-study perspective. *Neuroscience and Biobehavioral Reviews, 29*, 321–327.

Rose, R. J., Boughman, J. A., Corey, L. A., Nance, W. E., Christian, J. C., & Kang, K. W. (1980). Data from kinships of monozygotic twins indicate maternal effects on verbal intelligence. *Nature, 283*, 375–377.

Rose, R. J., Dick, D. M., Viken, R. J., & Kaprio, J. (2001). Gene-environment interaction in patterns of adolescent drinking: Regional residency moderates longitudinal influences on alcohol use. *Alcoholism: Clinical and Experimental Research, 25*, 637–643.

Rose, R. J., Dick, D. M., Viken, R. J., Pulkkinen, L., & Kaprio, J. (2001). Drinking or abstaining at age 14: A genetic epidemiological study. *Alcoholism: Clinical and Experimental Research, 25*, 1594–1604.

Rose, R. J., Harris, E. L., Christian, J. C., & Nance, W. E. (1979). Genetic variance in nonverbal intelligence: Data from the kinships of identical twins. *Science, 205*, 1153–1155.

Rose, R. J., & Kaprio, J. (1988). Frequency of social contact and intrapair resemblance of adult monozygotic cotwins. *Behavior Genetics*, *18*, 309–328.

Rose, R. J., Kaprio, J., Williams, C. J., Viken, R., & Obremski, K. (1990). Social contact and sibling similarity: Facts, issues, and red herrings. *Behavior Genetics, 20*, 763–778.

Rose, R. J., Kaprio, J., Winter, T., Koskenvuo, M., & Viken, R. J. (1999). Familial and socio-regional environmental effects on abstinence from alcohol at age 16. *Journal of Studies on Alcohol*, Supplement No. 13, 63–74.

Rose, R. J., Reed, T., & Bogle, A. (1987). Asymmetry of *a-b* ridge count and behavioral discordance of monozygotic twins. *Behavior Genetics, 17*, 125–140.

Rose, R. J., Viken, R. J., Dick, D. M., Bates, J., Pulkkinen, L., & Kaprio, J. (2003). It does take a village: Nonfamilial environments and children's behavior. *Psychological Science, 14*, 273–277.

Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.

Ross, L., & Nisbett, R. E. (1991). *The person and the situation: Perspectives of social psychology.* New York: McGraw-Hill.

Rossi, A. S. (1989). A life-course approach to gender, aging, and intergenerational relations. In K. W. Schaie & C. Schooler (Eds.), *Social structure and aging: Psychological processes* (pp. 207–236). Hillsdale, NJ: Erlbaum.

Rossi, A. S., & Rossi, P. H. (1990). *Of human bonding: Parent-child relations across the life course.* New York: Aldine de Gruyter.

Rothbart, M., & Bates, J. (1998). Temperament. In W. S. E. Damon & N. V. E. Eisenberg (Eds.), *Handbook of child psychology: Social, emotional and personality development*: *Vol. 3. Social, emotional and personality development* (5th ed., pp. 105–176). New York: Wiley.

Rothbart, M., & Derryberry (1981). Development of individual differences in temperament. In M. E. Lamb & A. L. Brown (Eds.), *Advances in developmental psychology* (Vol. 1., pp. 37–86). Hillsdale, NJ: Erlbaum.

Rothbart, M., & Putnam, S. P. (2002). Temperament and socialization. In L. Pulkkinen & A. Caspi (Eds.), *Paths to successful development. Personality in the life course* (pp. 19–45). Cambridge, UK: Cambridge University Press.

Rowe, D. C. (1994). The *limits of family influence: Genes, experience, and behavior*. New York: Guilford Press.

Rowe, D. C., & Gulley, B. (1992). Sibling effects on substance use and delinquency. *Criminology, 30*, 217–233.

Røysamb, E., Tambs, K., Reichborn-Kjennerud, T., Neale, M. C., & Harris, J. R. (2003). Happiness and health: Environmental and genetic contributions to the relationship between subjective well-being, perceived health, and somatic illness. *Journal of Personality and Social Psychology, 85*, 1136–1146.

Rubin, A. M. (1983). Television uses and gratifications: The interactions of viewing patterns and motivations. *Journal of Broadcasting, 27*, 37–51.

Rutter, M. (1984). Continuities and discontinuities in socioemotional development: Empirical and conceptual perspectives. In R. Harmon &

R. Emde (Eds.), *Continuities and discontinuities in development*. New York: Plenum.

Rutter, M. (1989). Pathways from childhood to adult life. *Journal of Child Psychology and Psychiatry, 1*, 23–51.

Rutter, M. (1994). Concepts of causation, tests of causal mechanisms, and implications for intervention. In A. C. Petersen & J. T. Mortimer (Eds.), *Youth unemployment and society* (pp. 147–171). Cambridge, UK: Cambridge University Press.

Rutter, M., Pickles, A., Murray, R., & Eaves, L. (2001). Testing hypotheses on specific environmental causal effects on behavior. *Psychological Bulletin, 127*, 291–324.

Rutter, M., & Silberg, J. (2002). Gene-environment interplay in relation to emotional and behavioral disturbance. *Annual Review of Psychology, 53*, 463–490.

Ryff, C. D. (1989). Happiness is everything or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology, 57*, 1069–1081.

Ryff, C. D., & Heincke, S. G. (1983). Subjective organization of personality in adulthood and aging. *Journal of Personality and Social Psychology, 44*, 807–816.

Ryff, C. D., & Keyes, C. L. M. (1995). The structure of psychological well-being. *Journal of Personality and Social Psychology, 69*, 719–727.

Saarni, C. (1997). Coping with aversive feelings. *Motivation and Emotion, 21*, 45–63.

Sallinen, M., Kinnunen, U., & Rönkä, A. (2004). Adolescents' experiences of parental employment and parenting: Connections to adolescents' well-being. *Journal of Adolescence, 27*, 221–237.

Salmivalli, C., & Kaukiainen, A. (2004). Female aggression revisited: Variable and person-centered approaches to studying gender differences in different types of aggression. *Aggressive Behavior, 30*, 158–163.

Salovey, P., Rothman, A. J., Detweiler, J. B., & Steward, W. T. (2000). Emotional states and physical health. *American Psychologist, 55*, 110–121.

Salovey, P., Stroud, L. R., Woolery, A., & Epel, E. S. (2002). Perceived emotional intelligence, stress reactivity, and symptom reports: Further explorations using the Trait Meta-Mood Scale. *Psychology and Health, 17*, 611–627.

Sarason, I. G., Sarason, B. R., Shearin, E. N., & Pierce, G. R. (1987). A brief measure of social support: Practical and theoretical implications. *Journal of Social and Personal Relationships, 4*, 497–510.

Sauli, H. (2004). Perheet kasvavat, lapsia syntyy vähemmän [Families grow, fewer children are born]. Retrieved February 26, 2005, from www.stat.fi/tup/hyvinvointikatsaus/hyka_2004_4_sauli.pdf.

Scarr, S., & McCartney, K. (1983). How people make their own environments: A theory of genotype → environmental effects. *Child Development, 54*, 424–435.

Scheier, M., & Carver, C. S. (1985). Optimism, coping, and health: Assessment and implication of generalized outcome expectancies. *Health Psychology, 4*, 219–247.

Scheier, M., & Carver, C. (1992). Effects of optimism on psychological and physical well-being: Theoretical overview and empirical update. *Cognitive Therapy and Research, 16*, 210–228.

Scheier, M., Carver, C., & Bridges, M. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the Life Orientation Test. *Journal of Personality and Social Psychology, 67*, 1063–1078.

Scheier, M., Carver, C., & Bridges, M. (2001). Optimism and pessimism, and psychological well-being. In E. C. Chang (Ed.), *Optimism and pessimism: Implications for theory, research, and practice* (pp. 189–216). Washington, DC: American Psychological Association.

Schmitz, S., & Mrazek, D. A. (2001). Genetic and environmental influences on the associations between attention problems and other problem behaviors. *Twin Research, 4*, 453–458.

Schousboe, K., Willemsen, G., Kyvik, K. O., Mortensen, J., Boomsma, D. I., Cornes, B. K., et al. (2003). Sex differences in heritability of BMI: A comparative study of results from twin studies in eight countries. *Twin Research, 6*, 409–421.

Schütte, N. S., Malouff, J. M., Hall, L. E., Haggerty, D. J., Cooper, J. T., Golden, C. J., et al. (1998). Development and validation of a measure of emotional intelligence. *Personality and Individual Differences, 25*, 167–177.

Scourfield, J., John, B., Martin, N., & McGuffin, P. (2004). The development of prosocial behaviour in children and adolescents: Twin study. *Journal of Child Psychology and Psychiatry, 45*, 927–935.

Seligman, M. (2003). Foreword: The past and future of positive psychology. In C. Keyes & J. Haidt (Eds.), *Flourishing. Positive psychology and the life well-lived* (pp. xi–xx). Washington, DC: American Psychological Association.

Selzer, M. L. (1971). The Michigan Alcoholism Screening Test: The quest for a new diagnostic instrument. *American Journal of Psychiatry, 127*, 1653–1658.

SeniorWatch (2005). Retrieved February 26, 2005, from www.seniorwatch.de.

Siegrist, J. (1996). Adverse health effects of high-effort/low-reward conditions. *Journal of Occupational Health Psychology, 1*, 27–41.

Sihvola, E., Keski-Rahkonen, A. K., Dick, D. M., Pulkkinen, L., Rose, R. J., Marttunen, M., et al. (2005). Major and minor depression in a population-based adolescent twin sample. Manuscript submitted for publication.

Silbereisen, R. K., & Kracke, B. (1997). Self-reported maturational timing and adaptation in adolescence. In J. Schulenberg, J. L. Maggs, & K. Hurrelmann (Eds.), *Health risks and developmental transitions during adolescence* (pp. 85–109). Cambridge, UK: Cambridge University Press.

Silberg, J., Rutter, M., Meyer, J., Maes, H., Hewitt, J., Simonoff, E., et al. (1996). Genetic and environmental influences on the covariation between hyperactivity and conduct disturbance in juvenile twins. *Journal of Psychology and Psychiatry, 37*, 803–816.

Silventoinen, K. (2003). Determinants of variation in adult body height. *Journal of Biosocial Sciences, 35*, 263–285.

Silventoinen, K., Kaprio, J., Lahelma, E., Viken, R. J., & Rose, R. J. (2003). Assortative mating by body height and BMI: Finnish twins and their spouses. *American Journal of Human Biology, 15*, 620–627.

Silventoinen, K., & Lahelma, E. (2002). Health inequalities by education and age in four Nordic countries, 1986 and 1994. *Journal of Epidemiology and Community Health, 56*, 253–258.

Silventoinen, K., Sammalisto, S., Perola, M., Boomsma, D. I., Cornes, B., Davis, C., et al. (2003). Heritability of adult body height: A comparative study of twin cohorts in eight countries. *Twin Research, 6*, 399–408.

Silventoinen, K., Sarlio-Lähteenkorva, S., Koskenvuo, M., Lahelma, E., & Kaprio, J. (2004). Effect of environmental and genetic factors on education-associated disparities in weight and weight gain: A study of Finnish adult twins. *American Journal of Clinical Nutrition, 80*, 815–822.

Silventoinen, K., Posthuma, D., Lahelma, E., Rose, R. J., Kaprio, J. (in press). Genetic and environmental factors affecting self-rated health from age 16 to 25: a longitudinal study of Finnish twins. *Behavior Genetics.*

Silverstein, M. (2002). The aging family and social support networks. Retrieved September 17, 2002, from http://www-bfc-usc.edu/enold/class5/L...re/week_5_the_aging_family_and-soci.htm.

Silverstein, M., & Bengtson, V. (1997). Intergenerational solidarity and the structure of adult-parent relationships in American families. *American Journal of Sociology, 103*, 429–460.

Silverstein, M., & Long, J. D. (1998). Trajectories of grandparents' perceived solidarity with adult grandchildren: A growth curve analysis over 23 years. *Journal of Marriage and Family*, *60*, 912–923.

Simonoff, E., Pickles, A., Hervas, A., Silberg, J. L., Rutter, M., & Eaves, L. (1998). Genetic influences on childhood hyperactivity: Contrast effects imply parental rating bias, not sibling interaction. *Psychological Medicine, 28*, 825–837.

Smith, T. W. (1994). Concepts and methods in the study of anger, hostility and health. In A. W. Siegman & T. W. Smith (Eds.), *Anger, hostility and the heart* (pp. 23–42). Hillsdale, NJ: Erlbaum.

Smith, T. W., & Christensen, A. J. (1992). Cardiovascular reactivity and interpersonal relations: Psychosomatic processes in social context. Special Issue: Social Psychophysiology. *Journal of Social and Clinical Psychology, 11*, 279–301.

Smith, V. (1998). The fractured world of the temporary worker: Power, participation, and fragmentation in the contemporary workplace. *Social Problems, 45*, 411–430.

Snyder, M. (1983). The influence of individuals on situations: Implications for understanding the links between personality and social behavior. *Journal of Personality, 51*, 497–516.

Solantaus, T., Leinonen, J., & Punamäki, R.-L. (2004). Children's mental health in times of economic recession. Replication and extension of the family stress model. *Developmental Psychology, 40*, 412–429.

Spanier, G. B. (1976). Measuring dyadic adjustment: New scales for assessing the quality of marriage and similar dyads. *Journal of Marriage and the Family, 38*, 15–28.

Stansfeld, S. A., Fuhrer, R., Shipley, M. J., & Marmot, M. G. (1999). Work characteristics predict psychiatric disorder: Prospective results from the Whitehall II Study. *Occupational and Environmental Medicine, 56*, 302–307.

STATA User's Guide Release 7. (2001). College Station, Texas: Stata Press.

Statistical Yearbook of Finland. (2002). Helsinki, Finland: Statistics Finland.

Stattin, H., & Kerr, M. (2000). Parental monitoring: A reinterpretation. *Child Development, 71*, 1072–1085.

Stattin, H., & Magnusson, D. (1990). *Pubertal maturation in female development* (Vol. 2). Hillsdale, NJ: Lawrence Erlbaum.

Strazdins, L., Korda, R. J., Lim, L., Broom, D. H., & D'Souza, R. M. (2004). Round-the-clock: Parent work schedules and children's well-being in a 24-h economy. *Social Science and Medicine, 59*, 1517–1527.

Svedberg, P., Lichtenstein, P., & Pedersen, N. L. (2001). Age and sex differences in genetic and environmental factors for self-rated health: A twin study. *Journal of Gerontology, 56B*, S171–S178.

Taylor, G. J. (2004). Alexithymia: 25 years of theory and research. In I. Nyklicek, L. Temoshok, & A. Vingerhoets (Eds.), *Emotional expression and health. Advances in theory, assessment and clinical applications* (pp. 137–153). New York: Brunner-Routledge.

Taylor, G. J., Bagby, R. M., & Parker, J. D. A. (1997). *Disorders of affect regulation: Alexithymia in medical and psychiatric illness*. New York: Cambridge University Press.

Thomas, D. C. (2004). *Statistical methods in genetic epidemiology*. Oxford, UK: Oxford University Press.

Thompson, R. A. (1990). Emotion and self-regulation. In R. A. Thompson (Ed.), *Socioemotional development. Nebraska symposium on motivation* (Vol. 36, pp. 367–467). Lincoln: University of Nebraska Press.

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. In N. A. Fox (Ed.), *The development of emotion regulation: Biological and behavioral considerations* (pp. 25–52). Monographs of the Society for Research in Child Development, 59 (2–3, Serial No. 240). Chicago: University of Chicago Press.

Thompson, R. A., Flood, M. F., & Lundquist, L. (1995). In D. Cicchetti & S. L. Toth (Eds.), *Emotion, cognition, and representation. Rochester symposium*

on developmental psychopathology (Vol. 6, pp. 261–299). Rochester, NY: University of Rochester Press.

Tinsley, B., & Parke, R. (1984). Grandparents as socialization agents for their grandchildren. In M. Lewis (Ed.), *Beyond the dyad* (pp. 161–194). New York: Plenum.

Tomassini, C., Stamatis, K., Grundy, E., Fokkema, T., Martikainen, P., Broese van Groenou, M., et al. (2004). Contacts between elderly parents and their children in four European countries: Current patterns and future prospects. *European Journal of Ageing*, *1*, 54–63.

Treloar, S. A., & Martin, N. G. (1990). Age at menarche as a fitness trait: Nonadditive genetic variance detected in a large twin sample. *American Journal of Human Genetics, 47*, 137–148.

Tremblay, R. E. (2000). The development of aggressive behavior during childhood: What have we learned in the past century? *International Journal of Behavioral Development, 24*, 129–141.

Turkheimer, E., Haley, A., Waldron, M., D'Onofrio, B., & Gottesman, I. I. (2003). Socioeconomic status modifies heritability of IQ in young children. *Psychological Science, 14*, 623–628.

Uhlenberg, P., & Hammill, B. G. (1998.) Frequency of grandparent contact with grandchild sets: Six factors that make a difference. *Gerontolology, 38*, 276–285.

Uhlenberg, P., & Kirby, J. B. (1998). Grandparenthood over time. Historical and demographic trends. In M. Szinovacz (Ed.), *Handbook of grandparenthood* (pp. 23–39). London: Greenwood Press.

U.S. Bureau of Labor Statistics. (1997). *Contingent and alternative employment arrangements* (USDL report 97–422). Washington, DC: Author.

Vaalamo, I., Pulkkinen, L., Kinnunen, T., Kaprio, J., & Rose, R. J. (2002). Interactive effects of internalizing and externalizing problem behaviors on recurrent pain in children. *Journal of Pediatric Psychology, 27*, 245–257.

Vahtera, J., Kivimäki, M., Pentti, J., Linna, A., Virtanen, M., Virtanen, P., et al. (2004). Organisational downsizing, sickness absence and mortality: The 10-Town prospective cohort study. *British Medical Journal, 328*, 555–557.

Vahtera, J., Kvimäki, M., Uutela, A., & Pentti, J. (2000). Hostility and ill health: Role of psychosocial resources in two contexts of working life. *Journal of Psychosomatic Research, 48*, 89–98.

Van Beijsterveldt, C. E. M., Bartels, M., Hudziak, J. J., & Boomsma, D. I. (2003). Causes of stability of aggression from early childhood to adolescence: A longitudinal genetic analysis in Dutch twins. *Behavior Genetics, 33*, 591–605.

Van den Oord, E. J. C. G., Boomsma, D. I., & Verhulst, F. C. (1994). A study of problem behaviors in 10- to 15-year-old biologically related and unrelated adoptees. *Behavior Genetics, 24*, 193–205.

Van der Valk, J. C., Verhulst, F. C., Stroet, T. M., & Boomsma, D. I. (1998). Quantitative genetic analysis of internalizing and externalizing problems in a large sample of 3-year-old twins. *Twin Research, 1*, 25–33.

van Ranst, N., Verschuren, K., & Marcoen, A. (1995). The meaning of grandparents as viewed by adolescent grandchildren: An empirical study in Belgium. *International Journal of Aging and Human Development, 41*, 311–324.

Varilo, T., & Peltonen, L. (2004). Isolates and their potential use in complex gene mapping efforts: Commentary. *Current Opinion in Genetics and Development, 14*, 316–323.

Vierikko, E. (2004). Genetic and environmental effects on aggression. (Jyväskylä Studies in Education, Psychology and Social Research, No. 242). Jyväskylä, Finland: University of Jyväskylä.

Vierikko, E., Pulkkinen, L., Kaprio, J., & Rose, R. J. (2004). Genetic and environmental influences on the relationship between aggression and hyperactivity-impulsivity as rated by teachers and parents. *Twin Research, 3*, 261–274.

Vierikko, E., Pulkkinen, L., Kaprio, J., & Rose, R. J. (in press). Genetic and environmental sources of continuity and change in aggression during early adolescence. *Aggressive Behavior.*

Vierikko, E., Pulkkinen, L., Kaprio, J., Viken, R., & Rose, R. J. (2003). Sex differences in genetic and environmental effects on aggression. *Aggressive Behavior, 29*, 55–68.

Virtanen, M., Kivimäki, M., Elovainio, M., & Vahtera, J. (2002). Selection from fixed-term to permanent employment: Prospective study on health status and behavioural risk factors. *Journal of Epidemiology and Community Health, 56*, 693–699.

Virtanen, M., Kivimäki, M., Elovainio, M., Vahtera, J., Kokko, K., & Pulkkinen, L. (2005). Mental health and hostility as predictors of temporary employment: Evidence from two prospective studies. *Social Science & Medicine, 61*, 2084–2095.

Virtanen, P., Liukkonen, V., Vahtera, J., Kivimäki, M., & Koskenvuo, M. (2003). Health inequalities in the workforce: The labour market core-periphery structure. *International Journal of Epidemiology, 32*, 1022–1028.

Vollrath, M., Alnaes, R., & Torgersen, S. (1996). Differential effects of coping in mental disorders: A prospective study in psychiatric outpatients. *Journal of Clinical Psychology, 52*, 125–135.

von Os, J., Wichers, M., Danckaerts, S., Van Gestal, C., Derom, C., & Vlietnick, R. (2001). A prospective twin study of birth weight discordance and child problem behavior. *Biological Psychiatry, 50*, 593–599.

Walden, T. A., & Smith, M. C. (1997). Emotion regulation. *Motivation and Emotion, 21*, 7–25.

Waldstein, S. R., Kauhanen, J., Neumann, S. A., & Katzel, L. I. (2002). Alexithymia and cardiovascular risk in older adults: Psychosocial, psychophysiological, and biomedical correlates. *Psychology and Health, 17*, 597–610.

Walker, A. (1999). Ageing in Europe: Challenges and consequences. *Zeitschrift für Geriatrie und Gerontologie, 33*, 390–397.

Walker, R. N. (1967). Some temperament traits in children as viewed by their peers, their teachers, and themselves. *Monographs of the Society for Research in Child Development*, Serial No. 114.

Warner, L. A., & White, H. R. (2003). Longitudinal effects of age at onset and first drinking situations on problem drinking. *Substance Use & Misuse, 38*, 1983–2016.

Waterman, A. S. (1999). Commentary. Identity, the identity statuses, and identity status development: A contemporary statement. *Developmental Review, 19*, 591–621.

Watkins, P. L., Ward, C. H., Southard, D. R., & Fisher, E. B., Jr. (1992). The Type A belief system: Relationships to hostility, social support, and life stress. *Behavioral Medicine, 18*, 27–32.

Weidner, G., Connor, S. L., Hollis, J. F., & Connor, W. E. (1992). Improvements in hostility and depression in relation to dietary change and cholesterol lowering: The family heart study. *Annals in Internal Medicine, 15*, 820–823.

Werdelin, J. (1966). Teacher ratings, peer ratings, and self-ratings of behavior in school. *Educational & Psychological Interactions*, No. 11.

Werner, E. E., & Smith, R. S. (2001). *Journeys from childhood to midlife: Risk, resilience, and recovery.* New York: Cornell University Press.

Wiesner, M., & Ittel, A. (2002). Relations of pubertal timing and depressive symptoms to substance use in early adolescence. *Journal of Early Adolescence, 22*, 5–23.

Williams, J. M., & Dunlop, L. C. (1999). Pubertal timing and self-reported delinquency among male adolescents. *Journal of Adolescence, 22*, 157–171.

Williams, R. B., Haney, T. L., Lee, K. L., Kong, Y., Blumenthal, J. A., & Whalen, R. E. (1980). Type A behavior, hostility, and coronary atherosclerosis. *Psychosomatic Medicine, 42*, 539–549.

Williams, S., & Poulton, R. (1999). Twins and maternal smoking: Ordeals for the fetal origins hypothesis? A cohort study. *British Medical Journal, 318*, 897–900.

Wills, T. A. (1998). Substance abuse. In H. S. Friedman (Ed.), *Encyclopedia of mental health* (pp. 607–619). San Diego, CA: Academic Press.

Winefield, A. H. (1995). Unemployment: Its psychological costs. In C. L. Cooper & I. T. Robinson (Eds.), *International Review of Industrial and Organizational Psychology: Vol. 10* (pp. 169–212). London: Wiley.

Winter, T., Karvonen, S., & Rose, R. J. (2002). Does religiousness explain regional differences in alcohol use in Finland? *Alcohol & Alcoholism, 37*, 330–339.

Wong, A. H., Gottesman, I. I., & Petronis, A. (2005). Phenotypic differences in genetically identical organisms: The epigenetic perspective. *Human Molecular Genetics*, 14 Suppl 1, R11–R18.

Woolf, C. M., & Gianas, A. D. (1976). Congenital cleft lip and fluctuating dermatoglyphic asymmetry. *American Journal of Human Genetics, 28*, 400–403.

www.diogenes-eu.org
www.minedu.fi/minedu/education/education_system.html
www.pisa.oecd.org
www.psy.vu.nl/mxbib/
www.stakes.info/files/pdf/Raportit/Facts_2005.pdf
www.stat.fi/index_en.html
www.vcu.edu/mx/

Ylinentalo, O. (1965). *Persoonallisuusinventaario kansakoulun ala-asteelle* [A personality inventory for elementary school]. Centre for Educational Research, University of Jyväskylä, Finland, Nr. 13.

Zarit, S. H., & Eggebeen, D. J. (2002). Parent-child relationships in adulthood and later years. In M. C. Bornstein (Ed.), *Handbook of parenting: Vol. 1: Children and parenting* (pp. 135–161). Mahwah, NJ: Erlbaum.

Zeidner, M., Boekaerts, M., & Pintrich, P. R. (2000). Self-regulation: Directions and challenges for future research. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 749–768). New York: Academic Press.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13–39). New York: Academic Press.

Zuckerman, M. (1979). *Sensation seeking: Beyond the optimal level of arousal*. Hillsdale, NJ: Erlbaum.

Author Index

Subject Index