



## New Directions in the Sociology of Aging

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NEW DIRECTIONS IN THE  
Sociology of  
Aging

Panel on New Directions in Social Demography, Social Epidemiology,  
and the Sociology of Aging

Linda J. Waite and Thomas J. Plewes, *Editors*

Committee on Population

Division of Behavioral and Social Sciences and Education

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PANEL ON NEW DIRECTIONS IN SOCIAL DEMOGRAPHY,  
SOCIAL EPIDEMIOLOGY, AND THE SOCIOLOGY OF AGING

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## Preface

The aging of the population of the United States is an inexorable demographic transformation. At a time of major economic and social change, the growing elderly population is placing an increasing strain on the federal, state, and local budgets that will almost certainly lead to changes in programs and services. Likewise, the social context within which older individuals and families function is changing the environment for older persons.

Understanding the causes, consequences and implications of these demographic, economic, and social changes is vital to the development of sound social policy. Sociology can be an important aid to this task. It offers a knowledge base, a number of useful analytic approaches and tools, and unique theoretical perspectives that can assist in understanding these complex issues. Because the social and physical environments in which people live shape them, grasping how social systems work, how various social institutions are interrelated, how attitudes and values are formed and transformed, how differences among individuals and groups are reproduced or reduced, and how realities are socially constructed are central to this task.

However, despite the significant potential of the sociology of aging, one indicator that interest in the sociology of aging has declined in recent years is a reported contraction in the number of grant submissions to the National Institute on Aging's (NIA's) Division of Behavioral and Social Research (BSR). In January 2009, a major independent review of BSR recommended that given the changing nature of the social context, BSR should strive "to revitalize the social demography, epidemiology, and sociology portfolios" (Cacioppo et al., 2009, p. 10) as well as to continue research on social networks and their relationship to health (Suzman, 2010).

In response to these circumstances, BSR turned to the National Research Council (NRC) to evaluate the recent contributions of social demography, social epidemiology, and sociology to the study of aging and to identify promising new research directions in these subfields.

### Statement of Task

An ad hoc panel of experts will conduct a study and prepare a report that will evaluate the recent contributions of social demography, social epidemiology, and sociology to the study of aging and seek to identify promising new research directions in these subfields. To support the panel's work, 8 to 10 papers will be commissioned and presented at an open workshop. By drawing on the papers, the discussions at the workshop, and the panel's own interpretation of the state of the literature, the panel will seek to identify and recommend to the National Institute on Aging's Division of Behavioral and Social Research promising research directions that can reasonably be expected to have high payoff for the study of aging.

In response, the NRC's Committee on Population (CPOP) established the Panel on New Directions in Social Demography, Social Epidemiology, and the Sociology of Aging. The panel interpreted its charge quite broadly, while understanding that a large part, but not all of aging research, is conducted under the auspices of NIA. Although the panel approached the topic with a broad brush, some topics were not considered germane for the purposes of this report. For example, specific issues, such as those of causality that arise from linkages between social constructs and health outcomes, were not explored in depth.

To gather information, the panel organized a two-day workshop to which it invited a series of leading researchers to offer their perspectives on the state of the field and to reflect upon promising future directions. Members of the panel and NRC staff visited several research centers to better appreciate how researchers from different disciplines working within an overarching model (the transdisciplinary approach) are working on aging issues, what obstacles this approach faces, and, to the extent it is successful, how it might be encouraged. The site visit to the Center for Cognitive and Social Neuroscience (CCSN) at the University of Chicago provided an opportunity to learn about the work of CCSN; the Chicago Health, Aging, and Social Relations Study; the Chicago Social Brain Network; and the Arete Initiative. A second site visit to Harvard University included meetings

with the Department of Health Care Policy, Department of Sociology, and the Center for Population and Development Studies.

The workshop presentations and discussions, together with these site visits, gave the panel the opportunity to develop the perspectives and articulate the challenges shared here. This two-part volume is the product of that study process. Part I is the final report of the panel. Part II contains revised versions of the papers presented at the workshop.

Part I, initially published in interim prepublication form under the title *The Future of the Sociology of Aging: An Agenda for Action* (National Research Council, 2013) is divided into four sections: (1) an introduction that documents the various approaches to the study of aging and discusses the role of sociology in what is a wide-ranging and diverse field of study; (2) a proposed three-dimensional conceptual model for studying social processes in aging over the life cycle; (3) a review of existing databases, data needs and opportunities, primarily in the area of measurement of interhousehold and intergenerational transmission of resources, biomarkers and biosocial interactions; and (4) a summary of roadblocks and bridges to transdisciplinary research that will affect the future directions of the field of sociology of aging.

Several themes emerge from the collection of papers in Part II, initially published in an interim prepublication form under the title *Perspectives on the Future of the Sociology of Aging* (National Research Council, 2012c). First is the need to grapple with the changing nature of the objects of study: social institutions, social networks, social groups, and social forces. These social arrangements vary significantly from generation to generation, and from place to place, and, sometimes even from year to year, leading to changing new and different understandings of how the life course should be organized. Thus, for example, the social factors that influence adults who have recently turned 65 are likely to be quite different from those influencing adults who will turn 65 in two or three decades. The ever-changing, dynamic nature of the subject matter offers special challenges to sociologists that may not characterize other fields. A second theme underscores the importance of recognizing that aging occurs across the entire life span, so research questions related to outcomes in old age cannot be properly understood by focusing solely on what occurs during the later stages of life (Elder, 2002). A third theme acknowledges the vast, largely untapped potential for greater integrated science. Some of the most promising recent research emerges at the interstices between disciplines when, for example, a researcher (or more frequently an interdisciplinary team of researchers) has begun to explore how genetic influences and social environments work in concert to vary the course of aging. These last two themes underscore the importance of adopting fruitful theoretical approaches. The choice of inputs, outputs, mechanisms, and theoretical constructs—and specification

of the levels at which they operate—are crucial to the success of any effort, whether it is the development of a model, the collection of data, or the design of an intervention trial.

The emergence of these common themes is particularly noteworthy given the wide variety of approaches and perspectives that the papers in Part II of this volume represent. The authors of these papers come from a range of disciplines: from sociology and demography to social genomics and public health. A close reading of these papers in this volume should give readers a better understanding of where the field of the sociology of aging stands today and how it may be gainfully advanced in the future. In addition, taken collectively, the papers highlight the assortment of tools and perspectives that can bolster understanding of aging processes in ways that can guide policy.

This report and the papers were prepared with the assistance and close cooperation of many individuals. I would like to first express appreciation to the members of the committee. Despite having many other responsibilities, they generously donated their time and expertise to the project. Members contributed to the study by providing background readings, leading discussions, making presentations, drafting and revising chapters, and critically commenting on the various report drafts. The perspectives that members brought to the table were instrumental in synthesizing ideas throughout the committee process.

Drafting the report was a collaborative enterprise. Special thanks go to Amy Smith (Social Insight) who synthesized drafts written by the committee to produce much of the body of the final report portion of this publication. A special note of appreciation is owed to those who contributed papers, polished them, and willingly made revisions in response to the external reviews.

Several members of the staff of the National Academies made significant contributions to the report. The panel was established under the auspices of CPOP, directed by Barney Cohen, who was instrumental in developing the study and providing guidance and support to the staff from project initiation through August 2012. Thanks are due to Keiko Ono, who served as a project officer for the project until July 2012; Robert Pool for research and writing assistance; Jacqui Sovde for logistical support; Danielle Johnson for report preparation; Kirsten Sampson Snyder for guiding the volume through review; Paula Whitacre for editing; and Yvonne Wise for managing the production process. Tom Plewes, the incoming director of CPOP, provided oversight of the preparation of the report for publication.

The project was undertaken at the request of the BSR at NIA and funding from NIA made this publication possible. Particular thanks go to Richard Suzman who was the intellectual catalyst for this project, and we are grateful to him and to NIA for their support.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the NRC Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

The review was conducted in two parts—with independent reviews conducted for each of the parts of this volume. The following individuals reviewed Part I of this final report: Nancy Adler, Departments of Psychiatry and Pediatrics, University of California, San Francisco; Jeffrey A. Burr, Department of Gerontology, McCormack Graduate School of Policy and Global Studies, University of Massachusetts, Boston; Deborah Carr, Department of Sociology, Rutgers University; Peter T. Ellison, Peabody Museum, Department of Human Evolutionary Biology, Harvard University; Fran Goldscheider, Department of Sociology, Emerita, Brown University, and professor, University of Maryland, College Park; Theodore J. (Jack) Iwashyna, Department of Internal Medicine, University of Michigan Health System; Scott M. Lynch, Department of Sociology and Office of Population Research, Princeton University; and Angela M. O’Rand, Trinity College of Arts and Sciences, Duke University.

The following individuals reviewed the volume of papers that appears as Part II of this final report: John T. Cacioppo, Department of Psychology, University of Chicago; Andrew J. Cherlin, Department of Sociology, Johns Hopkins University; Brian M. D’Onofrio, Department of Psychological and Brain Sciences, Indiana University; Fran Goldscheider, Department of Sociology, Emerita, Brown University, and professor, University of Maryland, College Park; Melissa Hardy, The Gerontology Center, Pennsylvania State University; Mark Hayward, Population Research Center, University of Texas, Austin; Theodore J. (Jack) Iwashyna, Department of Internal Medicine, University of Michigan; Hillard S. Kaplan, Department of Anthropology, University of New Mexico; Scott M. Lynch, Department of Sociology and Office of Population Research, Princeton University; James Nazroo, School of Social Sciences, University of Manchester, England; Jill Quadagno, Pepper Institute on Aging and Public Policy, Florida State University; Burton H. Singer, Emerging Pathogens Institute, University of Florida; and Mai Stafford, Department of Epidemiology and Public Health, University College London School of Life and Medical Sciences.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the contents of this volume before its release. The review of the report in Part I of

this report was overseen by Jane Menken, Institute of Behavioral Science, University of Colorado, Boulder. The review of the papers in Part II was overseen by Barney Cohen, then director of CPOP.

Appointed by the NRC, they were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content rests entirely with the authors and the institution.

Linda J. Waite, *Chair*  
Panel on New Directions in Social Demography,  
Social Epidemiology, and the Sociology of Aging

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# PART I

## FINAL REPORT



## Summary

The aging of the population of the United States is occurring at a time of major economic and social changes. These economic changes include consideration of increases in the age of eligibility for Social Security and Medicare and possible changes in benefit levels. Furthermore, changes in the social context in which older individuals and families function may well affect the nature of key social relationships and institutions that define the environment for older persons.

Sociology offers a knowledge base, a number of useful analytic approaches and tools, and unique theoretical perspectives that can facilitate understanding of these demographic, economic, and social changes, and, to the extent possible, their causes, consequences, and implications. Sociology is an integrative science, concerning itself with how social systems work and how various social institutions are interconnected, with how micro and macro social processes are linked, with how attitudes and values are formed, with how they differ among individuals and groups, and with how realities are socially constructed. In recent years, social demography, social epidemiology, and sociology have been called on to contribute to the study of aging and identify promising new research directions in these subfields.<sup>1</sup>

At the request of the National Institute on Aging's (NIA's) Division of Behavioral and Social Research (BSR), the National Research Council's Committee on Population established the Panel on New Directions in Social Demography, Social Epidemiology, and the Sociology of Aging. A major

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<sup>1</sup>In the title and body of this report, the term "sociology" is shorthand for the fields of sociology, social demography, and social epidemiology. The terms are used interchangeably.

part of the panel's charge in its Statement of Task was to conduct a study and prepare a report that will evaluate the recent contributions of social demography, social epidemiology, and sociology to the study of aging and seek to identify promising new research directions in these subfields. To support the panel's work, nine papers were prepared and presented at a workshop. These papers, included as Part II of this volume, were designed to come from a range of approaches and perspectives—from sociology and demography to social genomics and public health—yet there emerged from the papers a common and a collective highlighting of the broad array of tools and perspectives that can provide the basis for further advancing the understanding of aging processes in ways that can inform policy.

The panel drew on these papers, the discussions at the workshop, and the panel's own interpretation of the state of the literature to identify and recommend to NIA's BSR promising research directions that can reasonably be expected to have high payoff for the study of aging. We arrived at these recommendations by documenting the various approaches to the study of aging and the role of sociology, which is a wide-ranging and diverse field; laying out a proposed three-dimensional conceptual model for studying social processes in aging over the life course; reviewing existing databases and a discussion of data needs and opportunities; and summarizing roadblocks and bridges to the necessary transdisciplinary research that affect future directions in the sociology of aging. This work of the panel is presented in Part I of this volume.

Several themes became evident through the panel's documentation of the various approaches to the study of aging. The first is that aging is a focus of study in virtually all areas of policy and academic research, spanning the basic and applied sciences in fields ranging from anthropology, biology, and gerontology to engineering, architecture, and urban planning. It occurs at many different levels of analysis, from macro structures and systems, to the meso level of social institutions, and to the micro level of individual relationships and behaviors. The study of aging increasingly considers time as an important element embedded in the concept of life course that captures the significance of the passage of time over the lifelong process of aging, because old age itself cannot be understood without an awareness of the accumulated impact of the decades that came before. And the study of aging has fostered collaboration across the traditional disciplines—economics, biology, psychology, sociology—and the emerging fields, such as social genomics, computational sociology, biodemography, and social neuroscience. For example, in social epidemiology researchers originating in the disciplines sociology, epidemiology, physiology, and medicine have collaborated to make significant gains in understanding how factors in the social environment (such as socioeconomic position, income distribution, social networks, social support, social capital, community cohesion, work

## SUMMARY

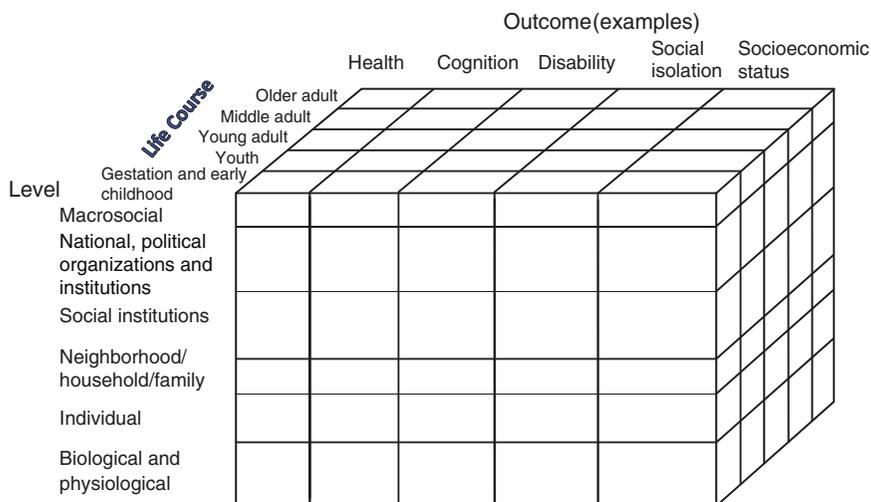


FIGURE S-1 Conceptual model for studying social processes in aging over the life course.

environment, neighborhood and community) may be related to a broad range of mental, physical, and behavioral health outcomes. This kind of transdisciplinary work can yield great benefits but is difficult to achieve and sustain.

The panel makes a strong case for the development of conceptual models that can encompass the lives, structures, and contexts across the aging process and capture heterogeneity, fluidity, and indeterminacy within the larger patterns. The next phase of aging research must be guided by such models. The panel documents a proposed conceptual model for studying social processes in aging and the life course (see Figure S-1).

The model has three dimensions: (1) levels from macro to subindividual; (2) developmental stages over the life course; and (3) examples of outcomes of interest along social, institutional, and biographical dimensions. The panel's deliberations regarding the further explication of, and connections across, different levels also informed this recommended conceptual model. In reviewing this work, the panel sees needs and opportunities for further developing this model or a set of models to guide research.

**Recommendation 1.** The National Institute on Aging should engage researchers in the development of a conceptual model, or a number of conceptual models, for social processes in aging over the life course in multiple dimensions.

The resulting model, which may be a version of the one used by the panel or may be actually several models, can play a much more specific role than simply serving as a guide for framing the aging research program. A model can make a contribution to standardizing the approach that science takes in assessing issues associated with an aging population. It can lay the intellectual basis for the development of cross-disciplinary metrics.

**Recommendation 2.** The conceptual model, or models, should be used by the National Institute on Aging to serve as the basis for developing a standard set of key measures, across disciplines, for use in surveys and other types of data collections and analyses that focus on aging issues.

Indeed, new requirements for data and new opportunities for data gathering have been generated by the ongoing changes in the social contexts of aging and refinements in the conceptualization of aging, particularly the appreciation of dynamic and reciprocal relationships between individuals and social contexts. The panel identifies several key areas in need of further development to enhance measurement and improve data quality, including the important task of wedding the timing and frequency of measurements to the conceptual models motivating their collection. The panel also emphasizes the promise of the growing study of biomarkers, which in turn generates a growing need for new measures to investigate the mediation of the social environment over the life course and identifies opportunities to gather data to take advantage of ongoing studies, linkages to existing databases, and new social media and technologies. We point out the importance of data-gathering efforts that harmonize across different disciplines, given the increasing prominence and promise of transdisciplinary research and make several recommendations to implement these findings.

**Recommendation 3.** The National Institute on Aging should manage its research program in a manner that promotes implementation of models and metrics in the areas of:

- Encouraging conceptualization of family relationships and exchanges, including behavior, expectations, plans and attitudes, and to develop measures of key family concepts, because the family is a fundamentally important social context for aging.
- Encouraging conceptualization of characteristics of contexts and local areas through development of new measures, expanded links to existing data, and ongoing incorporation of new technologies, such as global positioning systems, smartphones, and area mapping.

- **Building on recent advances in the use of biomeasures and linking them to social and behavioral processes through conceptualization of the potential links, attention to measurement tools and analysis techniques, identification of “best practices” in developing the linkages, and the development of protocols for cross-training of researchers in sociology with other relevant disciplines, such as genetics, economics, medicine, and biology.**
- **Illuminating the mechanisms that mediate between social contexts and health, both across the life course and over generations.**

This new focus should be data-based. There are a myriad of opportunities for generating the data that are needed to encourage and illuminate these new approaches. They range from augmenting existing studies to add scope and depth, to subsampling for populations of interest in ongoing surveys, to adopting new sample design strategies, to exploitation of the resources of the Internet.

**Recommendation 4. The National Institute on Aging should seek opportunities to:**

- **Supplement ongoing surveys by addition of respondents related to members of current samples.**
- **Identify subpopulations of interest and ensure their representation in its sponsored surveys.**
- **Explore the use of the Internet and other electronic media to gather information on patterns of human interaction, consumption, and behavior.**

This report repeatedly underscores the importance of the transdisciplinary approach to the study of aging. This approach is a process as well as a challenge. It demands the transformation of individual researchers into an effective team with a shared vision and a common vocabulary; however, there are both roadblocks and bridges to implementing this approach. The panel documents institutional and administrative impediments, disciplinary boundaries set by professions, disciplinary preferences exhibited by funding agencies, and, finally, the disciplinary silos within which the research community has been accustomed to operate and which have served as barriers to developing new and promising ways of studying important issues in aging. Nevertheless, there are growing examples of transdisciplinary bridges through institutional and administrative changes and the conscious efforts of journals, societies, and funding agencies to break down the walls between the disciplines. In view of the importance of the transdisciplinary

approach to the study of aging, these fledgling efforts would benefit from promotion and extension.

**Recommendation 5.** The National Institute on Aging should encourage universities and research organizations to intentionally promote transdisciplinary research by:

- Reducing institutional barriers to transdisciplinary research and interdisciplinary research teams.
- Developing structures to encourage input and participation from outside ongoing projects in such a way as to bring together, in a transdisciplinary research environment, researchers from several institutions, and representing multiple approaches.

# 1

## Introduction and Approach

The population of the United States is growing inexorably older. With birth rates historically low and life expectancy continuing to rise, the age distribution of the population in the United States is growing steadily older. The portion of Americans who are aged 65 or older reached 12 percent in 2010 and is projected to be 20.2 percent by 2050 (Vincent and Velkoff, 2010). This demographic shift is occurring at a time of major economic and social changes, which have important implications for the growing elderly population.

The dramatic growth in the percentage of the U.S. population that is older than the traditional retirement age of 65, for example, is placing an increasing strain on the federal budget that will almost certainly lead to changes in the Social Security and Medicare programs, such as increases in the age of eligibility and perhaps changes in benefit levels (see National Research Council, 2012b; National Research Council and National Academy of Public Administration, 2010). Other changes, such as the move away from defined-benefit toward defined-contribution retirement plans and other changes in corporate and municipal pension plans, and the 2008 financial recession, all have economic implications for older people. They are also likely to make it more difficult for certain groups of future retirees to fund their retirements at the level that they had planned and would like.

Along with these economic changes, the social context in which older individuals and families function is also changing, affecting, among other things, the nature of certain types of social relationships and institutions that provide part of the support infrastructure available to older persons. Demographic and social trends—such as changes in marriage and fertility

preferences, the increasing fragility of unions, the decline of the intact nuclear family, the increasing amount of time for some young people to transition to adulthood, and the continuing improvements in health and disability at older ages—all influence the needs of older persons.

To deal effectively with the challenges created by population aging, it is vital to first understand these demographic, economic, and social changes and, to the extent possible, their causes, consequences, and implications. Sociology offers a knowledge base, a number of useful analytic approaches and tools, and unique theoretical perspectives that can be important aids to this task. Furthermore, sociology is at its heart an integrative science, and it has been suggested that sociology is suited for “integrating what is known about human behavior” (Gove, 1995, p. 1,197). It concerns itself with how social systems work and how various social institutions are interconnected, with how micro and macro social processes are linked, with how attitudes and values are formed, with how they differ between individuals and groups, and with how realities are socially constructed.

The chapters in Part I refer, whenever possible, to the papers that appear in Part II. Following this introduction, Chapter 2 lays out the diverse approaches that have been taken to the study of aging and presents a conceptual model of aging that can be used to situate and relate research on aging conducted in sociology and throughout the social sciences, including transdisciplinary work. This conceptual model served as guidance for the chapter’s review of research that appears in Part II of the report. Chapter 3 then identifies some new and emerging data needs and opportunities in the study of aging. Chapter 4 directly examines the roadblocks to future transdisciplinary research on aging—and also examines the bridges that make such work feasible. This work may eliminate the roadblocks, while researchers compile essential new data that can be used in a clearly delineated and yet flexible conceptual model. This will enable sociologists of aging and researchers in complementary fields to engage in transdisciplinary research, tackling fundamental questions, and providing insights on both individual and collective experiences of aging.

Consistent with the task given to the panel to identify and recommend to the National Institute on Aging’s (NIA’s) Division of Behavioral and Social Research (BSR) promising research directions that can reasonably be expected to have high payoff for the study of aging, the panel makes some thirteen recommendations in this report. Not all are of equal importance. The several recommendations having to do with the standardization of measures across data collections and disciplines based on a conceptual framework should be considered of the highest priority. Others that would permit a fuller understanding of the mechanisms that contribute to health outcomes, particularly those that would associate biomeasures and social and behavioral processes are also of high priority.

## APPROACH

Human aging at both the individual and population level compels careful study. As life expectancy increases, the average individual is spending a greater proportion of the life span at an advanced age, and the population as a whole includes an increasing proportion of the aged. Aging has become a focus of study in virtually all areas of policy and academic research, spanning the basic and applied sciences in fields from anthropology, biology, and gerontology to engineering, architecture, and urban planning.

The diverse scholarly approaches to aging reflect the multifaceted and complex nature of aging and its many dimensions. Topics of attention include cognitive function, health, disability, financial, and emotional well-being, labor force participation, living arrangements, social ties and transfers, perceptions of aging and older persons, and public resource allocation. The study of aging also occurs at many different levels of analysis, from macro structures and systems, to the meso level of social institutions, the micro level of individual relationships and behaviors, and the even tighter focus at the level of physiology and biology (see Settersten and Angel, 2011). At any level of analysis, time is an important element. The concept of the life course, for example, captures the significance of the passage of time over the lifelong process of aging, as old age itself cannot be understood without an awareness of the accumulated impact of the decades that came before.

In addition to many different topics and levels of analysis, the study of aging can encompass many different kinds of questions, from the most applied to the quite philosophical. Some researchers are motivated to ask “What is the proper dose of a Beta blocker for older post-operative patients?” (Ahmed and Dell’Italia, 2004) and “How does urban/rural setting affect the quality of nursing home care?” (Kang, Meng, and Miller, 2011). Others seek answers to the questions “Does age bring wisdom?” (Grossmann et al., 2010) or “What is the meaning of life?” (Hill and Kaplan, 1999; Kaplan et al., 2000).

In the wide-ranging and diverse study of aging, sociology has often been at the forefront. Sociology is particularly well suited to that position as an integrative discipline that examines the operation of social institutions, the connections between macro and micro processes, the interaction of the social with the biological, and the social construction of reality over time. Already in 1979, the American Sociological Association recognized and created an institutional home for the sociology of aging by establishing what has subsequently become the section on Aging and the Life Course (Settersten and Angel, 2011). Today, a number of specialized journals publish social research on aging (e.g., *The Journals of Gerontology: Social Sciences*, *The Gerontologist*, *Research on Aging*, and *Psychology of Aging*)

and top general-interest sociology journals include aging-related research. The recent publication of the *Handbook of Sociology of Aging* (Settersten and Angel, 2011), a 700-page volume synthesizing 30 years of research, is the most recent and comprehensive expression of this enormously fertile field of study.

Sociology, of course, does not stand alone in the study of aging. As with other topics compelling concern and attention, the study of aging involves effort and approaches from many different fields. The study of aging has not only engaged many traditional disciplines—economics, biology, psychology—but has also fostered collaboration that has furthered new fields, such as social genomics, computational sociology, biodemography, and social neuroscience.

One particular example of successful merging of many disciplines is social epidemiology. Through the shared efforts of researchers originating in the disciplines of sociology, epidemiology, physiology, and medicine, significant gains have been made in understanding how factors in the social environment (such as socioeconomic position, income distribution, social networks, social support, social capital, community cohesion, work environment, neighborhood, and community) may be related to a broad range of mental, physical, and behavioral health outcomes. Social epidemiologists have successfully formulated and tested various hypotheses about the links between social conditions and health; they have also designed and implemented various health interventions to improve population health (see Gruenewald, Chapter 10).

This kind of work has come to be known as transdisciplinary. In the typology formulated by Rosenfield (1992), multidisciplinary work entails researchers from separate disciplines who work independently on the same issue from within their distinct disciplines, whereas interdisciplinary research involves scholars from different disciplines contributing distinct disciplinary perspectives to shared work on a common problem. Transdisciplinary work is a further step, as researchers from different disciplines collaborate to establish an overarching model that includes yet transcends their individual disciplines. The study of aging has called forth such collaboration from sociology and other disciplines.

Neither the continued development of transdisciplinary work, nor the significant role of sociology, will continue fruitfully without forethought and effort. Hurdles and limitations come in a variety of forms. Transdisciplinary work in any area faces many roadblocks, particularly institutional structures and funding sources geared to traditional disciplinary boundaries (see Chapter 4). The discipline of sociology also faces constraints that may impede its leadership in the study of aging. Indeed, the NIA's BSR has noted a surprising decline in the number of grant submissions in the sociology of aging in recent years.

For some time, concerns have been expressed about the state of sociology as a discipline, the place of sociology within the social sciences, and the direction of the field (see Boje and Svallfors, 2000; Cole, 2001; Davis, 1994; Mayer, 2009). Controversies within the discipline—for example, regarding the acceptance of genetic and biological bases for social behavior, the correctness and utility of social experiments and interventions, or the direct relevance for sociology of advances in cognitive and neuroscience—have sometimes made progress as a discipline difficult to define or achieve. The subject matter of sociology also overlaps with that of many other social sciences, and thus the discipline lacks an exclusive province.

Finally, in approaching the topic of sociology of aging, it is important to be aware that a persistent shortcoming of sociology, in the view of many sociologists, is a lack of theory to guide empirical research (Hirsch, Michaels, and Friedman, 1987). To the extent that this criticism is valid, this would be a major shortcoming because theory is widely acknowledged to be a fundamental component of the research process. Indeed, some argue that theory development in the sociology of aging has been slow (Alley et al., 2010; Clark et al., 2011; Entwisle, 2007; Mayer, 2009; Yen, Michael, and Perdue, 2009), and the theories that have been postulated have not been sufficiently integrated into a larger explanatory framework (Bengtson, Burgess, and Parrott, 1997).

The perceived weakness of theoretical development in sociology has several possible sources. One is a deeply ingrained bias in the research community favoring empirical work. Methods and theory are often perceived as distinct enterprises, with some researchers and practitioners considering theorization as an esoteric exercise (Bengtson, Burgess, and Parrott, 1997). Ferraro (2009) suggests that some reviewers deem theoretical articles inappropriate for publication in scientific journals, although scientific hypotheses are typically generated from theories or previous research. In the sociology of aging, another factor constraining the development of theory may be the close institutional relationship with gerontology. As an integrating science field aiming to improve the lives of older persons, gerontology brings a practice perspective to substantive problem areas such as health or disability. Reflecting this practical orientation, the Gerontological Society of America membership includes a large number of practitioners and service providers such as clinicians and social workers. Gerontology is multidisciplinary in that the theory employed in social gerontology research often comes from disciplines other than sociology (Alley et al., 2010). A further constraint on the development of theory in sociology may be a lack of resources, as major funders prioritize primary data collection over analysis, integration, reflection, or synthesis.

## 2

# A Conceptual Model of Aging for the Next Generation of Research

How individuals and societies experience and respond to aging is deeply influenced by the contexts in which that experience occurs. Individual and collective experiences, behaviors, and decisions are shaped by social contexts. Those contexts affect the significance, meaning, and interpretation of the aging experience for individuals as well as communities. Contexts are in turn collectively constituted by individuals. What is it like for an individual to turn 65 when remaining life expectancy is 20 years rather than 10? What are the implications for a society when those defined as “old” are a quarter of the population rather than a tenth?

Myriad changes in family and generational structures, in patterns of employment and retirement, in racial/ethnic composition, and in biological processes affecting longevity and senescence can influence vulnerability and resiliency in the aging population and shape disparities in well-being. Demographic, economic, political, and health-care changes affect the resources available to an aging population, and the resources—in wisdom, services, and accumulated wealth—that aging individuals can provide to others. As Phyllis Moen notes (see Chapter 9), “It is hard but essential for innovative research over the coming decades to study changing lives *and* changing structures, as well as the links (including mismatches) between the two.”

Grasping the changes in lives, structures, and contexts across the aging process requires conceptual models that can encompass the whole. It also calls for models that can capture heterogeneity, fluidity, and indeterminacy within larger patterns. Hardy and Skirbekk (see Chapter 7) caution,

The traditional measures of population aging implicitly assume homogeneity in the aging process, and temporal comparisons based on these traditional measures assume that the societal implications associated with skills, abilities, functionalities and behaviors linked to chronological age operate in the same way across time. There is ample evidence that neither of these assumptions is correct.

Aging is changing for individuals and societies, the social contexts of aging are changing, the shifts are not homogeneous, and the study of aging is changing as well (see Chapter 1). Clear conceptual models are needed for the next phase of research on aging. Useful models capture current understandings and guide emerging efforts, help to identify gaps in knowledge, suggest synergies among different approaches, and may facilitate transdisciplinary initiatives.

Theorizing and model-building exercises are never complete. New conceptualizations are challenged and refined by empirical findings. Multiple causal pathways and translational mechanisms are suggested by observations, but require further analysis. In the study of aging, priorities for theorizations and conceptualization include how and when contexts impact individual lives, relations, health, and genetic transcription. Concomitant attention is addressing how micro processes within and between individuals generate new macro contexts. These processes occur in a specific time, whether in the life course of an individual or the political and historical trajectory of a community or society, which is also significant to their impact.

An example of ongoing theory building is reviewed by Shanahan (see Chapter 12). Addressing the impact of social context on the individual and the life course, possible models include a critical period, a sensitive period, and a chain of risks. The critical period model posits a definite time during development in which a biological system changes durably in response to the environment; the sensitive period model also posits a specific time span for the period of heightened plasticity, but it views change as possible at other periods as well. The chains of risks model suggests that risks (such as low socioeconomic status) faced in childhood increase the likelihood of subsequent disadvantages, perhaps by increasing the chances that the individual may exhibit vigilance and mistrust of others, diminished self-regulation, and a proclivity for risky behaviors. This constellation of perceptions and behaviors, sometimes called the “defensive phenotype” (Miller, Chen, and Parker, 2011), then increases both exposure to stress and stress reactivity, adversely affecting health and other outcomes. A fourth model, developed by O’Rand (O’Rand and Hamil-Luker, 2005), proposes that early disadvantages initiate strongly path-dependent exposure to risks across the phases of life and that the differences attributable to initial disadvantage are magnified over time (analogous to compound interest) (Diprete and Eirich,

2006). Thus, while the chain of risks model points to the accumulation of risk factors, O'Rand's model suggests that the effect of early risk is accentuated over time. These different theoretical perspectives present nuanced life course models that address early exposures, durable changes, feedback mechanisms, and late-emerging consequences—all relevant to the experience of aging. The different perspectives may be appropriate to research questions addressing a range of exposures and risks and to designing and evaluating interventions across the life course.

As such questions are examined, the panel proposes a conceptual model to facilitate further theory and research efforts on the ways in which social processes and contexts affect aging. The model can be of use in many different disciplines and in transdisciplinary initiatives in the study of aging.

### A CONCEPTUAL MODEL OF AGING

A many-celled cube (see Figure 2-1) illustrates a conceptual model for studying social processes in aging over the life course. The model has three dimensions: (1) levels from macro to subindividual; (2) developmental stages over the life course; and (3) examples of outcomes of interest. The model is based on the work of Silverstein and Giarrusso (2011), who propose a biographical-institutional-societal model of the life course and the deliberations of the panel, particularly regarding the further explication of and connections among the different levels (see Figure 2-2). It is important

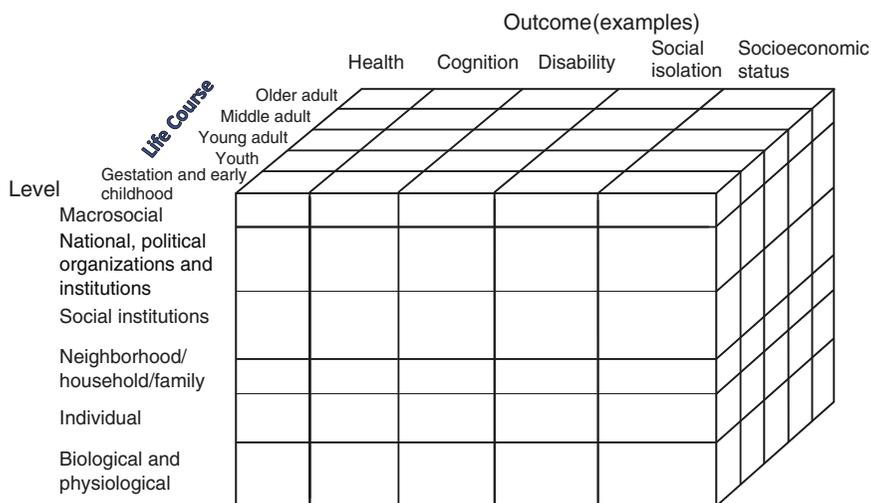
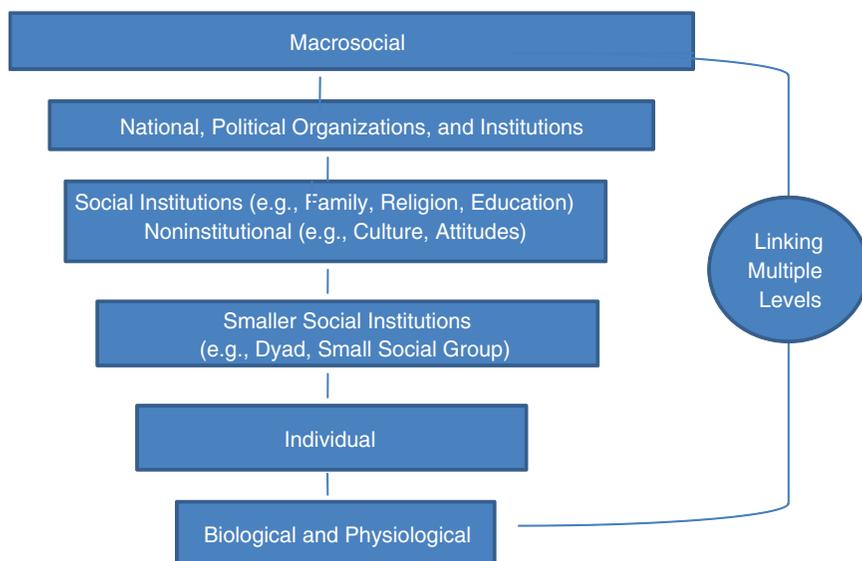


FIGURE 2-1 Conceptual model for studying social processes in aging over the life course.



**FIGURE 2-2** Changing social processes and social context in an aging society—The conceptual model: how the social sciences see the world.

to note that the model is intended to offer a heuristic for thinking conceptually about the linkages across levels but does not define a hierarchy nor does it present any specifics as to the combination of level, life stage, and outcome.

Each cell of this cube defines a set of topics of potential interest in the study of aging. For example, the cell at the lower left-hand corner of the cube addresses health as the outcome of interest at the biological and physiological level during gestation and childhood. Shanahan (see Chapter 12) describes recent research that falls within this cell. The cell in the upper right-hand corner, in contrast, examines socioeconomic status as the outcome at the macrosocial level during older adulthood. Angel and Settersten (see Chapter 6), Hardy and Skirbekk (see Chapter 7), and Moen (see Chapter 9) all point to important and unanswered questions about aging in this cell.

### Levels of Social Organization

As presented in the model, factors at all levels can have an impact on aging. Ascertaining the ways in which social processes and contexts relate to aging, both as causes and consequences, at all levels requires a clear understanding of the social fabric in which individuals are embedded.

Attention to levels includes addressing how individuals belong to and are nested in many layers of social units, from the largest agglomerations of nations and even international patterns; to major social institutions; to neighborhoods, workplaces, and civic or religious organizations; to households, couples, and families; and ultimately to individuals themselves and their physiologies.

The levels are interconnected and the flow of influence between levels is often multidirectional. The family, for example, mediates the effects of macrosocial changes on individuals. The degree to which the family serves this function may be affected by alterations in the family as a social institution, at the same time that the changing family itself contributes to macrosocial change.

### **Macrosocial (Demography)**

At the top of Figure 2-2 are the macrosocial or demographic trends operating at the societal level. Characteristics of the population at any given time are partially defined by population aging. Simultaneously, those characteristics affect how individuals and the society experience and respond to aging. Macrodemographic trends are the consequences of population aging and also influence the social experiences of aging. Some key demographic trends include the rapidly increasing number of the “oldest old,” a more racially and ethnically diverse older population, more immigrants and foreign-born citizens among the elderly, changing causes of death, and greater human capital (education and work experience) and labor force participation among older adults. The overall implication of these trends is a large and growing number of relatively healthy, active older adults. The fact that population aging is a global phenomenon will probably also modify norms and expectations surrounding the aging process (see Hardy and Skirbekk, Chapter 7; National Research Council, 2012a).

### **Institutions and Policies**

The next level is occupied by an array of social institutions and policies. A multiplicity of formal and informal social institutions structures the choices and decisions that individuals make as they move through later adulthood. For example, age-graded policy institutions such as Social Security and Medicare interact with other social factors (e.g., race, gender, education, prior work, and family experience) to shape the patterns of stratification and inequality among older adults. Social support, social integration, and social isolation are also institutionalized, with social norms and expectations generating known roles for aging adults (see Moen, Chapter 9).

### Contexts and Environment

The macrodemographic trends (the first level) and institutions (the second level) are widely shared by many older adults living in the United States in the early 21st century. The social and economic context for all older adults is formed by both demographics—for example, the proportion of 65- or 75-year-olds in the population—and social policies—for example, Social Security laws. The effects of demographic conditions or social policies on any particular individual may vary considerably. At the next level, contexts and environment, more divergence emerges based on individual sociological characteristics and other factors. From the household to the neighborhood, school and workplace, religious communities and civic organizations, contexts and environments are important influences on the development and functioning of individuals at the same time as they respond to characteristics and behaviors of individuals as they age (see Cagney et al., Chapter 8). For example, neighborhood contexts can exert cumulative impact across the life course (Wen and Gu, 2011) and across generations (Sharkey and Elwert, 2011).

Structural characteristics of neighborhoods (e.g., racial/ethnic diversity) and the nature of the built environment may also affect aging outcomes (Browning et al., 2006).

### Dyads and Small Social Groups

A further level is comprised of pairs of individuals (dyads) and small social groups of which virtually all older adults are members. This level has a significant impact on many outcomes among the aged. For example, Lindau et al. (2003) propose that health is determined within the social and cultural context of the dyad, and influenced by inputs of biophysical, psychocognitive, and social capital (Lindau et al., 2003). The most common and important dyad is the married couple or cohabiting partnership, at least for older men. Women are much more likely than men to be unpartnered, both because female life expectancy exceeds that of men and because women tend to marry men several years older than themselves (Lindau et al., 2007). Thus, differences in access to partnership mean that the aging life course tends to follow divergent trajectories for women and men in ways that tend to disadvantage women, socially, emotionally, and economically. Of course, unpartnered older adults need not live alone and most are not socially isolated (Cornwell, Laumann, and Schumm, 2008, p. 2). The authors find that age is positively related to the frequency of socializing with neighbors as well as participation in religious activities and volunteering (p. 12). Social networks important to older adults may span distances, ages, and relationships. Social networks, often measured as the others or “alters”

with whom people engage, for example in discussions of important matters, may consist of nuclear family, friends, more distant relatives, co-workers. Network members may know each other, may live with the older adult, may have frequent communication but do not need to have any of these characteristics (Cornwell, Laumann, and Schumm, 2008). Social networks have been linked to diagnosis and treatment of hypertension (Cornwell and Waite, 2012), to the potential of the person to act as a bridge between network members (Cornwell, 2011), and to sexual dysfunction in older men (Cornwell and Laumann, 2011).

### **Individual**

Much of sociology, social demography, and social epidemiology focuses on outcomes at the individual level, often individuals aggregated into groups of some kind, perhaps by age, gender, race/ethnicity, or education. Examples include age differences in social participation (Cornwell, Laumann, and Schumm, 2008), obesity or smoking behavior of individuals embedded in different social networks (Christakis and Fowler, 2007, 2008), mortality of married versus unmarried men (Rendall et al., 2011), racial differences in chronic conditions (Hayward et al., 2000), or grief following widowhood (Carr, 2004). These studies of individuals may in turn explicate the role of the life course (in the case of age differences), social structures (in the case of networks), social institutions (in the case of marriage), social isolation (in the case of widowhood), or social stratification (in the case of racial differences in chronic conditions). A key contribution of social epidemiology at this level is its focus on the factors and processes that determines heterogeneity in the response of individuals or groups, and when that heterogeneity in response socially patterned. A focus on individuals can reveal much about the social contexts and processes that affect them.

### **Biological and Physiological**

Humans are first and foremost social animals whose bodies evolved while perceiving and responding to social stimuli in ways that promoted their survival and adaptation. Thus, human physiology is attuned to characteristics of the social environment and interactions with others, and social behavior is likewise underpinned by complex biological processes (see Gruenewald, Chapter 10; Shanahan, Chapter 12). Perhaps for this reason, social conditions, such as isolation, poverty, low social status, or lack of social support, are strongly and consistently associated with poor health, and social risk factors rival or exceed traditional biomedical factors, such as smoking and cholesterol levels, in their power to predict poor health

outcomes (Holt-Lunstad, Smith, and Layton, 2010; House, Landis, and Umberson, 1988; Sharkey and Elwert, 2011).

Attention has turned recently to the ways that the social world “gets under the skin” to affect health and illness as individuals age. This has motivated the addition of biological, physiological, and functional measures to large-scale social surveys like the Health and Retirement Study, the Wisconsin Longitudinal Study, and the National Social Life, Health, and Aging Project (see Chapter 4). Linking biological and social processes is complex, because each of the processes is itself complicated, and because some research suggests interactions among these levels, so that the association between social risk factors and illness differs across states, regions, or countries (see Gruenewald, Chapter 10; Weinstein, Gleib, and Goldman, Chapter 11; Shanahan, Chapter 12; Schnittker, Chapter 13).

### Linking Multiple Levels

The idea that individuals are embedded in multiple layers of social units and organizations is well established. One of the main messages of Frank Furstenberg’s study of families living in inner-city neighborhoods was that families operate in the context of the neighborhoods and communities in which they are located: what parents can do for their children is partly determined by the resources available in the surrounding environment (Furstenberg, 1999). More recently, Small’s study of mother-to-mother networks at child-care centers found that individuals’ social capital depends fundamentally on the organizations in which they are embedded, and through multiple mechanisms, such organizations can create or reproduce network advantages for their members (Small, 2009).

A large body of research and theory also points to the importance of the macro levels that may appear to be far removed from individuals’ daily concerns. The political economy, as a whole, and specific state policies regarding entitlements, pensions, health care, and disability programs play an important role in shaping the health, financial resources, retirement decisions, and even marriage choices of older adults (see Marshall and Bengtson, 2011; Mayer, 2009).

Social experiences, such as social isolation, seem to affect biological and physiological outcomes, including blood pressure, sleep, and gene expression (Cacioppo and Hawkley, 2009; Cole et al., 2011; Hawkley et al., 2010). This appreciation of the impact of the social on the physiological is but a further illustration of the importance of examining linkages among multiple levels. The relationship between the social and the physiological goes the other way as well. Biologically based disease and disability certainly have an effect on the higher levels.

### Stages of the Life Course

The multiple levels of social organization in which individuals are embedded in the conceptual model (see Figure 2-1) are by no means static as those individuals proceed through life (Hobcraft, 2006, p. 173). The model and its levels accommodate another source of dynamism and fluidity in individuals' lives: temporal progression of the person through the stages of the life course, "a sequence of socially defined events and roles that the individual enacts over time" (Giele and Elder, 1998, p. 22).

The life course perspective considers developmental processes, culturally and normatively constructed life stages and age roles, demographic factors, biographical accounts, aging, the role of policies and institutions, and/or the association between events and understandings from birth to death (Mayer, 2009). It has helped researchers to model the social patterning of lives and consider the experience of aging as a result of institutions, policies, biological processes, and biography, all historically situated and interconnected with others (Hendricks, 2012; Mayer, 2009). The life course framework also attends to "the process of human growth and senescence within historical context, producing unique life experiences and trajectories for different birth cohorts" (Silverstein and Giarrusso, 2011, p. 35).

In the study of human development, adult development and aging, the life course paradigm has been extremely influential (Billari, 2009; Elder, 2002; Mayer, 2009). Since the 1970s, the extraordinary growth of national longitudinal studies of both adults and children—such as the Panel Study of Income Dynamics, the National Longitudinal Surveys, the Health and Retirement Study, and the Wisconsin Longitudinal Study (see Chapter 3)—has enabled researchers to directly examine individual outcomes at multiple observation points, to situate lives within historical periods, and to trace trajectories of individual lives.

As empirical evidence demonstrating the impact of childhood social experiences and biological exposures on adult outcomes accumulates, scholars have begun to more explicitly connect very early with very late stages in the life course. Smith (2009), for example, assesses the effect of health in childhood on labor market outcomes many years later. He has found that poor childhood health has a quantitatively large effect on family income, household wealth, individual earnings, and labor support, even after family-specific effects are taken into account (Smith, 2007, 2009). In a related paper, Smith and Smith (2010) found that psychological problems and substance abuse during childhood have large effects in adulthood on the ability of those affected to work and earn, the likelihood that they are married, the size of family assets, and education completed (Smith and Smith, 2010). These effects are not due to co-occurring physical health problems; estimates controlling for within-sibling differences show that characteristics

of families common to siblings do not account for these differences. The “arm” of childhood (Hayward and Gorman, 2004) is indeed very long (see also Johnson and Schoeni, 2007; Luo and Waite, 2005; Warren, Sheridan, and Hauser, 2002).

The social structure of the life course as a system of age-graded social statuses has consequences for activities, expectations, behaviors, social roles, and physical and mental health (Clark et al., 2011). As the life course itself changes (see Angel and Settersten, Chapter 6; Hardy and Skirbekk, Chapter 7), the life stages are becoming less clearly defined, more porous, fluid, and diverse. It should also be mentioned that the specific ages that define each life course phase lack precision. The ages demarcating entry to a particular life course stage may vary by social class and cohort. For example, the age demarcations for middle age is usually defined as age 45, but depending on social class and educational attainment, age 45 can be the age at which one has a first birth, or when one enters the “empty nest” stage.

The model in Figure 2-1 shows stages of the life course from older adulthood back through gestation and early childhood. These stages are discussed below.

### Older Adults

Older adults are clearly the most relevant target population of research for those who study aging. As adults move toward older age, activities and social roles tend to change. Many adults leave employment, or they leave a primary job for a second career or a different job (Gruber and Wise, 2005). They often experience declines in health, the loss of social network contacts (Cornwell, Laumann, and Schumm, 2008), and marital loss through widowhood. Both the risk of these changes and the adjustment to such losses are heterogeneous (Bonanno et al., 2002). Individuals’ subjective perceptions and objective situations also differ during these transitions (see Settersten and Mayer, 1997, on subjective age identification). The chronological age at which an individual becomes entitled to certain age-graded benefits or services has also varied over time and across countries or policy regimes, with substantial effects on behavior (Gruber and Wise, 2005). Likewise, cognitive skills change and with those changes come associated effects on wealth, wealth growth, and wealth composition in the individual’s retirement years (McArdle, Smith, and Willis, 2009).

### Middle-Aged Adults

When individuals reach middle age, their health begins to change significantly and individuals diverge. Many individuals maintain physical, cognitive, and emotional health; others develop chronic disease, functional

limitations, and disability. This divergence is socially patterned, with more socially disadvantaged groups showing health declines much earlier than the more advantaged, including the onset of some age-related chronic conditions (e.g., hypertension) and disabilities. The number of biological risk factors that individuals have also diverges by race/ethnicity and education in the middle years (Crimmins and Beltrán-Sánchez, 2011; Crimmins and Seeman, 2004). For example, among people aged 51-61, the estimated prevalence of hypertension (a common risk factor for a variety of diseases) was 61 percent for black women compared to 34 percent for white women. The greater divergence in health by groups appears to be due to “a long-term and cumulative process of health disadvantage over the life cycle” (Hayward et al., 2000, p. 926).

Health in middle and older ages depends in part on social experiences during earlier stages. Hughes and Waite (2009) found that both physical and psychological health are affected by earlier marital loss, so that although those currently married enjoy better health, those who have ever been divorced or widowed are worse off than those who have never had a marital loss (Dupre and Meadows, 2007; Hughes and Waite, 2009). Zhang and Hayward (2006) found that women who have been divorced face increased risks of developing cardiovascular disease, perhaps due to the stresses accompanying marital breakdown.

Some research suggests that middle-aged adults might be particularly vulnerable to sudden system changes, such as those that occur during major wars or the transition of former socialist countries (Mayer, 2009). The same may be true for other unexpected losses such as unemployment during an economic downturn.

### Young Adults and Youth

Recent advances in longitudinal data on the transition to adulthood, in particular the National Longitudinal Study of Adolescent Health (ADD Health) have led to an explosion of research on this stage in the life course. This longitudinal study of a nationally representative sample of adolescents in grades 7-12 in the United States during the 1994-1995 school year has produced a dataset that is innovative for its linkages among socioeconomic, family, individual, behavioral, biological and genetic levels (Harris and Cavanagh, 2008). The transition from youth to young adulthood is one of the most demographically dense in the life course, with frequent changes in living arrangements, educational enrollment, types and hours of employment, romantic and marital unions, and entry into childbearing (Rindfuss, 1991; Shanahan and Hofer, 2011). Experiences, exposures, and levels of educational attainment in the youth and young adult years may be pivotal for later stages of the life course (Crimmins and Cambois, 2003).

### Gestation and Early Childhood

A large body of research points to the intrauterine environment and early childhood as critical developmental periods for later health and cognitive function (Cunha et al., 2006; Fogel and Costa, 1997; Johnson and Schoeni, 2007). Poor health at birth and limited parental resources (including low income, lack of health insurance, and unwanted pregnancy) interfere with cognitive development and health capital in childhood, reduce educational attainment, and lead to worse labor market and health outcomes in adulthood (Johnson and Schoeni, 2007). These effects are substantial, and they are robust to the inclusion of sibling fixed effects and an extensive set of controls. The results reveal that low birth weight (defined as under 5.5 pounds) ages people in their 30s and 40s by 12 years, increases the probability of dropping out of high school by one-third, lowers labor force participation by 5 percentage points, and reduces labor market earnings by roughly 15 percent (Johnson and Schoeni, 2007, p. 26). Little is known about whether these effects continue at the later stages—suggesting the need for aging research that reaches back to early childhood.

### Outcomes in the Conceptual Model

Outcomes constitute the third dimension in the conceptual model. Figure 2-1 lists five outcomes of interests across the top of the cube: health, cognition, disability, social isolation, and socioeconomic status (SES). These serve as a possible set of outcomes to be considered, but they could be replaced by others, such as morbidity, longevity, mortality, social participation, social support, obesity, diabetes, retirement, emotional well-being, quality of life, caregiving, or labor force participation. The model, as presented, deliberately offers as examples outcomes that are general, important, and well researched, and that span disciplinary boundaries. The selection of outcomes to be studied in turn affects what theories of causation and translational mechanisms will be most useful in relating different levels of contexts and processes across the life course.

### Health

The World Health Organization defines health as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity” (World Health Organization, 2012). Health and long life are universally desired and are central to the daily experiences of all people. They become increasingly important at older ages as chronic conditions emerge, functional limitations appear, psychological health declines, and disabilities develop. Poor health and short life are key dimensions of social

disadvantage, especially by race (Crimmins and Seeman, 2004; Hayward et al., 2000; National Research Council, 2004). Social demography and social epidemiology have long-standing interests in health, including morbidity and mortality, and on health disparities.

### Cognition

Significant changes in cognitive function develop with age. These changes are evident in several major aspects of mental ability, although age-related declines do not develop uniformly either within or across cognitive domains. The nature of the change that occurs, the point at which changes become apparent, and the magnitude and rate of change vary, depending on the cognitive function in question. The five major areas of cognitive ability, ranked by their sensitivity to variation at the high end of the cognitive spectrum, are learning and memory, executive function abilities (e.g., concept formation and abstract thought), language, visuospatial abilities, and sustained attention (the ability to focus and perform a simple task). Cognitive impairment has been shown to markedly reduce the survival prospects of individuals and is also associated with a marked deficiency in an individual's quality of life and that of their caregivers (Matthews et al., 2009).

These processes are now being studied in the Healthy Brain Project at the National Institutes of Health, which focuses on the determinants of cognitive and emotional health. The multifaceted project will “assess the state of longitudinal and epidemiological research on demographic, social and biologic determinants of cognitive and emotional health in aging adults and the pathways by which cognitive and emotional health may reciprocally influence each other” (National Institutes of Health, 2012).

### Disability

The risk of disability, defined broadly as “impairments in body functioning, limitations in activities, and restrictions in participation” (Freedman, 2011, p. 57), is age graded and unevenly distributed among groups. Freedman notes that “the consequences associated with loss of functioning can be far-reaching for individuals, families, and communities in terms of both economic costs and quality of life. As such, although not inevitable outcomes of aging, disability and functioning are central topics in the study of late life” (Freedman, 2011, p. 57). Although disability-free life expectancy has been increasing, the dynamic process behind such increase is yet to be fully explored (Crimmins et al., 2009).

Frailty is a clinical syndrome that muscle weakness, bone fragility, very low body mass index, susceptibility to falling, vulnerability to trauma,

vulnerability to infection, high risk for delirium, blood pressure instability, and severely diminished physical capabilities. Frailty connotes vulnerability to adverse outcomes and limited ability to respond to and recover from stressors. Frail older adults are at increased risk of mortality. Frailty and disability are associated but not synonymous. Behavioral and social risk factors are important in the development of frailty (Fried et al., 2004; Walston et al., 2006).

### Social Isolation

Social isolation, a state studied by sociologists, is a surprisingly unhealthy state. In fact, the health risks associated with social isolation have been compared in magnitude to the well-known dangers of smoking cigarettes and obesity (House, 2001). There are a number of indicators of social isolation, including living alone, having a small social network, infrequent participation in social activities, that may be associated with health risks (Cornwell and Waite, 2009).

Much the same effects are experienced when there is perceived isolation, associated with feelings of loneliness and perceived lack of social support that are usually studied by psychologists. Indeed, loneliness is seen as a prevalent and serious social and public health problem (Hawkey and Cacioppo, 2010).

Research on loneliness, conducted mostly in Western countries, has shown that at any given time, 20 to 40 percent of older adults report feeling lonely (De Jong and Van Tilburg, 1999; Savikko et al., 2005; Theeke, 2009; Walker, 1993) and from 5 to 7 percent report feeling intense or persistent loneliness (Steffick, 2000; Victor et al., 2005). However, while socially isolated individuals tend to feel lonely, loneliness is not synonymous with objective isolation. Loneliness can be thought of as perceived isolation and is more accurately defined as the distressing feeling that accompanies discrepancies between one's desired and actual social relationships (Pinquart and Sorensen, 2003).

Prospective studies have shown that feelings of loneliness predict depressive symptoms (Cacioppo, Hawkey, and Thisted, 2010), impaired sleep and daytime dysfunction (Hawkey, Thisted, and Cacioppo, 2009; Hawkey et al., 2010), reductions in physical activity (Hawkey, Thisted, and Cacioppo, 2009), and impaired mental health and cognition (Wilson et al., 2007). At the biological level, loneliness is associated with increased vascular resistance (Cacioppo et al., 2002; Hawkey et al., 2003); increased systolic blood pressure (Hawkey et al., 2010); increased hypothalamic pituitary adrenocortical activity (Adam et al., 2006; Steptoe et al., 2004), under-expression of genes bearing anti-inflammatory glucocorticoid response elements (GREs); over-expression of genes bearing response elements for pro-inflammatory

NF- $\kappa$ B/Rel transcription factors (Cole et al., 2007, 2011); and altered immunity (Kiecolt Glaser, Garner, and Speicher, 1984; Pressman et al., 2005). Moreover, an increasing body of research shows that feelings of isolation and loneliness predict mortality (Luo et al., 2012; Patterson and Veenstra, 2010; Shiovitz and Ayalon, 2010; Tilvis et al., 2011).

## SES

SES can be measured in multiple ways (e.g., education, income, occupation, wealth, material deprivation, subjective social status, income inequality) and is one of the most robust predictors of health and well-being. It is also itself a measure of achievement, and its causes and consequences constitute one of the central topics of theory and research in sociology. SES is a frequently used predictor in social demography and social epidemiology (see Gruenewald, Chapter 10; Shanahan, Chapter 12), as those of high SES have an array of resources with which to pursue all goals, including health. These resources consist, of course, of financial resources, but also, in part, of information, social contacts, generally salubrious local environments free of toxins, access to health care, and skills in evaluating and adopting new treatments and technologies. Those with low status are more often exposed to stress, have few resources to counter stress, lack access to health care or face care of poor quality, tend to have poorer health habits, and face exposure to environmental toxins (Miech et al., 2011). One key dimension of SES—education—leads to desirable outcomes because it provides training in the acquisition, evaluation, and use of information, and because it helps develop self-direction and self-efficacy (Mirowsky and Ross, 2003; Ross and Mirowsky, 2001). SES has been consistently linked to health outcomes across the life course, regardless of how it is measured and regardless of the measure of health used (Bruce et al., 2010; Phelan et al., 2004; Smith, 2007).

### Theorizing the Conceptual Model

The three-dimensional conceptual model enables the consideration of, but does not articulate, relationships, causal mechanisms, interacting effects, or translation mechanisms that connect the different levels, stages, and outcomes. Theory can help specify causal pathways, within and among the cells in the model (Diez Roux, 2003). Each cell of the conceptual model includes many opportunities for further theorization.

Ross and Mirowsky (2001), for example, employed a series of multi-level models to test whether structural characteristics of the neighborhood indirectly influence health through individual-level processes such as physical activity. They found that neighborhood disadvantage contributes to

increases in perceived disorder within the neighborhood, which discourages walking and is consequently harmful to health. They further found that the effect of perceived disorder was partially mediated by fear. People who fear being robbed or attacked in their neighborhood were unlikely to walk for recreation or transportation (Ross and Mirowsky, 2001).

Theory may also help identify common biological mechanisms (e.g., cortico-striatal and limbic systems) behind a wide range of socially graded experiences and contexts that produce pro-inflammatory patterns (see Shanahan, Chapter 12). This very different set of questions can also be located within the three-dimensional model.

Cagney et al. (see Chapter 8) call for greater efforts to theorize the impact of multiple social contexts on older adults. They draw attention to the simultaneous and interactive effects of geographic, institutional, and social network influences on the individual and collective experience of aging.

Chronological age and time and historical epoch are other influences that permeate the entire cube. These are period and cohort effects, in addition to individual age and life course. "Period refers to a specific time point, such as a year or decade, and period effects are changes among people of all ages from one period to another period. Birth cohort refers to a group of people who are born at about the same time, and cohort effects are changes across these groups, regardless of age" (Schwadel, 2010, p. 3) The outcome of social isolation, for example, can be examined not only over an individual life course but also from vantage points of period and cohort. Cross-cutting themes, such as inequality and heterogeneity, could also be explored across all the different cells of the conceptual model, to theorize their impact on the experience of aging.

Older adults in the early 21st century may be able to take advantage of information technology to stay connected with relatives living far away, lessening isolation (period effect). The 20th century cohorts that experienced a high rate of divorce may become more isolated in old age due to family fragmentation (cohort effect). In addition to these inter-cohort effects, it is increasingly important to consider the effects of intra-cohort changes with age (Yang and Lee, 2009).

The conceptual model elaborated here both situates the many different ways the study of aging has been approached and suggests many different opportunities that remain for further study.

**Recommendation 1.** The National Institute on Aging should engage researchers in the development of a conceptual model, or a number of conceptual models, for social processes in aging over the life course in multiple dimensions.

Greater theorization is needed to explicate the interrelationships among the different levels, stages, outcomes, and cells of the conceptual model. Further data and transdisciplinary work, as discussed in the next chapters, are imperative and the research community is urged to think carefully and conceptually about the linkages across levels, stages, outcomes, and cells. Indeed, the model offers a heuristic for this but points to no specific cells as more important than others; what is important is the consideration of context and levels. It should be noted, as Angel and Settersten observe “aging is one of the most intricate scientific puzzles, posing many significant challenges for individuals, families, and societies” (see Angel and Settersten, Chapter 6).

**Recommendation 2. The conceptual model, or models, should be used by the National Institute on Aging to serve as the basis for developing a standard set of key measures, across disciplines, for use in surveys and other types of data collections and analyses that focus on aging issues.**

The process for obtaining those measures from databases is discussed in Chapter 3.

## 3

## Data Needs and Opportunities

The aging of individuals and the aging of populations are two interrelated phenomena. These phenomena, along with the joint aging of institutions and of bodies, have been the subject of multitiered scientific investigations that have brought together many disciplines, sociology among them. The investigations have led to an established knowledge base and a rich portfolio of datasets about older people and the process of aging. The growing understanding of ongoing changes in the social contexts of aging as well as refinements in the conceptualization of aging, particularly the appreciation of dynamic and reciprocal relationships between individuals and social contexts, have combined to create new needs—and opportunities—for data gathering and analysis.

This chapter identifies several key areas in need of further development to enhance measurement and data quality. For example, it is becoming increasingly important to measure interhousehold and intergenerational transmission of resources but current measures are inadequate to portray those transmissions. Emerging living arrangements make it difficult to distinguish the varying types of parent figures. Similarly, while actual transfers are measured, latent support information is not generally gathered. The new context of intergenerational transmission needs entirely new measures such as space-time linked measures of neighborhood environments.

This chapter also points to the wedding of biological and sociological measures that is already underway and suggests that the growing study of biomarkers also generates a growing need for new measures, particularly to investigate the mediation of the social environment over the life course. Finally, this chapter identifies opportunities to gather data to take advantage

of ongoing studies, linkages to existing databases, and new social media and technologies. Given the increasing prominence of transdisciplinary research, data-gathering efforts should attend to harmonization across different disciplines, as well as across studies, surveys, or countries.

### THE CURRENT PORTFOLIO OF DATASETS

The call for new data by no means dismisses the currently available portfolio of data. Indeed, current data include a wealth of material and are increasingly valuable, as they are repositories of longitudinal records and perspectives, can be augmented with additional research protocols, and can be utilized to examine entirely new questions not anticipated when they were designed.

Among longitudinal data sources, the Health and Retirement Study (HRS) is considered a national gem (see Hauser and Weir, 2010, and Hauser and Willis, 2005). Since its inception in the early 1990s, the HRS has become the largest, most representative longitudinal study of the U.S. population aged 50 and older. Funded by a cooperative agreement between the National Institute on Aging (NIA) and the University of Michigan, the HRS addresses the health and economic well-being of Americans during the latter part of life. It is cross-sectionally representative, with new cohorts added every six years. Because the HRS started with a probability sample, it can be used to generalize to subpopulations or cohorts and for framing the further study of subpopulations.

Scientists from a variety of disciplines, including economics, demography, sociology, psychology, medicine, epidemiology, health services, and survey methodology have been involved in the design and ongoing revisions of the HRS. Its content now incorporates economic, social, psychological, and physiological measures. Economic content has expanded to include measures of wealth from all sources, consumption and time use over the life course. Psychosocial content addresses well-being, life style, family ties, social relationships, personality, work life, and self-related beliefs. Physiological data collected by the HRS now includes a range of biomarkers on cardiovascular health, performance and anthropometric measures, and biological risk measures, as well as DNA sample for large-scale genotyping.

The HRS itself is of immense research value, permitting the study of relationships between health and cognitive outcomes, genetic profiles, economic status and behaviors, and social relationships *over time and across cohorts and ages*. It further features potential linkages to other data sources, including Medicare claims, the National Death Index, and administrative earnings and benefits data from Social Security. The HRS also meshes well with other datasets because a number of studies in Europe, Asia, and Latin America were deliberately designed to include measures that overlapped

with it.<sup>1</sup> The value of the HRS has thus been heightened as it has influenced the development of comparable large-scale longitudinal studies of aging in many other nations.

The HRS is reported throughout to have yielded more than 1,400 papers and publications—the outcome of work by more than 1,000 authors and co-authors and analysis by more than 10,000 registered data users (Hauser and Weir, 2010, p. 113). It has been described as “the model for a network of harmonized international longitudinal studies that monitors work, health, social, psychological, family and economic status, and assesses critical life transitions and trajectories related to retirement, economic security, health and function, social and behavioral function and support systems” (Weir et al., 2011, p. 905).

While HRS is a superb resource, the current portfolio includes other important datasets addressing many aspects of aging. The Wisconsin Longitudinal Study (WLS) began as a 1957 survey of Wisconsin high school seniors to assess the demand for postsecondary schooling. In subsequent data collection cycles, the survey has gradually expanded and shifted focus, moving from an earlier concern with education, career, and family to giving greater attention to health and aging. Siblings, spouses, and survivors of the original cohort of graduates have been added to the sample, and a range of biomarkers and DNA sampling have been added to the data collection protocols. Although no one involved in the original survey could have anticipated this, over several decades the WLS has become a foundation for a major study of the life course and aging (Hauser, 2009; Sewell et al., 2004).

Other datasets crucial to the study of aging include both large data monitoring efforts and in-depth studies of selected topics. Among these valuable datasets are

- the National Health Interview Survey;
- the Current Population Survey;
- the American Community Survey;
- the National Longitudinal Mortality Study;
- the Panel Study of Income Dynamics (PSID), a long-running panel with unique multigenerational coverage, a recently expanded health content and a Disability and Time Use “daily diary” module, focused on older adults;

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<sup>1</sup>These include the Mexican Health and Aging Study; the English Longitudinal Study of Ageing; the Korean Longitudinal Study of Ageing; the Japanese Study of Aging and Retirement; the China Health and Retirement Longitudinal Study; the Longitudinal Aging Study in India; and the Survey of Health, Ageing, and Retirement in Europe (now comprising 16 nations). Other national studies with some elements comparable to HRS include the Irish Longitudinal Study on Ageing, the Canadian Longitudinal Study of Aging, and the Costa Rican Study of Longevity and Healthy Aging (see Hauser and Weir, 2010, p. 113).

- Midlife in the United States (MIDUS), which includes biosocial data collection and psychological measures;
- the National Social Life Health and Aging Project;
- the National Longitudinal Surveys of Youth (NLSY), particularly the NLSY79—a nationally representative sample of 12,686 young men and women who were 14-22 years old when they were first surveyed in 1979 and are now in their late 40s and in their 50s; and
- the National Longitudinal Study of Adolescent Health.

To call for new data on aging is thus not to disparage the excellent foundation for research that has been carefully built. Indeed, the current portfolio of datasets has already permitted significant research beyond what it was originally designed to address. Hauser and Willis (2005), key figures in establishing this portfolio, acknowledge and celebrate this (p. 229):

The contingencies of economic and social change, interacting with those of the life course, imply that no longitudinal survey design will ever anticipate all uses of a study—or guarantee that planned uses of data will pay off. Indeed, we are impressed that the best research based on a given survey often explores questions or tests theories that were not contemplated by the designers of the survey. What we can do is to give our studies enough strength to hold up across time and to keep our eyes open for new opportunities to create data and add to knowledge.

### NEW DATA AND MEASUREMENT NEEDS

In the process of scientific inquiry, the need for data is necessarily ever-changing. As Seltzer (2011b, p. 1) observes

Statements about what we know are very useful, but to move forward we must also determine what we still need to know and how we can know it. We collect data to address important research questions, but existing data then constrain our ability to address the new questions we discover.

The changing demographics of the aging population require changing data collections. An increased focus on data on the “oldest old,” and growing groups like immigrants and foreign-born citizens is putting pressure on existing data sources. Information on changing causes of death, and on human capital (education and work experience) and labor force participation among older adults is also in short supply.

The important subject of social engagement of the elderly and their well-being is also undercovered in current collections. Some of these topics require especially innovative approaches to data collection, such as employed in the study on social volunteering and health (Fried et al., 2004).

Many of the new questions regarding aging have to do with the connections between social contexts and the mechanisms that mediate or translate between the micro (perhaps as small as a code of DNA) and the macro (perhaps as large as the global economy), and between different domains that influence and constitute the social phenomenon of aging. Angel and Settersten (see Chapter 6) affirm the need to study “the friction of human lives in action.” Among the many instances of that friction that call for further data and new measures are intergenerational and interhousehold dynamics and the biological correlates of diverse social contexts over the life course. Transdisciplinary approaches may be particularly fruitful in these research endeavors.

Sometimes new data to shed light on new and emerging trends can be obtained from innovative use of current data collections. An example of an innovative design to capture understudied and “novel” populations might be the Non-Normative Child Supplement to the WLS. In this survey, parents who reported in earlier waves of data collection that at least one child has a major mental health or developmental disability (major depression, ADHD, etc.) are selected to participate in a supplement that captures the distinctive aging experiences of parents whose grown children may have characteristics and traits of special interest.

### **Measurement of Interhousehold and Intergenerational Transmission of Resources**

Without doubt, the demography of family life in the United States has changed, in ways that include increased life expectancy, lower fertility, lengthening of generations, divorce, nonmarital childbearing, multipartner fertility, social parents when one biological parent cohabits, and grandparents who themselves separate and repartner. “These demographic changes,” asserts Seltzer (2011b, p. 1), “alter what a family is, and may change what a family does.” With the aging of cohorts whose lives have been affected by these demographic changes, new kinds of data are needed to understand the ramifications of these changes not only for individual welfare across the life course, but also for the transmission of health and resources across generations, the heterogeneity of risk, and the maintenance and exacerbation of disparities in the larger society.

When, why, and how do adult children and parents help each other? Will older adults exchange aid (financial or in-kind transfers) with adult stepchildren to the same degree as with biological children, or as with biological children raised in other households? How does the quality of the relationship with each child in a family structure affect the dynamic of intertransfers? What levels of care will adult children provide biological but absent parents, stepparents, or parent figures acquired through

cohabitation? On whom can individuals potentially depend for support? How secure is the family safety net when it includes new types of relationships? Who will provide care for those without children?

Current measures are often inadequate to these questions. The proliferation of parent figures can be challenging for surveys to capture or even code. Many people experience living arrangements that are difficult to describe using standard household enumeration methods. The terminology—such as “former stepchildren”—can be difficult to parse. Intergenerational transfers of resources require data collection across households, tracking adult children who live elsewhere. Many of these issues were not concerns when primary datasets were originally designed. For example, the HRS relies on one spouse/partner to report on his or her own and the partner’s children—an increasingly difficult task. The intensity of help is also not measured. The PSID does not follow stepchildren. Most major national surveys address actual transfers but not latent support, making it harder to study intergenerational impact on risk. (On survey shortcomings regarding intergenerational transfers, see Bianchi, 2011.)

Concerns about intergenerational transfers encompass not only internal family structures, but also local environments, such as neighborhoods. Recent studies show that the neighborhood environment in one generation may have a lingering impact on the next generation, with results confirming a powerful link between neighborhoods and cognitive ability that extends across generations (Sharkey and Elwert, 2011). Thus, not only the private resources in a family, however defined, but also the impact of context—in this instance, the neighborhood of residence—are also passed across generations. This intergenerational transmission of context clearly calls for new measures and data, such as space-time linked measures of neighborhood environments, to understand the maintenance and reproduction of inequality, the need for care among aging parents, and the capacity to provide care by adult children.

Contexts other than neighborhoods are also relevant to “the friction of human lives in action.” In *Networks, Neighborhoods, and Institutions: An Integrated “Activity Space” Approach for Research on Aging* (see Chapter 8), Cagney et al. encourage attention to activity space, or those places in which people engage in routine activities. This may include not only residence and neighborhood, but also workplaces, recreational sites, stores, clinics, streets, both formal and informal institutional settings, and any site of unstructured yet patterned interaction. The emphasis in this approach is on integrated, simultaneous, and interactive effects of multiple geographic and institutional settings. This too calls attention to the inadequacy of current measures. Cagney et al. point out, for example, that neighborhood is often defined by convenience, according to predefined administrative boundaries or census tract, rather than a spatial demarcation

relevant to the inhabitants' lives. As aging changes and the conceptualization of aging changes, a common concern across researchers is that investigation of aging populations has focused too much on individual-level characteristics and now needs to acquire more data on the friction and flows among between individuals, households, generations, and other social contexts and networks.

### Measurement of Biomarkers and Biosocial Interaction

The need for new measures, already being addressed but nonetheless ever-growing, is also evident in the area of biomarkers, particularly to investigate the mediation of social environment on physiology over the life course. The wedding of biological and sociological measures has been under way and is changing the landscape in basic ways. As Butz and Torrey (2006, p. 1,899) observe, "No field outside the social sciences is having as much of an impact within the field as biology." Datasets that survey economic, social, and health phenomena increasingly incorporate biomarkers collected from survey respondents. This has included measures of, the cardiovascular system, metabolic activity, immune systems, and anthropometrics as well as the collection of samples for genetic analysis.

A primary instigation for new measurements is to gather the biological correlates of socioeconomic status (SES), or, as Gruenewald describes it in *Opportunities and Challenges in the Study of Biosocial Dynamics in Healthy Aging* (see Chapter 10), the pathways by which social environment and experience get "under the skin." Bachrach and Abeles (2004, p. 22) note that "scientists have extensively documented the relationship of socioeconomic status to health but are barely beginning to understand the processes generating the relationship." Indeed, some lament that the exponential increase in biomarker collection has outpaced theorizing about biosocial interactions (see Weinstein, Gleib, and Goldman, Chapter 11; Shnittker, Chapter 13).

Research on biomarkers to identify the biological processes that underlie links between social factors and health is under way but much remains to be done.<sup>2</sup> A number of questions relate biomarkers and the aging process. Some of these concern the impact of SES over the life course, particularly the timeframe when SES becomes embodied. Several different life course frameworks have been proposed to explain the role of biosocial processes in healthy aging. The impact of SES may be greatest at a sensitive period,

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<sup>2</sup>In this report, biomarkers are defined to include not only chemical or metabolomic levels that can be detected in a tissue sample (including blood and saliva) but also physiological measures (e.g., blood pressure, peak expiratory flow) and anthropomorphic measures (e.g., height, weight) and functional measures (e.g., grip strength).

such that events and environments at certain life course phases may have a stronger impact than those at other life phases. Or perhaps a critical period is the most essential, if experiences and exposures during a specific narrow window of development permanently “program” bodily systems, which will be relatively unaffected by subsequent exposure to risk—or to security and abundance. A third framework posits an accumulation of risk, or “chain of insults,” accruing over time. And the social context, especially SES, may moderate the relationship between genes and various outcomes (Caspi et al., 2003). Adjudicating between these different models, or perhaps constructing a hybrid model, calls for much new data. A serious shortcoming of current investigation is the lack of biomarkers from earlier life periods in samples of older persons.

In the view of Gruenewald (see Chapter 10), “Exciting opportunities are on the horizon for identifying how SES experiences at different phases of the life course get under the skin to affect a wide array of biological processes and how SES disparities in biological functioning might track across the life time.” Gruenewald goes on to explain [*italics in original*]

These biological imprints of social adversity in childhood may provide clues as to the trajectories of healthy or unhealthy aging that lie ahead. *Longitudinal, life course investigations that concurrently measure social and biological factors from childhood to adulthood will be particularly fruitful for understanding when social adversity is embodied for different systems, the permanency of biological imprints, and the genetic, psychosocial and behavioral modifiers of these links.*

Some researchers go further, citing the need for collection of biomarkers not only across an individual’s life time but also across generations in order to understand and appreciate the impact of SES across the life course (see Kuzawa, 2005). To Shanahan (see Chapter 12), the next big opportunity in biosocial investigation may be population-based social genomics, particularly gene expression association with stress response (including defensive or inflammatory responses). Social genomics study the mechanisms by which social experiences regulate genetic activity, specifically the rate at which information contained in DNA is transcribed into mRNA. Shanahan (see Chapter 12) sees social genomics as a most “promising subfield” of research on aging because:

By establishing these mediational links between social experiences and transcriptional activity, scientists can begin to understand how social experiences, like those associated with socioeconomic status, affect physical and mental health. Thus, a major payoff of social genomics for demography and social epidemiology is the strengthening of causal claims by specifying the mechanisms that link social experience with behavior and health.

Population-based social genomics necessarily involves expanding the collection of biomarkers to include samples for genetic analysis in many different phases of the life course. Data collection from before, during, and after periods that might be sensitive or critical would be necessary for adjudicating different frameworks regarding the impact of SES and social relationships across the life course. Different phases of the life course may also be sensitive with respect to different aspects of the regulatory system. Evidence also suggests intergenerational transmission of gene expression patterns in response to social experiences over longer time scales, such as decades or generations, in which physiological changes adjust to more gradual changes in the environment (Kuzawa, 2005).

Initiatives in biosocial investigation involve not only enhancing the range of available biomarkers but also refining measures of SES and social risk that may correlate with these biological measures and moderate their relationship with health or other outcomes later in life. This particularly includes measures of chronic stressors, those features of social context “that are graded by SES and heighten a sense of vigilance, mistrust, and threat and that diminish self-regulatory capacities” (see Shanahan, Chapter 12). For example, work on specific aspects of the social environment shows that social isolation or loneliness is a trigger for proinflammatory gene expression in certain individuals. Discerning a relationship among environment, physiology, and behavior, as well as the implications of that interaction for healthy aging, requires careful measurement in all these domains—although, as Shanahan (Chapter 12) underscores, “it may be that stressor-inflammatory symptom associations are characterized by multifinality (the same causal agents leading to different outcomes), equifinality (diverse causal agents leading to the same outcome), or both—types of complexity that are often not considered in empirical research.”

The process of defining and implementing these new measures will winnow them. Some debates concern which measures are most appropriate to particular phenomena. Others challenge the mechanisms they purport to mediate. Weinstein, Gleib, and Goldman (see Chapter 11) note the enduring doubts over whether the relationship between SES and health is as universal as suggested; other doubts concern what counts as evidence for stress or allostatic load. Another set of concerns addresses the strength of the evidence regarding the extent to which biomarker data are useful in mediating the relationship between SES and health status—which Weinstein, Gleib, and Goldman consider an open question. These issues do not foreclose this line of research; rather, they call for careful measures, the development of and attention to theory, and a full assessment of null and inconsistent results.

Other concerns raised by Schnittker (see Chapter 13) suggest that while social genomic research demonstrates the relevance of SES for gene expression, this research reveals little regarding what it is about SES that

matters. This too calls not only for further development of conceptualization and measures of SES, but also for further thinking about causation and correlation. Tracing biological pathways is thus part of the whole picture of research on aging, but not a final answer. In the view of Schnittker (Chapter 13):

One risk in demanding a biological mechanism lies in prematurely foreclosing on a generative sense of uncertainty, especially when mediating pathways are dynamic. . . . [I]n general, socioeconomic status is linked to health through a variety of proximate mechanisms that change over time and, therefore, will involve different biological pathways at different times. . . . Provisionality, in this sense, is part of the effect itself, not a reflection of scientific naiveté.

As biosocial investigations of aging continue, new measures of both SES and physiology are needed. Several reviews (Seeman and McEwen, 1996; Uchino et al., 1996) have concluded that social support is reliably related to beneficial effects on cardiovascular, endocrine, and immune systems. Most studies, however, looked only at the positive aspects of social relationships, neglecting the negative impact of much social interaction or the burden of some social ties. In many studies, physiological processes were unidimensional, with cardiovascular reactivity, for example, measured as high or low, although it is a joint function of sympathetic and vagal activity.

Insights from sociology and social epidemiology of aging could contribute to medical research and practice, and to research in biology. For example, a current major focus of research in inpatient care is in understanding how to improve functional outcomes. Biomarkers for poor functional outcomes are being actively sought for severe sepsis, acute lung injury, and stroke. The key outcome of trials of therapeutic hypothermia and early interventions for ischemic stroke is good functional outcome (Iwashyna and Netzer, 2012, p. 329). Biological models of these diseases could be enriched and improved by the inclusion of recent approaches to physical frailty (Freedman, 2011) and physical functioning as reflected in the International Classification of Functioning. Recent work on social environments during childhood, cited in this report, also offer the possibility of improving biological models at this important stage of development. Indeed, scholars in the sociology of aging have much to offer medical interventionists and clinical epidemiologists on conceptualizing and measuring these key outcomes.

**Recommendation 3. The National Institute on Aging should manage its research program in a manner that promotes implementation of models and metrics in the areas of:**

- Encouraging conceptualization of family relationships and exchanges, including behavior, expectations, plans and attitudes, and to develop measures of key family concepts, because the family is a fundamentally important social context for aging.
- Encouraging conceptualization of characteristics of contexts and local areas through development of new measures, expanded links to existing data, and ongoing incorporation of new technologies, such as global positioning systems, smartphones, and area mapping.
- Building on recent advances in the use of biomeasures and linking them to social and behavioral processes through conceptualization of the potential links, attention to measurement tools and analysis techniques, identification of “best practices” in developing the linkages, and the development of protocols for cross-training of researchers in sociology with other relevant disciplines, such as genetics, economics, medicine, and biology.
- Illuminating the mechanisms that mediate between social contexts and health, both across the life course and over generations.

## OPPORTUNITIES

The need for new data can be met in a variety of ways. Many different study designs are available. Some approaches simply augment existing studies, adding scope or depth to those ongoing surveys. Other opportunities include subsampling for populations of interest and linking the survey data to auxiliary data within the contexts of the ongoing surveys. Still other opportunities involve sophisticated sample design strategies for hypothesis-driven samples, exploring new data collection techniques such as Ecological Momentary Assessments (EMAs), and agent-based models. The most challenging new frontier is found in mining the resources of the Internet and exploring the use of search technologies to reveal human behaviors for populations of interest. Transdisciplinary efforts (see Chapter 4) are also promising avenues.

### Augmenting Existing Surveys

One way to address new data needs is to add new instruments, measures, and respondents to existing surveys. As an example of overlaying new collection instruments to existing collections, several NIA-funded surveys in recent years have added the collection of daily diary data, which captures momentary reports of physical and mental health (e.g., National Study of Daily Experience in MIDUS, Disability and Use of Time in PSID).

As noted above, many current surveys were designed before intergenerational issues came to the forefront of aging research. More survey questions on intergenerational transfers of resources could be added to the next wave of ongoing longitudinal surveys. These might address new topics, e.g., types and intensity of nonfinancial assistance, or perceived potential sources of (or responsibilities to provide) care. They might also address an expanded range of relationships, for example, adult children of cohabiting partners, or former stepchildren. (Such information about family relationships might be successfully collected with use of retrospective questions.) They might also include much more attention to the negative aspects of social relationships, including those characterized by strain or conflict, or those fostering unhealthy behaviors.

Existing social surveys can also be augmented with the addition of biomarkers. The development of new technologies, such as dried blood spots and a growing number of point-of-service meters, make it more feasible to collect a range of useful biomarkers. These may be less invasive for respondents, easier for staff to collect, and require less sophisticated handling of samples.

The important question of intergenerational transfers could be explicated by additional information collected in the process of conducting existing surveys. This might include, for example, intergenerational relationships, such as the children and grandchildren of respondents in the WLS, or the stepchildren of respondents in the PSID, or the parents of respondents in the National Longitudinal Survey of Adult Health as part of the HRS. It might even include relationships within many other types of social networks—for example, the neighbors or colleagues or teammates of established respondents, to explore other aspects of the quality and structures of social networks and their impact on healthy aging.

Surveys could also be combined in various ways with other ways of obtaining data and evaluating evidence. Respondents in large, nationally representative samples might be combined with randomized clinical trials or interventions, for example. Both have strengths and weaknesses that could offset one another if combined. Clinical trials have the strength of random assignment, which, in theory, equalizes all the unmeasured characteristics of subjects across treatment and control groups. Surveys generally have the strength that respondents represent the population at large, which means that findings from these survey data characterize the population as a whole. Clinical trials typically do *not* represent the general population but some more restricted groups, such as those who volunteer or those who visit particular clinics or health-care providers. And survey respondents who have had some treatment or experience have *not* been randomly assigned to it. The combination of treatments to subjects, randomly assigned, with survey data collection would yield samples that would represent some population

that could be characterized and results that *could* be generalized to that population.

Clinical trials could also be enriched by the addition of key social concepts and measures to the data collected about patients. For example, the efficacy of interventions to improve functional status, or to avoid re-hospitalization, may depend on the social support and social environment into which patients are released. Measures of the social support available to patients, characteristics of the households and neighborhoods in which they will recover (Cagney et al., see Chapter 8), and demands or conflicts they may face could add a great deal to bring the voice of the sociological study of aging in those conversations to inform this research.

### Subsamples

A different way to take advantage of existing population surveys is to use them to define representative subsamples on which to conduct much deeper, more detailed investigation. The broad aims of many population-based surveys require data collection across a great number of domains. That scope necessarily competes with depth of coverage. By defining subsamples within the surveyed population, these supplemental substudies could devote resources to more detailed investigation and more thorough social, psychological, and physiological assessments.

The sociological study of aging also has much to contribute to for designing and interpreting key outcomes in clinical trials and patient-level interventions and their evaluation. It can and should contribute appropriate phenotypic characterization of patient outcomes for understanding disease processes and nonmortality outcomes (Iwashyna and Netzer, 2012).

Necessary resources might include more sophisticated training and greater time for staff to conduct in-person interviews, as well as the use of an array of other techniques for assessing social and psychological factors. Fuller attention could be given, in smaller studies, to mapping social networks and exploring both negative and positive aspects of social interactions. They could also investigate intergenerational transfers more extensively.

Subsamples could also be defined for further physiological or clinical research. While many useful protocols are community-based and can be conducted in a broad population survey, others must necessarily be confined to a clinic or in-home clinical assessment. These permit significantly more detailed and in-depth physiological and neuropsychological assessments and the collection of a greater range of biomarkers from respondents than generally done in surveys.

A paramount example of such a substudy is the Aging, Demographics, and Memory Substudy (ADAMS), a population-based study of dementia

funded by NIA. In ADAMS, a selected subsample of HRS respondents received extensive in-home clinical and neuropsychological assessments of their cognitive status. While community-based studies have focused on particular geographical areas or on nationally distributed samples that are not representative of the population as a whole, ADAMS is the first study of its kind to undertake in person assessments of dementia in a national sample that is representative of the U.S. elderly population.<sup>3</sup>

In addition to the wealth of information about the members of representative subsamples, substudies also offer opportunities to validate and explore the significance of findings from the broad samples from which they are drawn. For example, challenge tests performed in clinics may provide perspective on the seated, resting blood pressure measurements performed in the larger survey, and detailed assessments of insulin resistance may help in the interpretation of data on glycosylated hemoglobin from the larger sample population.

Moreover, by sampling from the larger initial population-based sample in known ways, more informed generalizations can be made about the larger cohort and about the population from which it was originally drawn.

### Linkages with Auxiliary Data

A further way to extract yet more value from the current portfolio of population-based datasets is to link them with administrative data. Such linkages can vastly enhance the value of existing observations without increasing the burden on either respondents or survey staff. Cross-linking of data can make any dataset much more valuable to investigators by expanding the range of factors that can be analyzed or controlled for. Cross-linking may also increase risks of disclosure, and such risks must be addressed. Possible useful linkages include linking survey data to the administrative records of Medicare (such as pioneered with HRS data),<sup>4</sup> to Social Security administrative data, to private employer pension plans, and to the National Death Index. The forthcoming availability of the 1940 Census of Population records affords a new avenue for studying ancestry and the impact of locality on social phenomena. The explosive growth of electronic medical records offers another source of potential record linkages, though, like administrative data from Medicare and Social Security records, there are significant privacy concerns to take into account.

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<sup>3</sup>See <http://hrsonline.isr.umich.edu/index.php?p=shoavail&iyear=XB> [August 2012].

<sup>4</sup>HRS obtains information about health-care costs and diagnoses from Medicare records maintained by the Centers for Medicare & Medicaid Services. It is able to do this match because the HRS asks all respondents who are eligible for Medicare to provide their identification numbers; more than 80 percent of them consent to do so. The data are held in a restricted database. Available: <http://hrsonline.isr.umich.edu/index.php?p=medicare> [April 2013].

### Exploring New and Emerging Data Sources

In addition to focusing on extending the usefulness of survey data by increasing cross-linkages with existing administrative data sources, data providers, and other organizations are profitably experimenting with techniques that mine the resources of the Internet through Web searches, Twitter messages, Facebook, and blog posts. These sources are used to generate massive databases of big data that, if appropriately queried, could reveal patterns that illuminate sociological laws of human behavior. There is a growing variety of applications of big data techniques. Government agencies from the Intelligence Advanced Research Activity to the Census Bureau have taken an interest in using Web search queries, Internet commerce postings, Internet traffic flow, financial market indicators, traffic Webcams, changes in Wikipedia entries, and the like to detect patterns in communication, consumption, and population movement.

Other Web-enabled techniques are gaining traction. For example, crowd-sourcing techniques distribute tasks and problems to groups of people via the Web and assemble their input. These techniques have promise to increase understanding of human dynamics in an environment that is conducive to providing quick insights, though the anonymity of the Web currently limits the reliability of the observations. Like big data applications, however, crowd-sourcing techniques require a great deal more research to validate and generalize the data that are thus developed.

### Alternative Sampling Strategies for Hypothesis-Driven Studies

Another design approach is to devise specific sampling strategies for hypothesis-driven studies. For example, workplace-based samples might be chosen so as to investigate the impact of the intersection of work characteristics and workplace policies on many aspects of the experience of aging. Questions to be addressed might include whether retirement is feasible, when it occurs, and if it eventuates in subsequent employment or other commitments. Other questions in hypothesis-driven studies might concern issues, such as postemployment health, income security, social satisfaction, capacity to assist others, or the strength and content of social networks.

### Ecological Momentary Assessments

EMAs and other data collection techniques that gather geographic information can also be used to gain the new measures needed in research on aging. EMAs involve repeatedly sampling respondents' current experience and behaviors in real time, in their natural environments. Respondents provide data entries at periodic intervals or random time samples, using

a range of technologies, including cellphones, global positioning system devices, electronic diaries, and physiological sensors, such as ActiGraph accelerometer activity monitoring devices. Data on respondents' affective, behavioral, and contextual experiences, as well as physiological status and reactions, can be made as close in time to these experiences as possible. Because it permits real-time data capture, EMAs eliminate the recall bias that can occur in retrospective summary self-reports. Because it occurs in real-world environments, EMAs maximize ecological validity. EMAs also facilitate measurements requiring temporal and spatial precision.

In addition, EMAs enable tracking relations between individuals. For example, members of a family may record reactions to an event in parallel, or they may record reactions to each other. EMAs also allow the study of microprocesses and contextual associations that influence behavior in real-world contexts, including health behaviors or response to stressors. Other advantages of EMAs are improvement in compliance via electronic data capture, elimination of recall problems among the cognitively impaired, ease of implementation, and validation of global measures. (For more on EMAs, see Cain et al., 2009; Shiffman et al., 2008).

Furthermore, EMAs may be an important part of study designs that investigate activity space. While standard survey-based approaches often include abstract categories of institutional participation (such as church attendance, club membership), they lack the means to observe actual social and spatial exposures. Similarly, assessments of neighborhood characteristics may note the existence of facilities or institutions and estimate the impact of institutional density on aging-related outcomes, but they cannot assess actual participation in local institutions. EMAs and other means of measuring activity space make it more possible to study exposure to a range of institutions and settings. Cagney et al. (see Chapter 8) note the critical role of "overlapping routines and casual contact among neighborhood residents in developing public trust. In the absence of activity space information, the potential for such contact characterizing a given residential area is difficult to observe."<sup>5</sup>

### Agent-Based Models

Agent-based models (ABMs) may also be useful in research on aging. These models combine tools from artificial intelligence with theories

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<sup>5</sup>EMAs may also make it possible for local stakeholders to gather data relevant to advocating for or designing public policies or interventions. For example, electronic audit tools, adapted to lower literacy skills and physical limitations of an older population, can be used by residents to gather photo, audio, and location data documenting the walkability of a neighborhood (see Syme and King, Chapter 14).

of social process and behavior. They construct “agents” (or avatars) that are autonomous, interdependent, adaptive rule followers. Such agents are capable of strategic goal-oriented actions across time and are able to adapt by, for example, adjusting the timing or sequencing of key transitions. The models also generate settings of social time and space. In computerized thought experiments, agents are placed within these settings and become socially integrated through networks of interactions. ABMs thus allow a test of possible mechanisms that produce different pattern outcomes. They can illuminate such fundamental processes as the emergence of social structure, unintended consequences of policy interventions, or the social ramifications of rapid technological or environmental change. With due regard for the limitations of experimental designs (including questions of external validity), ABMs are one tool for examining how the micro level is linked to the macro level in ways far more complex and dynamic than aggregation. (For more on ABMs, see Hardy and Skirbekk, Chapter 7, and Macy and Miller, 2002.)

**Recommendation 4.** The National Institute on Aging should seek opportunities to:

- Supplement ongoing surveys by addition of respondents related to members of current samples.
- Identify subpopulations of interest and ensure their representation in sponsored surveys.
- Explore the use of the Internet and other electronic media to gather information on patterns of human interaction, consumption, and behavior.

#### HARMONIZATION OF DATA COLLECTION EFFORTS

With the number and range of studies being conducted on aging, the need for international comparisons, and the involvement of researchers from many different disciplines, harmonization of efforts is crucial. Comparability enhances replicability, aggregation, validation, data linkages, and tests of universality. It also makes collaboration across disciplines and genuinely transdisciplinary research more feasible. There are reasonable limits to the goal of harmonization. As Hauser and Weir note (2010, p. S125), congruence and overlap in studies are very helpful, but measures and designs should “not be so similar that the same gaps or problems could occur in every study.” Furthermore, the most significant variables seem to retain their significance across the variety of measures used to capture them. This appears to be the case, for example, for social class and health. As Syme and King note (see Chapter 14), “Social class has been measured in many

different ways in different population groups, but the same result emerges in virtually all of these studies—those from reduced social circumstances have higher rates of virtually all diseases.” These admonitions do not lessen the value of all that can be gained by harmonization across surveys and settings and among researchers.

### Cross-Survey Comparability

Cross-survey comparability of measures is of obvious importance. Comparability of measures may be particularly challenging when those measures are meant to capture something that is itself in flux. The concept of parent, for example, has gained some fluidity during recent cultural and demographic change. The term may be deemed to apply to biological parents, stepparents, social parents acquired through a biological parent’s cohabitation with another adult, and perhaps other parent figures. Household resident is another term open to different interpretations—by both data collectors and respondents. Surveys have used a variety of rules to determine who is a household resident, with some resulting confusion. The 2000 decennial census, for example, has an overcount of children about around age 10, which analysts attribute to the different definitions and interpretations of household residents in situations of joint custody (Seltzer, 2011a, p. 3).

Other measures would seem less susceptible to variable interpretation or cultural change. Geographic proximity might seem straightforward to measure and is significant in aging research to study, among other things, intergenerational transfer of resources, such as the ability of a grandparent to provide child-care to a grandchild, or for an adult child to provide assistance with errands and housekeeping to a parent. Yet there is great variation across surveys in how proximity is measured, with some asking distance in miles and others asking for travel time.

Response categories can also vary, making it problematic to compare measures even when the same metric is used. Comparisons and aggregations are compromised by such variation. Comparisons can also be affected by subtle aspects of survey administration such as mode of interview, order of questions, and interviewer-respondent interaction that are above and beyond the precise wording of a particular measure.

Other issues may arise in the comparability of biomarkers. Here, not only is the definition of the measure a concern, but also the cross-study reliability of correct implementation of complex protocols and the cross-study validity of assessments, particularly when complex assays of samples are involved.

### International Standardization

Comparable national data are essential for comparing findings on aging around the globe. Although the aging of populations is occurring throughout the world, it is occurring at different tempos and exhibits very different demographic profiles (see Hardy and Skirbekk, Chapter 7). Data analyses that make national, regional, and international trends more evident, and projections more valid, require comparable data.

Internationally comparable data are also critical for distinguishing between local and universal phenomena. The connection between SES and health, for example, may differ substantially depending on social policies, safety nets, degrees of social inequality, and life course exposures. International investigations of the SES-health nexus require comparable measures as they observe patterns and attempt to trace causal connections.

Some progress has been made in recent years in harmonizing international data on aging through extending HRS-type data collections in several countries, but there are additional opportunities in this area. The initiatives in Asia along these lines are discussed in a recent National Research Council report (National Research Council, 2012a).

Assessments of progress on international harmonization vary. Hauser and Weir (2010, p. S111) report considerable progress: “There is now a domestic and international cohort of longitudinal studies of aging that one might better describe in terms of a network of investigators and samples than as a collection of discrete projects. Collaboration, cooperation, and harmonization are guiding principles.” They cite a roster of international studies, all influenced by and comparable to HRS.

Despite this overall progress, there are areas in which comparisons are less well developed. Weinstein, Gleib, and Goldman (see Chapter 11) are more cautious in their assessment, particularly with regard to the new measures that integrate biological and sociological data. They remark on the imperative of international comparisons of social gradients in health that integrate biological mechanisms, but they cite researchers in this field who lament that “such undertakings are generally unable to establish whether divergent findings reflect true variability in the physiological pathways linking SES to health across countries, regions, and time periods; differences across datasets in measurement error or definitions of biomarkers, SES and health outcomes; differences in analytic strategies; or differences in sample size.”<sup>6</sup>

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<sup>6</sup>Citing Goldman et al. (2011, p. 311).

### Crossing Disciplines

Transdisciplinary research on aging seems to be both an already-established enterprise and a serious ongoing challenge (see Chapter 4). Major longitudinal studies have been designed and conducted with the participation of researchers with expertise in a great variety of disciplines, and they are overseen by interdisciplinary groups. Regarding the development of the HRS, Hauser and Willis (2005, p. 214) recall that when selection of measures required adjudication at a higher level, “these decisions were based on the potential of a given measure to contribute to the goals and theoretical frameworks of the HRS rather than their contribution to particular disciplinary concerns.”

Again, the relationship between SES and health points to the importance of harmonization. As Hauser and Willis (2005, p. 217) admit

In the past, surveys with good health measures have had poor economic measures, and vice versa, and surveys with both measures have been cross-sectional. This has hampered serious investigation. The availability of longitudinal observations with extensive and detailed data on both health and socioeconomic status has stimulated analysis and discussion by leaders in several disciplines of the interactions between health and social and economic standing across the life course.

The demand for more high-quality data on both social and health dimensions, including biomarkers, is growing at a great rate, as is the need to expand the range of feasible data collection protocols and assays. As discussed above, despite considerable advances, large population surveys continue to suffer from a relative dearth of biomarkers. Social genomics and other areas of investigation require such data, but it is not sufficient. Advances in the use of biomarkers require transdisciplinary teams to design studies and analyze findings. Intellectual exchange and cooperation within such teams involve many opportunities as well as challenges. As Shanahan (see Chapter 12) asserts, “Population-based studies of health have traditionally had an admirably interdisciplinary quality. As the models that describe connections between social, psychological, and biological levels of analysis becomes increasingly complex, greater attention should be paid to how such teams are organized and encouraged.”

### OBSTACLES TO DATA GATHERING AND USAGE

Emerging needs for new data and measures are being identified. Opportunities are available for adding to the database on aging. Trends in harmonization facilitate gains from research. Yet there are obstacles to be addressed. These require overcoming some of the unique challenges to

collecting data from older adults, especially the frail elderly. There are concerns over response burden, challenges in doing telephone interviews with the hearing impaired and those with cognitive functioning difficulties, problems of institutionalization, issues with concerned children who serve as “gate keepers” in turning away potential interviewers, and vigilance among institutional review board (IRB) panels who view elderly populations as vulnerable. Other obstacles are also important. The issue of managing the costs of new data-gathering initiatives and re-evaluating the restrictions on data usage are discussed at further length here.

### Costs

Although it is clear that important scientific questions are motivating new strategies for data collection and measurement, resources for research are finite and must be allocated carefully. The agenda for research on aging is broad, and the need for new data can appear daunting. But there are also ways of limiting and managing costs.

One way to limit the costs of new data collection is to augment ongoing efforts. Discrete measures could be added to current population-based surveys or subsamples could be drawn from existing samples for in-depth, hypothesis-driven studies. They could take full advantage of the existing infrastructure of ongoing biosocial surveys, increasing their value for research without incurring the costs of launching an entirely new research endeavor.

Other possible data collection efforts are unavoidably costly. These include in-depth social and physiological assessments. The comprehensive measurement of social factors (such as life experience interviews or daily assessments of experiences and behaviors) can be quite invasive and require detailed training and instruction to collect accurately. Biomarkers can be very expensive to gather and may entail conducting in-person interviews to acquire informed consent for obtaining biospecimens; providing equipment, training, and appropriate settings for collection; validating proper implementation; and ensuring subsequent secure storage and processing. After the cost of these measures could be contained by limiting their implementation to selected subsamples of population-based surveys, as discussed above, they would nonetheless be considerable.

Of course, nothing is as costly as doing a job poorly. Regarding the vexed efforts to ascertain the exact relationship between SES and health over the life course, Gruenewald (see Chapter 10) remarks that “the biggest challenge is concurrent high-quality measurement of both social and biological characteristics within studies. Early large-scale biosocial investigations tended to add fairly crude measures of one or the other domain depending on the original study framework with the result that failure to observe significant or strong biosocial associations led to aspersions on the whole

enterprise.” The selection of inexpensive measures, if they are not truly adequate to the research questions being addressed, provides little saving.

A further point to keep in mind about the costs of data collection is that these accrue not only to those collecting the data but also to those providing it—the respondents or subjects. The burden can include time, effort, discomfort, and willingness to risk disclosure of private information. These can discourage response and compliance, especially with more invasive, detailed, or frequent forms of data collection. Attrition in longitudinal surveys is a particular concern if data gathering becomes too onerous on respondents. As Hauser and Willis (2005, p. 214) observe, “surveys are successful only when members of the population are willing to join with funding organizations and researchers in adding to the society’s knowledge.” Attention to the costs of new measures must therefore also consider the costs to respondents.

### Restrictions on Use

No matter the quantity and quality of the data collected, the database on aging will be of little value if researchers cannot access it fully. At the same time that the technology and methodology for accessing data are expanding exponentially, a growing number of restrictions encumber full access to data. Whether well-intentioned or misguided, a variety of regulations and practices inhibit full data usage.

Making data available to researchers does entail risks, and, to a large extent, concerns about privacy and data access are warranted. Possible violations of privacy, confidentiality, and security of respondents loom large in a social context that accords even greater attention to the erosion of privacy, hidden forms of surveillance, the commercial exploitation of personal data, and security threats from hacking of databases. Concerns may be heightened when collected research data seem particularly private, such as biomarkers revealing health problems or the potential for health problems, socially stigmatized or illegal behavior, or personal financial information.

The increased feasibility of identifying and tracking individuals accompanying improvements in data processing and search capabilities also raises grave concerns. Earlier means of deidentifying data provide little reassurance when date of birth, gender, and zip code alone are sufficient to personally identify 87 percent of the population (King, 2011, p. 720).

Butz and Torrey (2006, p. 1,898) discuss the dilemma with particular reference to longitudinal data in the social sciences:

There is a debilitating tradeoff between the power of richly detailed data on individuals (and firms and other organizations) to test important hypotheses, on the one hand, and the possibility that such detailed infor-

mation will threaten the privacy and confidentiality of the persons and organizations described in the data, on the other hand. The masking of subject identity arises in many fields of science but is particularly vexing in social sciences where available masking techniques necessarily reduce the amount of information in the data. Exact-matched data files from multiple surveys and administrative record sources are particularly valuable analytically, but also particularly at risk for disclosure. Consider, for example, matched files that contain demographic and attitudinal information from persons in surveys, economic information on these same persons from government records, and medical information from providers. When longitudinal data are so matched, the analytical payoff can be unprecedented at relatively little cost in time and money.

In another instance, aware of the growing problem of identity theft, the Social Security Administration recently restricted access to a large part of the Social Security Death Master File, an index of 90 million deaths that are reported to the agency and that include names, Social Security numbers, and dates of death. In 2012, the agency declared that the records that had been contributed by state agencies were exempted from public disclosure. By this decision, records that had been used for social epidemiological research were foreclosed for those purposes (Sack, 2012).

Addressing these risks of disclosure is valid, and methods, institutional arrangements and systems for protecting the data have emerged to mitigate the risks. Advances in methodology for insuring data access while ensuring privacy and confidentiality have opened new possibilities (National Research Council, 2007, 2010). Among the techniques that are used with some success are to eliminate direct identifiers in records and to foreclose the possibility of identifying unique individuals in small cells by replacement or masking techniques. These techniques have been employed, for example, by the Inter-University Consortium for Political and Social Research, which is a major repository of datasets (National Research Council, 2009, p. 61). Other protection systems tightly control access to authorized (and sworn) researchers using such facilities as the NORC data enclave.

Nevertheless, current procedures and practices for ensuring access and protecting confidentiality may be unduly burdensome or even dysfunctional. Often access to survey data involves cumbersome administrative and legal arrangements or licensing agreements. Sometimes this entails traveling to secure enclaves or submitting statistical software to be run in a special protected facility. Some data sharing protocols require researchers to do their work in locked rooms without access to the Internet, other data sources, electronic communication with other researchers, or their customary software and hardware tools. Such restrictions reduce or preclude the use that can be made of exceptionally valuable samples.

Other restrictions limit who in the research community can aspire to access. Geographic area measures (such as poverty rates or crime rates in a given region, state, county, metropolitan area, census tract, or neighborhood) are often closely controlled. Those wishing to use these data must meet stringent requirements, such as having an active grant that can stand surety against misuse of data (as the HRS does). One effect of such requirements is that younger scholars, those not at major research institutions, those beginning work in a new area, and those defining new areas of inquiry are seriously handicapped—limiting the scientific community and damaging the research enterprise.

The restrictions currently in place do not necessarily provide enhanced security to respondents, or at least not in a way that balances the costs to researchers. A case in point is the Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule, implemented in 2003. Although intended to establish equilibrium between protecting the privacy of individual health information and preserving the legitimate use of this information by researchers, the rule is often seen as adversely affecting biomedical research. In 2007, the Institute of Medicine (IOM) commissioned a national survey about the HIPAA Privacy Rule among epidemiologists (see Ness, 2007). The survey addressed questions of the scope, degree, type, and variability of influence of the rule on research conducted by epidemiologists on human subjects. Epidemiologists ranked their perceptions and offered further comments on barriers, delays, and added costs of doing research because of the rule. On a 5-point Likert scale, 67.8 percent reported that the rule makes research more difficult, ranking this at 4 to 5; almost 40 percent gave a similar ranking when asked whether the rule had increased research costs; and 51 percent indicated that the additional time added by the rule to complete research projects was high. Other concerns among epidemiologists were the variability and confusion of implementation, with different IRBs being seen as having different interpretations of the rule, sometimes preventing linkages to public records or private-sector maintained data files. Overall, as one respondent reflected, “In the main, HIPAA has not prevented any research that I have desired to pursue. What it has done is slow the research enterprise through its training and compliance elements. I and my staff spend more time doing compliance related things and less and less time doing actual research” (Ness, 2007, p. 2,167).

Has the HIPAA Privacy Rule actually enhanced the protection of respondents? The surveyed epidemiologists are skeptical. Only one-quarter perceived that the rule enhanced the privacy and confidentiality of study participants. And even that gain comes at a cost. Researchers expressed frustration that, while offering little substantive privacy protection beyond what was already available in the Common Rule, the new restrictions had increased the burden on respondents who are now faced with far more

cumbersome consent forms. Not only is the HIPAA consent process time-consuming for subjects, but, as one epidemiologist observed, it “detracts from the informed consent process pertaining to the more critical issue: the actual medical risks and benefits of participating” (Institute of Medicine, 2009; Ness, 2007, p. 2,167). In reaction to these issues with HIPAA, the IOM panel recommended a new approach to protecting privacy and insuring access involving data security, increased transparency, and greater accountability. Included in the panel’s recommendations was a recommendation that the U.S. Department of Health and Human Services (HHS) regularly convene consensus development conferences in collaboration with health research stakeholders to collect and evaluate current practices in privacy protection in order to identify and disseminate best practices for responsible research. As a practical matter, the panel recommended that HHS provide reasonable protection against civil suits brought pursuant to federal or state law for members of IRBs and Privacy Boards for decisions made within the scope of their responsibilities under the HIPAA Privacy Rule and the Common Rule (Institute of Medicine, 2009). The need for consideration of these and other measures to foster research uses of data while protecting privacy is a continuing issue.

## 4

## Roadblocks and Bridges to Transdisciplinary Research

Team science is growing. As recently as 15 or even 10 years ago, most research was accomplished by solo investigators working in single disciplines. Disciplines are still important. They provide linkages to well-developed theoretical frameworks, an accumulation of scientific evidence and impart an important shared perspective. In the past decade, multidisciplinary research teams have become much more prominent and are having a much greater impact in the production of knowledge (see Wuchty, Jones, and Uzzi, 2007). As the issues that scientists and scholars investigate in their study of aging increase in complexity, the need for research teams—and the institutional infrastructure to support those teams—also increases.

Just as team science is growing, so is the science of team science as evidenced in a supplement to the *American Journal of Preventive Medicine* (Syme, 2008) with appreciation of the synergies and challenges that such work entails. Rosenfield's (1992) formulation, as mentioned in Chapter 1, has become predominant since first proposed. Rosenfield (1992) characterizes *transdisciplinarity* as involving researchers from different disciplines constructing an overarching model that includes but transcends their individual disciplines. In Rosenfield's typology, transdisciplinarity supersedes *multidisciplinarity*, in which researchers from separate disciplines work on the same problem independently with the intention of later combining their findings. Transdisciplinarity is also a step further than *interdisciplinarity*, in which scholars from different disciplines contribute their distinct perspectives to shared work on a common problem. Transdisciplinary research thus requires, as Duncan (2012, p. 7) observes from his own experience in the

field of child development, a “true integration of disciplines at the level of concepts, assumptions, theories, methods, and interpretation.”

Of course, the analytical distinctions are never quite so tidy during the actual research. Adler and Stewart (2010, p. 253), reflecting on their experiences as director and administrator, respectively, of the MacArthur Network on Socioeconomic Status and Health, remark that “the boundaries between these categories are blurry, particularly between interdisciplinarity and transdisciplinarity. While each type of category shift indicates progress toward greater integration, it’s not always clear when a category shift has occurred.”

Transdisciplinarity is both a process and a challenge. It demands the transformation of individual researchers into an effective team with a shared vision. This type of work is not for all researchers. As Adler and Stewart (2010, p. 254) note, “Traditional approaches to science reward individual effort. As a result, relatively few people have experience working in a highly collaborative manner, and some are not particularly interested in doing so.” The meetings of their research network, for example, included many guests who “did brilliant research and enriched our understanding of the problem but did not engage in the process of merging their thinking with that of others”—and thus were not invited to join the network.

Transdisciplinary research is also not appropriate to all questions. Progress in any field requires what Duncan (2012, p. 6) refers to as both the “deepening and broadening” of the field’s conceptual and empirical perspective. But for fundamental and complex social issues such as aging, broad transdisciplinary work has become imperative. The collaborative and synergistic aging research being done by scholars from many disciplines and often from multiple institutions (such as the work being done at the University of Chicago and at Harvard University, discussed below as examples of bridges to transdisciplinary research) is yielding new conceptual models, methodologies, evidence bases, and insights. For such fields as social genomics or cognitive neuroscience, which are of increasing importance to the study of aging, integrative multilevel transdisciplinary work is the only way to make progress. Research that transcends disciplines is imperative and merits support.

## ROADBLOCKS TO TRANSDISCIPLINARY RESEARCH

The need for transdisciplinary research in aging is increasingly recognized and is growing, yet many roadblocks encumber progress. Existing institutional infrastructure favors research that is deep rather than broad; as Duncan (2012, p. 13) observes, “there is little to worry about depth—the gravitational forces within our traditional social and behavioral disciplines and proposal review panels are robust and likely to stay that way.” By

contrast, support for transdisciplinary research faces many constraints and obstacles. These include institutional and administrative rigidities, established specializations among journals and professional societies, funder preferences and policies, and the incentives and constraints embedded in academic and research career tracks.

### **Institutional and Administrative Constraints**

The organization of universities, other research institutions, and federal agencies can have significant implications for the kind of aging research that is conducted. Many constraints to transdisciplinary research result from institutional arrangements, left over from an earlier era, set in place to strengthen individual disciplines and the work done in them. Universities have long been organized into disciplinary departments, and administrative support systems have grown around this structure. Other roadblocks to transdisciplinary research, such as institutional review boards (IRBs), are more recent. These institutional and administrative arrangements were not initiated to obstruct transdisciplinary research, but this has become an unintended consequence.

“In most universities,” Adler and Stewart (2010, p. 254) observe, “power and resources flow through departments which are organized by discipline.” That captures the problem succinctly. Work that exists between, across, and among many departments and institutions may well fall outside the flow of attention, power, and resources. Transdisciplinary projects must negotiate leadership, direction, and management, including what particular department or division will bear the costs, not only the cost of investments in specialized research tools but also the indirect and overhead costs of managing complex and extensive projects. Large, complex projects with federal or foundation funding present challenges to grants management, need for research resources and administrative support, and cost sharing. Assigning and carrying costs for transdisciplinary work constitute a substantial hurdle in institutions designed to channel internal resources through disciplinary departments.

Administrative capacity is another constraint. University research offices rarely have the experience or skills to manage the budgets, staffing, and timelines involved in the complex multidivision or multi-institution projects that often define aging research. Research offices may be organized more toward competing with other universities to obtain grants, rather than collaborating with them to build multi-institution projects. They may be ready to address compliance and regulatory issues, but less capable of facilitating work among scholars attempting to cross not only disciplinary divides, but also the mundane chasms of different time zones, laboratory protocols, or conference styles.

The requirement that all research involving human subjects be assessed by an IRB can inhibit transdisciplinary research as researchers from different divisions or schools in the same university or at different research organizations must seek approval from a number of IRBs. A lack of transdisciplinary perspective among the members of these boards can impede careful oversight, as review groups narrow themselves to standard disciplinary concerns and questions. For example, review boards in medical schools often give great attention to assessing the risks of procedures to patients, which is not relevant either for survey research or observational studies.

### Disciplinary Boundaries of Professional Journals and Societies

Other aspects of institutional infrastructure can also impede transdisciplinary research in aging. Where, for example, can the results be published? Editors and reviewers of high-prestige disciplinary journals can be difficult gatekeepers, resistant to publishing transdisciplinary work. They may lack the breadth of expertise to assess the research, or they may appreciate its value yet still consider it a poor fit for an explicitly disciplinary journal. To illustrate: the *American Journal of Sociology*, a leading journal in the field of sociology, has published nine articles (including a book review) with the word “biology” or “genetics” in the title or abstract since 1991, while publishing 75 items on “inequality” or “stratification” in the same period. In view of the relative lack of transdisciplinary focus in journals associated with the discipline of sociology, researchers have often turned to such as *The Journals of Gerontology* or *The Gerontologist*. While not as career enhancing as published articles in the *American Journal of Sociology*, articles in such journals do certainly contribute to transdisciplinary conversations.

Professional societies often parallel this disciplinary bias. Significant development of scholars occurs in the separate professional societies, such as the American Sociological Association. Professional societies’ conferences, sections, workshops, and publications are core institutional venues that facilitate scholarly growth. Few such institutional homes exist for fostering interdisciplinary exposure and exchange.

### Disciplinary Preferences of Funding Agencies

Funding presents another immense roadblock for transdisciplinary work. Funding agencies often maintain disciplinary identities, inviting and reviewing proposals that will deepen work in particular disciplines. Constructing a proposal outside these conventions can leave a research team outside these funding streams. For example, study sections at the National Institutes of Health (NIH) tend to be disciplinarily and theoretically narrow and are not always open to research that truly incorporates the perspectives

of multiple disciplines. This focus is critical because the way NIH characterizes research deeply affects how new research proposals are viewed and funded.

Funding can be a particular impediment at the earliest stages of transdisciplinary work on aging issues. The whole process of forming a team, identifying talented representatives of different disciplines willing to engage in a team enterprise, and formulating the shared models and methodologies that the team will use is an endeavor that itself takes substantial resources. Funding at the early stages can make all the difference for constructing grant proposals that will be recognizable and acceptable to conventional major funders who are looking for mature teams with established methodologies already showing preliminary results.

### Disciplinary Career Paths

A final set of constraints to transdisciplinary work is the incentive structure for individual researchers, particularly as those constraints affect the opportunities, promotion, and mobility of junior researchers. Even as the research of greatest impact is being conducted by teams, the academic departments of universities continue to evaluate their junior faculty members on the basis of their achievements within a discipline, strictly defined, and to insist on contributions made independently. Likewise, different disciplines have differing basis for judging impact—some highly value published results in specific publications; others give higher value to the presentation of results at conferences. Such differences in what counts as a rewardable activity may be a substantial impediment for junior faculty.

The lack of opportunities to publish transdisciplinary work on aging (given the disciplinary focus of many scholarly journals) or to present it at the conferences of professional societies (organized, again, by discipline) clearly puts at risk the chance for junior researchers to attain tenure or advance. Choosing transdisciplinary approach for their research may be harmful to their careers.

### BRIDGES TO TRANSDISCIPLINARY RESEARCH

None of these roadblocks to transdisciplinary aging research is insurmountable. Indeed, many bridges to transdisciplinary research are now being constructed or proposed. Researchers are demanding and devising the institutional and administrative structures they need to facilitate transdisciplinary research. Journals and professional societies are giving attention to and creating opportunities for sharing transdisciplinary research findings. Some funders are supporting transdisciplinary research and creating stepping stones for transdisciplinary career tracks.

### Institutional and Administrative Bridges

Institutional and administrative bridges to transdisciplinary research take many forms. Some transdisciplinary research initiatives involve not only several disciplines, but also multiple teams and several different institutions. A few examples illustrate transdisciplinary initiatives at different institutional levels.<sup>1</sup>

The Center for Cognitive and Social Neuroscience (CCSN) at the University of Chicago broadly addresses neural, hormonal, cellular, and genetic mechanisms and their effects on the mind, behavior, and health. Specific topics pursued by the center's research teams range widely, from genetic expression of social experiences to posttraumatic stress syndrome among military veterans. All the research projects share a common characteristic: research teams that are deliberately transdisciplinary.

The Chicago Health, Aging, and Social Relations Study (CHASRS) is another transdisciplinary initiative that has made an effort to transcend institutional barriers, such as the departmental segmentation of most universities. Within CHASRS, researchers from psychology, sociology, demography, and biostatistics have studied how social isolation affects the cardiovascular, immune, and nervous systems of affected individuals. They have directly confronted their different disciplinary conceptualizations of key phenomena, and their utilization of different types of data. Their efforts have resulted in some important synergies involving measures and datasets. Some of the questions and a loneliness scale developed and piloted in the relatively small CHASRS studies were swiftly adopted by the Health and Retirement Study (HRS) in its far more extensive longitudinal data collection effort. CHASRS also created a social network measure that is now included in the National Social Life, Health, and Aging Project, another national population-based study of health and social factors among older adults.

The Survey of Health, Ageing and Retirement in Europe (SHARE) also takes a multidisciplinary as well as cross-national approach to developing a panel database of microdata on health, socioeconomic status, and social and family networks. The survey collects data from more than 55,000 individuals aged 50 or older from 20 European countries (Max Planck Institute for Social Law and Social Policy, 2012).

Like the HRS, with which it is harmonized, SHARE attempts to capture the dynamic character of the aging process and link it with other measures. For example, the German part of SHARE wave 4 contains three scientific method projects that include innovative biomarkers (e.g., dried blood spots,

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<sup>1</sup>The committee conducted site visits to transdisciplinary research teams working at the University of Chicago and Harvard University in 2011.

waist circumference, and blood pressure), linking the SHARE data with the German pension data and conducting nonresponse experiments.

The Department of Health Care Policy at the Harvard University Medical School, one of nine departments at the school, was conceived in the late 1980s to be explicitly multidisciplinary, enabling physicians and social scientists to work together. This program houses the Robert Wood Johnson Foundation Health & Society Scholars Program in which four different disciplines—social epidemiology, public policy, history of science, and neuroscience—work together on health solutions, including work on aging health.

The Health Care Policy Department's Catalyst Health Disparities Research Program promotes new collaborative research, education, and training opportunities in the biomedical, clinical, and social sciences to address racial/ethnic, socioeconomic, and other disparities in health and health care. The program facilitates Harvard-wide research on health disparities through research and methods seminars, personalized consultations, networking events, and transdisciplinary condition-specific symposia. The program also provides training and mentorship opportunities for junior faculty, fellows, and students interested in health disparities research. Since the department's inception, some 15 other medical schools have established similar transdisciplinary departments of health policy research.

Perhaps the effort most explicitly aimed at constructing bridges to transdisciplinary research in an academic setting is the Arete Initiative of the University of Chicago.<sup>2</sup> This university-wide research development program facilitates transdisciplinary and multi-institution collaboration. The program's staff members help identify individual participants and institutional collaborators for major research projects addressing questions that must be approached with breadth. The Arete Initiative advises researchers attempting to build research teams, define projects, pursue funds, broker collaborative arrangements, and manage the budgets, staff, logistics, and operating norms of extensive projects. The Arete initiative has provided both impetus and crucial guidance for transdisciplinary research teams addressing on complex questions.

Another organization building bridges to transdisciplinary science is the MacArthur Foundation, which has a long history of investing in innovative science on aging. In addition to funding the first round of Midlife in the United States (MIDUS), which was subsequently funded by the National Institute on Aging (NIA), the Foundation has made significant infrastructure investments. Since 1982, the MacArthur Foundation has established 24 networks (Adler and Stewart, 2010, p. 253). Their purpose is to enable sustained programmatic investigations that transcend boundaries among

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<sup>2</sup>See <http://arete.uchicago.edu/about.shtml> [August 2012].

the biological, behavioral, and social sciences. The MacArthur Foundation describes these networks as “research institutions without wall that bring together highly talented individuals from a spectrum of disciplines, perspectives, and research methods.”<sup>3</sup> Current networks include the Research Network on an Aging Society, the Research Network on Transitions to Adulthood, the Research Network on Youth and Political Participation, and the Research Network on Law and Neuroscience.

### **Journals and Professional Societies Acknowledging Transdisciplinary Research**

Journals and professional societies can also rise to the challenge of fostering transdisciplinary work on aging. Some discipline-specific journals are publishing occasional issues or regular sections featuring transdisciplinary work—see, for example, the *American Journal of Preventive Medicine* (2008) Supplement 1; the *American Journal of Sociology* Special Issue on Exploring Genetics and Social Structure (2008). Journals can further this effort by selecting and encouraging reviewers to recommend that scholars submitting papers consider and incorporate insights from other disciplines.

Some professional societies are taking similar initiatives. The Society for Research in Child Development, for example, has decided that every third president must be from a field outside of developmental psychology (Duncan, 2012, p. 7). Furthermore, it has made promoting transdisciplinary work part of its strategic plan; it therefore funds proposals for workshops and conferences on issues across disciplines and is beginning a series of themed meetings in the years between its conventional biennial meetings (Duncan, 2012, p. 13).

### **Funding for Transdisciplinary Research**

Some major funding organizations have stepped forward to fund transdisciplinary work. Although study sections at the NIH can be narrowly disciplinary, the NIH has undertaken other efforts to support transdisciplinary research. Its program projects, for example, include clusters of projects on a common theme. With shared administrative cores, these offer one mechanism through which research teams and topics can incorporate a number of disciplines. For example, the National Institute on Minority Health and Health Disparities has announced a program to establish specialized Transdisciplinary Collaborative Centers for Health Disparities Research that support transdisciplinary coalitions of academic institutions, community organizations, service providers and systems, government agencies,

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<sup>3</sup>See <http://www.macfound.org/networks> [April 2012].

and other stakeholders focused on priority areas in minority health and health disparities. This initiative will support transdisciplinary targeted research, implementation, and dissemination activities that transcend customary approaches, and “silo” organizational structures to address critical questions at multiple levels in innovative ways.<sup>4</sup> A number of NIH component organizations, including NIA, have come together to sponsor research applications on fatigue and fatigability in aging with the specific intention of promoting “research studies employing transdisciplinary approaches that could lead to increased understanding of mechanisms contributing to, assessment of, or potential interventions for, increased fatigue or fatigability in older persons.”<sup>5</sup>

Funding at the early stages of transdisciplinary research can be particularly difficult to obtain. The NIA-funded Centers on the Demography and Economics of Aging, which are interdisciplinary by design, have provided significant funding for pilot projects. All of the centers investigate aspects of health and health care, the societal impact of population aging and the economic and social circumstances of older people. In addition, each center has its own disciplinary specializations, and they are encouraged to interrelate their work. Some of the specialization topics covered in the various centers are global aging and cross-national comparisons, the biodemography of aging, the relationships among biology and genetics, health and mortality, and life expectancy—all topics addressed in this report. They are a natural transdisciplinary training ground in that they habitually bring together researchers across disciplines for preliminary research that sets the stage for preparation of a proposal for a larger project.

Adler and Stewart (2010, p. 258) also praise the MacArthur Foundation for early sustained flexible funding as the Network on Socioeconomic Status and Health developed its research agenda as a group. This funding permitted initial time for exploration and discussion, some risky pilot work, and the latitude to act on emergent opportunities. With MacArthur Foundation support, the network was able to explore some new ways to test hypotheses, identify some ongoing data collection efforts that could be expanded, and hold meetings with enough regularity to forge a shared agenda. The research network was then able to successfully compete for funds from more traditional sources. Thus, Adler and Stewart conclude, “in the same way that venture capital energized the biotech industry through early funding of promising ideas, the ability to fund promising ideas that would not have sufficient preliminary data to attract NIH funding, was an extremely effective use of our funds.”

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<sup>4</sup>See <http://grants.nih.gov/grants/guide/rfa-files/RFA-MD-12-007.html> [September 2013].

<sup>5</sup>See <http://grants.nih.gov/grants/guide/pa-files/PA-08-162.html> [September 2013].

### Advancing Transdisciplinary Research Careers

Transdisciplinary research cannot advance without researchers, who require feasible career paths that provide opportunities, resources, and recognition of their work. These are beginning to become available. Some integrative research networks have made a point of supporting graduate students, postdoctoral fellows, and junior faculties, although the insufficiency of formal positions for junior members can be a problem. Some researchers also advocate master lectures at professional societies, seminars organized across departments, and service on panels reviewing transdisciplinary work. Training grants, such as the T-32 grants funded by NIH, generally include graduate and postdoctoral scholars in a number of disciplines in seminars, classes, workshops, and projects, fostering transdisciplinary understanding, knowledge, and collaboration.

The number of grants submitted on the sociology of aging is partly a function of the number of young scholars of aging coming out of the pipeline. Given that NIA center grants and the training provided in those centers is transdisciplinary, these training grants provide an important foundation for junior scholars who will define and carry out the research, both disciplinary and transdisciplinary, on the sociology, social demography, and social epidemiology of aging. Whereas datasets like HRS, MIDUS, the National Longitudinal Study of Adolescent Health, and the Wisconsin Longitudinal Study create research opportunities for new generations of scholars, they also provide rich opportunities for graduate students, postdoctoral fellows, and junior faculty to learn about how surveys are done, how research questions are developed, and how scholars seek external funding to support these projects. All of these opportunities provide a foundation for a vigorous, enthusiastic, and skilled workforce to carry out an agenda of future research.

The Robert Wood Johnson Foundation has established and funds a notable series of programs of postdoctoral fellowships, all of which have as a key goal training young scholars to do transdisciplinary research. The Robert Wood Johnson Foundation Clinical Scholars program funds recent graduates of medical school to train in program development and research methods, helping them to find solutions to the challenges posed by the U.S. health-care system, community health and health services research. The Robert Wood Johnson Foundation Scholars in Health Policy Research Program is a two-year fellowship targeting outstanding new Ph.D.s in economics, political science, and sociology to advance their involvement in health policy research. This program strongly encourages collaboration, cooperation, and shared understandings among these disciplines. The Robert Wood Johnson Foundation Health and Society Scholars Program is based on the principle that progress in the field of population health depends upon

transdisciplinary collaboration and exchange. Its goal is to improve health by training scholars to rigorously investigate connections among biological, genetic, behavioral, environmental, economic, and social determinants of health, and to develop, evaluate, and disseminate knowledge and interventions that integrate and act on these determinants to improve health.

**Recommendation 5.** The National Institute on Aging should encourage universities and research organizations to intentionally promote transdisciplinary research by:

- Reducing institutional barriers to transdisciplinary research and interdisciplinary research teams.
- Developing structures to encourage input and participation from outside ongoing projects in such a way as to bring together, in a transdisciplinary research environment, researchers from several institutions, and representing multiple approaches.

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## Appendix

### Biographical Sketches of Panel Members

**Linda J. Waite** (*Chair*) is Lucy Flower professor of urban sociology and professor of sociology in the Department of Sociology, Population Research Center at the University of Chicago. She is also director of the Center on the Demography and Economics of Aging at NORC at the University of Chicago. Her current research interests include social demography; aging; the family; health; working families; and the link among biology, psychology, and the social world. She has conducted a pioneering study on marriage, which argues that marriage changes people's behavior in ways that promote economic, emotional, and physical well-being. She has also studied the decision to cohabit, the transition from cohabitation to marriage and the characteristics of cohabiting unions. She has examined the role of religious participation over the life course and the lives of working couples with children. She has M.A. and Ph.D. degrees in sociology from the University of Michigan.

**John T. Cacioppo** is the Tiffany and Margaret Blake Distinguished Service professor at the University of Chicago, the director of the University of Chicago Center for Cognitive and Social Neuroscience, and the director of the Arete Initiative of the Office of the Vice President for Research and National Laboratories at the University of Chicago. Prior to joining the faculty at the University of Chicago, he served on the faculty of the University of Notre Dame (1977-1979), the University of Iowa (1979-1989), and the Ohio State University (1989-1999). Among the awards he has received are the Scientific Impact Award from the Society for Experimental Social Psychology (2009) and the Presidential Citation from the American

Psychological Association (2008). His current research interests include social neuroscience, social isolation and connection, and the evaluative processes (e.g., emotions, affects, and attitudes). He has a B.S. in economics from the University of Missouri, and M.A. and Ph.D. degrees in psychology from the Ohio State University.

**Andrew J. Cherlin** is the Benjamin H. Griswold III professor of public policy in the Department of Sociology at Johns Hopkins University. His research is in the sociology of families and public policy, and he has published books and articles on topics such as marriage and divorce, children's well-being, intergenerational relations, family policy, and welfare policy. He is the principal investigator of the Three-City Study, an interdisciplinary study of low-income children and their caregivers in the postwelfare reform era. He has a B.S. in engineering and applied science from Yale University, and M.S. and Ph.D. degrees in sociology from the University of California, Los Angeles.

**Nicholas A. Christakis** is professor of medical sociology in the Department of Health Care Policy at Harvard Medical School; professor of medicine in the Department of Medicine at Harvard Medical School; and professor of sociology in the Department of Sociology in the Harvard Faculty of Arts and Sciences. He is an internist and social scientist who conducts research on social factors that affect health, health care, and longevity. His lab is currently focused on the relationship between social networks and health, engaging two types of phenomena: the social, mathematical, and biological rules governing how social networks form ("connection") and the biological and social implications of how they operate to influence thoughts, feelings, and behaviors ("contagion"). Other ongoing investigations in the lab consider the effects of neighborhoods on people's health, the biodemographic determinants of longevity, the widowhood effect ("dying of a broken heart"), and the genetic bases for human behaviors. Christakis was elected to the Institute of Medicine in 2006. He has a B.S. in biology from Yale University, an M.D. from Harvard Medical School, an M.P.H. from Harvard School of Public Health, and a Ph.D. in sociology from the University of Pennsylvania.

**Melissa Hardy** is a distinguished professor of sociology and demography at Pennsylvania State University. She conducts research in mortality, health disparities, the demography of work and retirement, and inequality and financial security in old age. Her career interest in the retirement process includes gender and racial/ethnic differences in the timing and precipitants of retirement, as well as variation in the nature of the transition (e.g., distinctions between partial and complete retirement; between short-term retirement followed by reentry and sustained retirement; between retirement

from career jobs and retirement from bridge jobs). Her current work involves expanding information available for the original four cohorts addressed by the National Longitudinal Surveys, revisiting the Tremin Study of Women's Health, connecting early life experiences to later life outcomes, and the modeling of intensive longitudinal data and comparative data on aging. She has a B.A. in sociology from Albright College and M.A. and Ph.D. degrees in sociology from Indiana University.

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# PART II

# PAPERS



## 5

# Introduction and Overview

*Linda J. Waite*

The population of the United States is growing inexorably older. With birth rates historically low and life expectancy continuing to rise, the age distribution of the population in the United States is growing steadily older. The portion of Americans who are 65 or older, which was 8 percent in 1950, reached 12 percent in 2010 and is projected to be 22 percent by 2050 (United Nations, 2011). This demographic shift is occurring at a time of major economic and social changes, which have important implications for the growing elderly population.

The dramatic growth in the percentage of the U.S. population that is older than the traditional retirement age of 65, for example, is placing an increasing strain on the federal budget that will almost certainly lead to changes in the Social Security and Medicare programs, such as increases in the age of eligibility and, perhaps, changes in benefit levels (see National Research Council and National Academy of Public Administration, 2010). Other changes, such as the move away from defined-benefit toward defined-contribution retirement plans, changes in some corporate and municipal pension plans as a result of market pressures, and the 2008 financial crisis precipitated by the crash of the housing market, all have economic implications for older people. They are also likely to make it more difficult for certain groups of future retirees to fund their retirements at the level that they had planned and would like.

Along with these economic changes, the social context within which older individuals and families function is also changing, affecting, among other things, the nature of certain types of social relationships and institutions that provide part of the support infrastructure available to older

persons. Demographic and social trends—such as changes in marriage and fertility preferences, the increasing fragility of unions, the decline of the intact nuclear family, the increasing amount of time for some young people to transition to adulthood and the continuing improvements in health and disability at older ages—all influence the amount and types of support available to older persons and their need for support.

To deal effectively with the challenges created by population aging, it is vital to first understand these demographic, economic, and social changes and, to the extent possible, their causes, consequences, and implications. Sociology offers a knowledge base, a number of useful analytic approaches and tools, and unique theoretical perspectives that can be important aids to this task. Furthermore, sociology is at its heart an integrative science, perhaps the discipline that is best suited for “integrating what is known about human behavior” (Gove, 1995, p. 1,197). It concerns itself with how social systems work and how various social institutions are interconnected, with how micro and macro social processes are linked, with how attitudes and values are formed, how they differ between individuals and groups, and with how realities are socially constructed.

Surprisingly, given the significant potential of the field at this time, interest in the sociology of aging, as measured solely by the number of grant submissions to the National Institute on Aging’s Division of Behavioral and Social Research (BSR) has declined in recent years. In January 2009, a major independent review of BSR recommended that given the changing nature of the social context, BSR should strive “to revitalize the social demography, epidemiology, and sociology portfolios” (Cacioppo et al., 2009, p. 10) as well as continue research on social networks and their relationship to health (Suzman, 2010). In response to these recommendations, BSR turned to the National Research Council (NRC) to evaluate the recent contributions of social demography, social epidemiology, and sociology to the study of aging and identify promising new research directions in these subfields. In response, the NRC’s Committee on Population established an ad hoc Panel on New Directions in Social Demography, Social Epidemiology, and the Sociology of Aging. Part of the panel’s charge was to organize a workshop, inviting a series of leading researchers to a two-day meeting to offer their perspectives on the state of the field and to reflect upon promising future directions. This volume contains revised versions of the papers presented at that workshop.

Several themes emerge from this collection of papers. First is the need to grapple with the changing nature of what is being studied: social institutions, social networks, social groups, and social forces. These social arrangements vary significantly different over the life course, from generation to generation, and more problematically, sometimes even from year to year. Thus, for example, the social factors that influence those adults who have

recently turned 65 are likely to be quite different from those influencing adults who will turn 65 in two or three decades. The dynamic nature of the subject matter offers a challenge to sociologists that is not present—or not present to the same degree—in some other fields. A second theme is the importance of recognizing that aging takes place across the entire life span, so research questions related to old age outcomes cannot be properly understood by focusing solely on what occurs during the last stage of life (Elder, 1999). A third theme is the vast mostly untapped potential for greater integrated science. Some of the most promising recent research has been done at the interstices between disciplines when a researcher (or more frequently an interdisciplinary team of researchers) has begun to explore how genetic influences and social environments work in concert to vary the course of aging. Both of these last two themes underline the importance of adopting fruitful theoretical approaches. The choice of inputs, outputs, mechanisms, and theoretical constructs is crucial to the success of any effort, whether it is the development of a model, the collection of data, or the design of an intervention trial.

The emergence of these common themes is particularly noteworthy given the wide variety of approaches and perspectives that the papers in this volume represent. The authors of these papers come from a range of disciplines, from sociology and demography to social genomics and public health. A close reading of the papers in this volume should give readers a better understanding of where the field of the sociology of aging stands today and where it may be headed fruitfully in the future. In addition, taken collectively, the papers highlight the broad array of tools and perspectives that can provide the basis for further advancing our understanding of aging processes in ways that can guide policy.

## THE CHANGING SOCIAL AND ECONOMIC ASPECTS OF AGING

People's lives are obviously shaped by the social, political, and economic contexts into which they are born and within which they grow up, live, form families, work, and retire. In Chapter 6, Angel and Settersten take up the daunting challenge of reviewing some of the most critical social and economic changes that are occurring in U.S. society and what they possibly imply for the well-being of older people.

The authors begin with the observation that the typical life course has changed over the past few generations. With people living longer healthy lives, “retirement” has become a time when, at least potentially, people still have the health and the resources to live life in new, often rewarding ways. At the same time, the three principal phases of the life-cycle that have traditionally described an individual's trajectory over the life course—education followed by work followed by retirement—have been evolving

dramatically. The time in each phase (or box as the authors refer to them) is more variable than ever before as more people now learn new skills as adults so that their work years cannot be characterized as a straightforward upward movement through the ranks in a single profession or even a single company. Instead, with the churning in the economy, many workers find themselves looking for new jobs at several times in their lives, even as they approach retirement age. At the same time, marriage and first birth have been delayed, and the length of time children remain in the education phase or in a pre-work phase has in some cases been growing longer, which also has important financial implications for retirement planning.

At the same time, social relationships and institutions have been changing just as dramatically. As the prevalence of second or even third marriages has risen, mixed families—with stepparents and stepchildren, ex-spouses and their current spouses and children, stepsiblings, half-siblings, and so on—have grown in frequency. More children are born to unmarried mothers, more families are formed by cohabitation, and more men and women are heading into retirement alone. Families are also more dispersed than they have traditionally been in the past, thanks to increasing mobility for school, work, and retirement. With new patterns come new ambiguities. In particular, the roles and obligation associated with taking care of aging parents are no longer as clear-cut as they once were because of the more complex dynamics associated with mixed families.

Patterns of retirement are shifting as well. Age at retirement has fallen for men over the past 20 years, but the traditional pattern of working full-time until retirement age and then retiring to a life of full-time leisure is being replaced with a range of other trajectories, including transitioning to intermittent or part-time work. The choices are complicated by the uncertainties related to the growing fiscal stresses facing the Social Security and Medicare systems as an increasingly large percentage of the population becomes eligible to claim retirement benefits.

### THREE POTENTIAL CONTRIBUTIONS FROM DEMOGRAPHY

In Chapter 7, Hardy and Skirbekk provide a global perspective on the demography of population aging and points to three particularly promising areas of research where demographers can make real and substantive contributions to furthering our understanding of population aging. The first is biodemography, with a particular focus on understanding the interrelations between chronological age, health, and disability. As the average life expectancy of the population increases, it will be important to understand how health and disability of the aging population are evolving—a task that will be helped along by a study of how various biological microprocesses

(genetics, cellular biology, biochemistry, etc.) are linked with the health of individual cohorts and entire populations.

A second area to study is changes in the life course. Each new population cohort that comes along experiences a different life course, depending on such factors as education, employment patterns, family structure, gender roles, and social inequality. Any detailed forecasts of what to expect with an aging population will need to take into account the changing life course.

A third area where demographers can make important contributions to further understanding of the challenges of population aging is in the development of better forecasts, projections, and simulations that take into account the changes taking place in successive cohorts as well as the evolving microprocesses to develop a “big picture” of future populations and their macrolevel features. Such forecasts should be more accurate than those that do not take these factors into account and thus should help policy makers prepare more effective ways to anticipate the needs of future populations.

## THEORETICAL APPROACHES TO THE SOCIOLOGY OF AGING

One of the contributions of sociology to understanding the issues involved with aging has been the development of a number of theories whose roots lie in a wide variety of different approaches to understanding the world around us. Bengtson et al. (1977) identified 16 different theoretical approaches used in the sociology of aging including, for example, disengagement theory, which views aging as encompassing an inevitable process of withdrawing or disengaging from various social roles, activities, and relationships (Cumming and Henry, 1961); and social exchange theory, which seeks to explain human interactions and relationships in terms of cost-benefit analyses in which individuals decide which social actions to take by finding a course that maximizes value (Blau, 1964). One of the most dominant theoretical approaches has been the life course approach, which has been used to study how early life events and cumulative processes of disadvantage help shape later outcomes (Elder, 1999). Not a full-fledged theory as such, it is more of a guiding principle that “human development and aging take place across the entire life-span . . . adolescent, mid-life, and old age behavior cannot be fully understood by focusing solely on the specific life-stage in question” (Elder, 1999, p. 7). The life course perspective reminds us that to understand the differences between individuals in their later years, we must keep in mind their experiences throughout life, even reaching back in some cases to include influences before birth. The importance of the choice of theoretical approaches in illuminating different aspects of aging is illustrated in Chapters 8 and 9.

In Chapter 8, Cagney and colleagues describe one such approach that builds on the concept of “activity space.” The concept has its roots in three

theoretical constructs that sociologists have found useful in studying aging: social networks, neighborhoods, and institutions. Social networks—the collections of people that a particular individual knows and has interactions with—have been shown to be related to a number of health behaviors and outcomes including smoking behavior and obesity. Generally speaking, older people with larger, more active networks are likely to be healthier and live longer, but network sizes and the amount of contact with people in one's network both tend to decline with age.

Neighborhoods have also been shown to influence health outcomes among older adults in various ways. People living in economically disadvantaged neighborhoods, for example, tend to be at greater risk for disease and have lower life expectancy. At the same time, there are various health advantages for older adults to living in neighborhoods with many other older adults nearby.

Institutions, which Cagney and colleagues define as “physical locations where some form of organized social activity takes place,” play a similarly important role in the health of older adults, particularly those institutions such as long-term care facilities that promote greater social integration. Similarly, research has found that involvement in such institutions as churches, volunteer organizations, recreational facilities, and even informal gatherings in restaurants or other places have various beneficial effects for aging adults.

Cagney and colleagues argue that research into the effects of social factors on older adults can be enriched by applying the theoretical construct of activity space, which is defined as, in essence, the collection of all locations with which individuals come in contact during their day-to-day activities. The concept of activity space not only integrates the more basic concepts of social network, neighborhood, and institution, but it goes beyond them to include other factors that may play a role in the health of older adults. Individuals may, for instance, spend much of their time outside of their own neighborhoods—shopping, visiting family and friends, going to medical appointments, taking part in recreational and other activities, and so on. With its focus on individuals' actual, regular contacts, Cagney and colleagues suggest, the concept of activity space has the potential to provide a more accurate account of the various influences to which individuals are exposed. It can also help explain different outcomes in individuals who may share the same networks, neighborhoods, and institutions. On the other hand, accumulating data on activity spaces is likely to be more challenging than getting information on the more restricted constructs; one potential approach would be to use global positioning system tracking, perhaps through a smartphone, to gather the data. Ultimately, the authors argue, the benefits of learning about older adults' routine activities and examining the role of

these activities in health and disease are likely to be worth the investment that such studies will require.

In Chapter 9, Moen offers a different theoretical approach, institutional theory, for analyzing the issues surrounding aging. In this context, “institutions” are not places where organized social activities take place, as described by Cagney and colleagues in the previous chapter, but instead are “taken-for-granted schemas about ‘appropriate’ behavior—formal and informal rules and conventions representing collectively developed patterns of living which often reflect organizational and community answers to past problems and uncertainties.” Or, in other words, institutions are conscious or unconscious rules about how to behave in and think about various social situations. They come in various forms: practices and conventions, policies, programs, and so on. Although institutional theory offers an important prism through which social arrangements can be examined, to date it has been applied only sparingly in the study of aging.

After describing a number of ways in which current research in the sociology of aging has connections and overlaps with institutional theory, Moen makes several suggestions for future research directions that combine institutional theory and the life course approach with basic concepts and theories from sociology. The first suggestion is to move beyond the individual as the unit of analysis to look also at “organizational, occupational, associational, regulatory, family, and governmental policies and conventions” and how they intersect with individual lives to shape various aspects of the aging process. Moen’s chapter also underlines the importance of studying social change both within and across cohorts and doing so in a way that can capture the heterogeneity, differences in risk, and inequality in cohorts as they age and explain these variations in institutional terms. Such work could point to interventions and policies that could focus on the most vulnerable and aim to reduce differences in risk.

## THE INTERACTION BETWEEN BIOLOGY AND SOCIAL FACTORS

Some of the most exciting opportunities for new research in the field of aging involve interdisciplinary collaborations that have the potential to examine research questions from multiple angles, produce new insights and perspectives on long-standing problems, elicit a new awareness of the value of certain types of data, and allow the dissemination of science across a wide multidisciplinary audience. The study of the biological effects of social forces—particularly as it applies to the aging process—is still in its infancy, and many questions remain. As Gruenewald notes in Chapter 10, the study of biosocial processes in human aging is primarily the product of work in two areas of research: social epidemiology and social and health psychology. Over the years, social epidemiologists have accumulated a great

deal of data indicating that various social factors—socioeconomic status (SES), education, social isolation, a lack of social support, social networks, and the social environment—affect rates of morbidity and mortality. One of the most striking results from such research is the finding that the correlations between social risk factors and poor health are similar to—and sometimes greater than—the correlations between biomedical factors, such as smoking or obesity, and poor health. Recently, social surveys such as the Health and Retirement Study (HRS) and the National Social Life, Health and Aging Project (NSHAP) have begun collecting biomarkers. This holds great promise for providing new insights into the potentially important role of biological influences and their interaction with the social and economic environment.

At the same time that social epidemiologists have been tracing out the effects of social factors on health with large-scale studies, social and health psychologists have been investigating the same phenomena on a smaller scale, using measures of social and biological processes that are finer grained than those used in earlier epidemiological research. The work has included examinations of how psychosocial stressors and other social factors, such as the presence of supportive relationships, affect various biological measures, such as the level of stress hormones or the expression of various stress-related genes. New technologies for measuring biomarkers in the field have even made it possible to observe the biological effects of various social experiences on individuals as they go about their daily lives.

After describing the background of the field, Gruenewald reviews the major findings from research on biological processes. There is, for example, a large and growing body of evidence that connects lower SES with a variety of poor health outcomes: shorter life expectancies and greater mortality rates, increased chances of contracting most diseases, and diseases that progress more quickly. Furthermore, it now seems clear that having a lower SES early in life results in increased health risks later in life in a way that is independent of the effects of SES at that later time. This has led to the development of the accumulation of risk model, which predicts that various adverse social factors, such as low SES, have negative biological effects that accumulate over the life course, so that an older adult's health prospects are shaped by social experiences from throughout his or her life. As Gruenewald notes, however, many questions about this phenomenon remain to be answered, such as exactly when and how the effects of SES leave their biological mark. In concluding the chapter, Gruenewald points to a number of areas in this field that need further investigation, such as “a greater understanding of the range of social conditions linked to biological processes, the characteristics of biosocial interactions at different phases of the life course, and how such processes operate across time to influence healthy aging.”

While it is undoubtedly true that by combining biological and social data, researchers are opening up new fields of inquiry and are able for the first time to explore many new questions and connections, in Chapter 11, Weinstein and colleagues offer a somewhat less optimistic view of the value of recent biosocial survey efforts. According to the authors, biosocial research to date has not fully lived up to initial expectations. The authors also are particularly critical of certain theoretical concepts such as allostatic load and argue that there is generally an urgent need for stronger and better theory to be developed at a similar pace to additional data collection efforts in order to better guide future investigations.

In developing a deeper understanding of how social forces affect health, it is necessary to delve into the specifics of exactly what happens inside the human body, on a cellular and molecular level, in response to social stimuli. One of the most promising areas of research along these lines examines how social forces affect the rate of gene transcription. In each cell of the body some genes are active and others are inactive, and the pattern of activity varies over time, partly in response to external stimuli. An active gene is one whose DNA is being transcribed into messenger RNA, which is the molecular that directs the production of proteins—the ultimate product of the genes.

In Chapter 12, Shanahan describes the subfield of social genomics that studies how social factors affect the regulation of gene transcription—that is, the activity rates of various genes in a cell. More specifically, he examines what is known about how SES affects the rates of gene transcription in ways that ultimately result in stress-related inflammatory responses and inflammation-related disease. Shanahan suggests that future population studies will need to look at a wide variety of social and biological processes that take place on different levels over periods of many decades. In particular, because modeling the effect of social forces on health will require the inclusion of processes at every level from the cellular to the societal, future studies should examine variables across these levels—accumulating data on patterns of gene transcription and on the stress experienced by various socioeconomic groups, for example, as well as on many of the other variables between these two extremes.

Furthermore, because the effects of social factors on individuals can start accumulating before the age of five and because diseases develop over many decades, the most effective studies will follow individuals for much of their lives, gathering social and biological data at many different points along the life course. Finally, improving our understanding of social genomics will require both the creation of better measures of social context and the development of diverse research designs that can strengthen evidence of causality and also tease out how various contexts—policy settings, political economies, demographic compositions, and so forth—shape the effects of

socioeconomic status on gene expression. “The payoff for such efforts,” Shanahan writes, “will be increasingly thorough explanations of SES gradients in health, and thus the scientific basis for effective prevention and intervention.” Commenting on Shanahan’s paper, Schnittker, in Chapter 13, raises a number of useful points that are worthy of consideration, including speculation on the possible consequences of fully adopting a social genomic agenda on the future direction of aging research.

### INTERVENTION TRIALS

Ultimately, if theoretical knowledge about the aging population is to be put to practical use in improving the health status of people as they age, then it will be important to translate it into sound behavioral health interventions as well as clinical trials. But while carrying out such intervention trials may at first seem straightforward, there are actually many challenges to performing such trials in a way that provides useful, trustworthy data. In Chapter 14, Syme and King begin their discussion of clinical intervention trials with a review of the 2000 Institute of Medicine report *Promoting Health: Intervention Strategies from Social and Behavioral Research*. Although generally optimistic about the potential of intervention trials based on social and behavioral research, the report noted that, with few exceptions, most such trials up to that point had either failed or had only modest success. In large part, Syme and King suggest, this is because of an array of challenges facing researchers who undertake such trials. The authors argue, for example, that it is difficult to carry out a true randomized controlled trial because the subjects who are serving as the control group may decide themselves to make changes in their health-related behavior, making them less useful as controls. In other cases, the subjects in the treatment group may change their behavior in ways other than those specified for the trial, making it difficult to attribute any changes in outcome solely to the treatment. Selection bias is another concern, as those who are willing to take part in—and to complete—extensive health-related trials are in some cases likely to be more health-conscious and to differ in other significant ways from the general population. The authors conclude that results of intervention trials are quite sensitive to the selection of risk factors, the selection of outcomes, and the time frame over which the intervention is carried out; a poor choice in any of these areas can make it difficult to discern the true effects on an intervention. Finally, because of the way that many different factors, some of which may be seemingly insignificant, can affect the outcome of interventions, it can be difficult to reproduce the results of a study. Researchers may need to be content with finding general patterns in results rather than demanding strict reproducibility.

Fortunately, the science of intervention has made a number of advances since the release of the IOM report. There have been a number of advances in the methodology of randomized controlled trials, for example; some of these advances have increased the real-world relevance of such trials, while others have focused on the best ways to induce multiple behavioral changes to take into account the fact that most diseases are influenced by multiple risk factors. Another advance has been the use of “stealth interventions” that use subjects’ interests in areas other than their own health—such as the environment or their faith—to induce them to change health-related behaviors. The chapter ends with several suggestions for improving clinical intervention trials in the future.

### LOOKING TO THE FUTURE

As the papers in this volume demonstrate, there is great value in applying the tools of sociological research to the study of aging. While practitioners of the sociology of aging can certainly point to a great many achievements made to date, many important questions remain as yet answered. Yet many new and promising techniques and approaches remain to be applied. The most valuable approaches may be those that tackle the issues surrounding aging at multiple levels and from various angles simultaneously.

The papers here offer a starting point and a set of arrows pointing in directions that seem likely to reward further investigation. Certainly one among many promising recent developments has been the emergence of new and highly innovative data that are enabling researchers to better understand how genes and social environments work in concert to vary the course of aging. This area of research is already producing much interesting work, and it seems that its future is particularly promising. Nonetheless, there are few long-term issues facing this country that are more important than the aging of its population and the changes that this aging will bring, it is our hope that the volume will begin conversations, trigger ideas, and instigate research projects that will, in time, combine to lead to a far deeper and more complete understanding of how individuals, groups, and society as a whole will be evolving in the face of this historical shift.

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## 6

# The New Realities of Aging: Social and Economic Contexts

*Jacqueline L. Angel and Richard A. Settersten, Jr.*

This chapter addresses some of the new realities of aging as they are shaped by contemporary social and economic contexts. Changes in these contexts have dramatically altered the perceptions, behaviors, and opportunities of older people, which in turn affect the experiences and meanings of aging for everyone in society. With increasing globalization, aging populations also need to adapt to life in a diverse and multigenerational world. The primary objectives of this chapter are to describe these new realities and the processes that give rise to them; to examine some of their outcomes and implications; and to highlight the importance of viewing the science of human aging through a sociological lens.

We begin with some of the most significant *social* issues, examining the new configuration of the life course by considering the shifting boundaries and markers of different life periods; the erosion of traditional pathways through education, work, and retirement; and the future of aging based on what we know about younger cohorts. Next, we point to the growing diversity of family and social relationships and the new strengths, vulnerabilities, and ambiguities they bring, paying close attention to effects on social support, health, and intergenerational financial exchanges.

The discussion then turns to some of the most pressing *economic* issues. We describe the changing contingencies of retirement for individuals and groups and then examine a larger range of concerns related to public economies and aging policies and programs. It is here, especially, that we entertain the roles of various *policies and institutions* because they are crucial levers for both responding to these new realities and preparing for the future.

## REORGANIZATION OF THE LIFE COURSE

### The Shifting Boundaries of Life Periods

The past century saw significant reductions in mortality, morbidity, and fertility (see Hardy and Skirbekk, this volume). These factors, which created aging societies, have fundamentally transformed human experience and the landscape of the life course (Settersten and Trauten, 2009). Old age is a prime example. Longer, healthier lives make it possible for individuals to become and be “old” in brand new ways. Old age extends multiple decades, but it is comprised of early and late phases that are often extremely different from one another. This is reflected in what has been called the “third” and “fourth” ages of life (e.g., Laslett, 1989). The “third age” can span several decades and is viewed as a time of opportunity and activity. It is a period during which most mature adults no longer have childcare or work responsibilities but are in good health and have other resources. Moen (2003) calls this period “mid-course” and emphasizes the possibility of developing new identities and ways of being productively engaged, and of revising existing relationships and beginning new ones. The “fourth age,” in contrast, is defined by the three “Ds”: decrepitude, dependence, and death (Laslett, 1989). Individuals can expect major encounters with chronic illness to be followed quickly by death (the so-called compression of morbidity; see Fries, 2005).

These categories underscore important distinctions among old age groups. Clearly, experiences related to aging into one’s 80s and 90s cannot be oversimplified or glorified, as the transition from the third to the fourth age is a difficult one. The advantages of the third age can quickly dissolve as health and resources change. Social gerontologists do a disfavor to older people when they actively promote images of successful aging that deny or underplay the hardships that come with growing old. These tensions are also exhibited in media depictions of old age (Harrington, Bielby, and Bardo, 2011). Longevity brings an important paradox: humans now live longer than ever before, and aspire to live even longer, yet this quest must be to also ensure that the quality of lives is commensurate with the quantity of years.

### The Shifting “Boxes” of Education, Work, and Leisure

The past half-century also saw dramatic changes in the allocation of educational, work, and leisure experiences across the life course. A prime example relates to the three successive “boxes” of education early in life, work in the middle, and retirement at the end (e.g., Kohli, 2007). This three-box structure traditionally characterized the lives of men, but it also

increasingly did so for women as their educational attainment and labor force participation grew.

The boundaries and content of these three boxes, however, have been shifting and are even eroding (Settersten and Trauten, 2010). The early part of adult life, for example, has seen major extensions in education. Some young adults are postponing entry into the labor force as a full-time worker because of occupational ambitions; they pursue higher education and work concurrently or alternate between taking classes and going to work. These changes mean that individuals from recent cohorts are putting off saving for retirement, potentially reducing their resources in old age. The problem is exacerbated by the fact that gains in longevity have also extended the retirement period.

In the middle-adulthood years, rapid technological change and innovation have similarly made it necessary for working-age adults to return to school or seek additional training that will allow them to update their skill set and knowledge to stay competitive in new markets. Yet scholarships and student loan programs are generally awarded only to full-time degree-seeking students, disqualifying most adults. As a result, expenses for educational activity must often be paid out-of-pocket, making a return to school unaffordable for many adults, especially if it also means losing health insurance. These constraints make it difficult for adults to improve their economic standing in the job market.

The need to remain competitive has especially grown as “lifetime” models of work—in which employers and employees invest in a long-term partnership, and employee longevity in a firm means better wages, job security, job mobility, and pensions—have vanished. Stable work has itself become uncertain, and many jobs no longer come with health insurance or benefits or with the levels of protection they once did. This is especially reflected in “contingent” models of work characterized by time-bound contracts with no promise of work beyond those parameters—or which offer no employment contracts (Barker and Christensen, 1998). The shift toward contingent models of work, partly the result of the decline in manufacturing jobs, carries significant implications for social policies and for the financial security of individuals and families. For example, such a shift means that health-care coverage, pension plans, and Social Security benefit levels may be jeopardized or significantly lowered. Because careers have become more disjointed, it may also mean that individuals need unemployment insurance more often and for longer periods of time. Changes such as these affect the well-being not only of employees but also of the spouses and children attached to them as dependents and beneficiaries.

Another consequence of these changes is that many older people are unaware of when and how to transition into retirement and, specifically, how to gauge the end of their work years. As people approach the end of their

work years, a wider array of routes into retirement is now more common (see Moen, this volume). The last quarter of the 20th century witnessed a surprising trend toward early retirement that, when coupled with delays in full-time work at the front of adult life, meant that the period of gainful work became shorter. Evidence is now mounting, however, that the trend toward early retirement is reversing and will jump ahead by at least a few years (Hardy, 2011). This phenomenon is produced partly by incremental changes in eligibility ages for Social Security and partly by the need for individuals to remain employed longer in order to support themselves and their family members. Older workers with defined contribution plans are much more likely to remain in the labor force than those with defined benefits plans (Pang, Warshawsky, and Weitzer, 2008). For many, the need to remain employed has also grown as a result of the current economic recession (Van Horn, Corre, and Heidkamp, 2011).

In the changing world of work, men and women may anticipate working for some time, but if their jobs disappear and they are unable to find another place of employment, then retirement becomes a kind of “default” status—at least until they manage to retrain or relocate. For others, the unpredictability of retirement income may mean that they think they will not be able to afford retirement at all. As inequality expands, retirement may also become bimodal: an intermittent period between jobs or when no more work can be found versus a planned interim period between employment and when health declines impose limits on activities.

Despite these and other changes, the three-box structure is created and reinforced by policies that regulate education, work, and retirement. When the lives of individuals depart from this three-box structure, whether by choice or out of necessity, they are penalized for it. Sociologists have important roles to play in both analyzing the effects of social policies on the life course and helping policy makers revise outdated policies that were based on an earlier model of the life course.

### Anticipating the Future of Aging

Much knowledge about aging is based on cohorts born in the first few decades of the 20th century. The past century was punctuated by remarkable events and changes related to war, economic hardship and prosperity, health epidemics, civil rights reforms, and innovations in medicine, communication, and transportation. The Great Depression and military service during World War II, in particular, heavily marked the lives of men and women who are now old (see Settersten, 2006). These historical events and changes may be “hidden variables” (Spiro, Schnurr, and Aldwin, 1997) beneath much of the scientific knowledge base in gerontology. In terms of policies, these cohorts are also unique: their early lives saw and benefited

significantly from the conception of the New Deal and its programs in the early 1930s; their military service, too, brought educational, housing, and other benefits related to the G.I. Bill after World War II; and they later benefited from the programs of the Great Society of the mid-1960s. These programs were also aimed at the middle class as they democratized opportunities (higher education, pensions, and job perquisites in the form of fringe benefits) and generated comparatively healthy rates of economic growth, which counteracted the economic forces of wealth inequality.

Present understanding of the sociology of aging is based on the unique experiences of this cohort (see examples in Settersten and Angel, 2011). However, it is unclear how this knowledge will apply to future cohorts whose historical experiences have been very different from those who are currently old remains unknown. One way to increase this understanding is to become more intimately acquainted with cohorts who are *not yet old*. For example, negative public discourse surrounding the Baby Boom generation has focused on how its size has strained social institutions or undermined public resources (see also Schulz and Binstock, 2006). But it is important to remember that the physical, psychological, and social statuses of the Boomers are rather favorable relative to past cohorts. The recent surge of interest in the civic engagement of the young-old seems symbolic of the new potentials inherent in the Boomers (O'Neill, Morrow-Howell, and Wilson, 2011). Important insights for policy making will be found in probing the implications of Boomers' better positions, on average, in all aspects of aging as well as their aspirations and expectations for old age (Hughes and Waite, 2007). Their better statuses on average, however, are also undermined by the extraordinary variability and inequality among them.

Becoming more closely acquainted with cohorts currently in early adulthood is also important. Members of these cohorts are experiencing a prolonged transition to adulthood, with significant delays in leaving home, finishing school, starting work, getting married or partnered, and having children (e.g., Settersten and Ray, 2010). Their routes into adulthood are more circuitous and do not match the linear models of life that underlie many contemporary policies related to education, work, and family, which creates risks. Relative to other cohorts, younger generations are in some ways better off and in some ways worse off; they have encountered new vulnerabilities as the service and knowledge sectors of the economy have grown (see Danziger and Rouse, 2007). Their worldviews on a wide range of social and political issues differ from previous cohorts (see Smith, 2005). As these young adults grow older, they, like the Boomers, will further challenge much of what is now taken for granted about aging.

## FAMILY AND SOCIAL RELATIONSHIPS

### New Types of Relationships

As the life course has been reorganized, so, too, have family and social relationships. Marriage and families have been “deinstitutionalized,” and the social norms that once governed the expectations and obligations of individuals have weakened (Giddens, 1994; Kohli, 2007). Profound social change and modernization have left people with more choices and fewer constraints on their lives (Angel and Settersten, 2011). The dissolution of the “traditional” long-lived nuclear family is but a small part of the larger picture. The wide variety of family (and family-like) configurations and relationships today is driven by myriad factors, including serial divorces and remarriage across generations, multipartner fertility and nonmarital childbearing, and concurrent survival of multiple generations across many decades (Treas and Marcum, 2011). The geographic dispersion and mobility of immediate family members also create new challenges for families.

Some of these changes are tied to the demographic parameters discussed earlier. Decreases in mortality have radically altered the “supply” of kin at different points in life and produced long-term joint survival of family members (Uhlenberg, 1996). In today’s demographic conditions, family relationships have the potential to become more important, active, and intense. These relationships may become more significant and positive all around because lower fertility has meant that there are fewer relationships in which to invest, they are of longer duration, and they exist across many generations.

But the reverse is also possible, as the new demographic climate may instead foster family ties that are *less* important, active, and intense. Because the presence of these ties can be counted on for many decades, individuals may *disinvest* in family relationships under the assumption that they are always available and can be activated as needed. In this scenario, family ties become more vulnerable as time together becomes more sporadic and as families themselves become more fragmented and risk-laden. Much remains to be learned about the relative nature of nuclear, multigenerational, and extra-familial ties at different times in life, and about the circumstances under which relationships beyond parents and children are activated, by whom, and for what purposes.

Of the many relationships in an extended family, grandparents, and especially grandmothers, are critically important, for they often serve as “safety valves” or “stabilizers” by solving problems and mediating between family members (Hagestad, 1986; Putney and Bengtson, 2003). The significance of grandparents is likely to continue growing amidst marital instability (Uhlenberg, 2005). At the same time, grandparental ties, especially

paternal ones, may be more tenuous because of that instability and geographic dispersion (Bianchi et al., 2008).

Some of the potential gains for relationships that come with longevity may be offset by divorce, which has remained at high and stable levels since the mid-1970s. Nearly half of all recent marriages will end in divorce, and first marriages that end in divorce last about eight years (Kreider, 2005). A major transformation in the past century is that divorce rather than death is now the great disruptor of family relationships (Uhlenberg, 1989). The nature of disruption that comes from divorce and remarriage is inherently different than death, although both clearly affect the quality and duration of relationships (Carr and Moorman, 2011). Divorce and remarriage also mean something different for young couples with underage children and shorter marriages relative to older couples with grown children and long-standing marriages. Unprecedented complexities result when divorce and remarriage occur multiple times within particular families or for multiple families in the extended family matrix. New complexities result from the increased proportion of single-parent households, cohabitating couples, gay and lesbian couples, and individuals who are intentionally single and childless. There is much to learn about what these varied relationships mean for aging individuals and their families.

### **New Ambiguities in Relationships**

Given the new diversity of relationships, many are no longer ascribed and must be continually negotiated. Relationships can become challenging because individuals do not know how to relate to one another in new life periods. Even relationships between parents and children, among siblings, and between spouses—which might be expected to be among the clearest or most meaningful of relationships—can be characterized by considerable ambivalence (Connidis and McMullin, 2002; Lüscher, 2005; Suito et al., 2011). It is hard to know what it means to assume new family statuses and interact with others who are remotely or uncertainly related to each other, or whom are rarely seen. In addition, ambivalence can be exacerbated by the fact that meaningful family-like ties may also be socially and politically contested and unrecognized or even deemed illegitimate in the eyes of the law.

Today, for example, little is known of what it means to be a “grandparent,” let alone a “great-grandparent,” especially set against the backdrop of divorces, remarriages, multipartner fertility, and the like. New life conditions bring opportunities for involvement with grandchildren or great-grandchildren, but there is much to learn about *how* people fill these roles and what expectations they and others have. Grandparents have traditionally participated in the informal care of grandchildren (Pebley

and Rudkin, 1999). Recent years, however, have seen a sharp increase in grandparents who have primary responsibility for rearing grandchildren (Casper and Bianchi, 2002). Although many of these grandparents report that there are benefits associated with this responsibility, there may still be negative consequences for the physical, social, and psychological well-being of these caregivers (Leticq, Bailey, and Porterfield, 2008; Williams, 2011). Further, relative to their counterparts who do not have caregiving responsibilities, grandparent caregivers are more likely to be single, live below the poverty line, and have health limitations, which make it all the more difficult to manage their caregiving responsibilities (Kreider and Ellis, 2011). From the vantage point of the child, research has also not yet begun to address the short- and long-term implications of having been raised by grandparents.

The new complexities of family configurations also pose new questions about who is responsible for the care of older people, including growing proportions of people who have never married or parented, as well as aged parents who live far away from adult children and will inevitably need other informal sources of support and alternative social safety nets (Baca-Zinn, Eitzen, and Wells, 2010; Pavalko, 2011). Policies must assume not that families today have deficits relative to “traditional” forms, but that they have strengths—and that the challenges they face reflect dramatic social and economic changes of the past half-century (Koontz, 2000).

### SOCIAL DIMENSIONS OF VARIABILITY AND INEQUALITY ACROSS THE LIFE COURSE

Decades ago, Neugarten (1979) noted that members of a cohort “fan out” over time as their unique life experiences accumulate and result in great variability by the time they are old. Inequality also tends to increase with age as a result of processes related to social stratification and exclusion and to the accumulation of advantage and disadvantage over the life course (Dannefer, 2003).

How, then, are late-life experiences different based on health and wealth? Theories of the cumulative advantage and disadvantage process can identify those aspects of the causes and consequences of inequality at earlier points in life (e.g., Hamil-Luker and O’Rand, 2007; O’Rand, 2003). For example, advantages related to wealth may grow more monotonically over time while advantages related to health seem less straightforward. A large body of research shows that accumulated wealth through income and assets are major factors that separate those who are well off in retirement from those who are not (Shea, Miles, and Hayward, 1996). The functional form of this accumulation may depend on cohort, i.e., how age intersects with historical (economic) trends. For example, individual and family resilience

may allow young adults of lower socioeconomic status to recover from health setbacks, but at some point, lowered resilience increases fragility and may lead to a profound drop in health status. Such gradual declines with discontinuities, then, reflect a significant degradation in modal health.

On the other hand, the advantages of accumulated health, in contrast, may be linear in that those with poor health do not survive to old age, or far into old age; but among those who survive, age eventually becomes a “leveler” of sorts—it brings challenges that cannot be escaped or compensated for, even among those with plentiful resources (Ferraro, 2011; Herd, 2006; Lynch, 2003; Willson, Shuey, and Elder, 2007). A life course and intergenerational perspective, is helpful in examining the consequences of asset accumulation and group social mobility, topics that will be taken up in greater depth below.

These topics are especially timely because the United States is becoming more ethnically diverse, and inequality does not exist independent of age, race, and gender (Warner and Brown, 2011). Age-, race-, and gender-based inequalities are reinforced by social policies that fail to address group-specific vulnerabilities, such as labor force disadvantages, blocked educational opportunities, and unequal access to healthy lifestyles and health care (Angel and Angel, 2006; Herd, Robert, and House, 2010).

In many respects, aging and old age in the United States are “private troubles” more than “public issues,” to use C. Wright Mills’ (1959) famous phrases. That is, beyond the basic protections provided by old-age policies, they are conditions to be managed using whatever resources one has or can marshal for his or her own well-being. This is, of course, not only true of old age but of every period of life, particularly the vast space between childhood and old age, when few supports are offered (Settersten and Trauten, 2010). The emphasis on personal responsibility seems likely to grow as public resources dwindle and are further threatened by negative economic and political environments (Quadagno, Kail, and Shekha, 2011). It is too soon to gauge whether poverty will continue to be concentrated among the young and wealth among the elderly. What is certain, though, is that the growing divide between the “haves” and the “have-nots” increases tensions about the resource differentials across racial/ethnic groups, and leaves even more vulnerable the groups who are already disadvantaged in terms of health and economic security (Whitfield et al., 2006; Willson and Hardy, 2002).

Consider the case of the Hispanic population, the fastest growing American minority group, and by example Mexican Americans (Angel et al., 2012). Although the Mexican American population has on average extremely low levels of education, health insurance, income, and wealth, they live a longer life than other racial/ethnic groups with similar economic profiles. Even so, the possibility of an increased number of years characterized

by poor health and material hardship raises serious questions related to the potential burden on government and family that such dependency implies, especially for late-life immigrants (Angel et al., 2004). Many grown children in low-income minority families are increasingly ill-equipped to care for aging parents given their own family responsibilities, occupational mobility, and persistent financial strains (Dilworth-Anderson, Williams, and Gibson, 2002).

### INTERGENERATIONAL FINANCIAL EXCHANGES AND INHERITANCE

The consequences of variability and inequalities across families are perhaps nowhere more apparent than in the financial exchanges and inheritance across generations. Family exchanges fuel inequalities in the larger society. Money and assets carry significant implications for family obligations, expectations, and responsibilities (Angel, 2008). Gifts, bequests, and inheritance will take on greater salience for older Americans, especially for women, who fear that they will outlive their wealth (Dannefer and Shura, 2009). Yet there are scant sociological analyses on the connection between expectations and reality in living through the retirement years (Street and Desai, 2011).

In normal family development, the pattern of instrumental aid, defined in terms of help with daily tasks such as transportation, caregiving, and money management between generations, is downward from the parent to the child until the child reaches adulthood (Hogan, Eggebeen, and Clogg, 1993; Silverstein et al., 2002). As the parent reaches later life, the flow of instrumental assistance begins to move upward from adult child to the parent (Eggebeen and Hogan, 1990). Studies are needed to examine how changes in the structure, values, ethnic composition, and economic status of families have affected their exchange of financial resources across generational lines. Changes in the modern role of kinship should prompt new questions about intergenerational solidarity and the extent to which the receipt of financial assistance might attenuate notions of filial responsibility. Here, research shows (Silverstein, Gans, and Yang, 2006) that kin outrank step-kin in the support they receive. Remle (2011), for example, demonstrates that children in blended families are less likely to receive financial transfers, and when they do, they receive smaller amounts of money than grown children in nuclear families.

Other questions point to the role of household and family characteristics in determining resource flows—quality, number of kin, the meaning of kin, and kin relationships. Intergenerational transfers involving mid- and late-life individuals as givers and receivers are affected by typical life-cycle problems. The timing of transfers in human capital investments can

dramatically alter the course of an adult child's life (Kohli, 2004). Parents across all social classes are now providing more support to their adult children, but there are extraordinary inequities in what young adult children get from their parents across social classes (Settersten and Ray, 2010). Moreover, the "empty nest" today comes later and remains open or cluttered. These supports may bring financial, emotional, and other strains for parents at midlife and beyond. At the same time, it may be that the greater investments that parents now make in their young adult children may bring greater support when parents are old—if these children feel stronger filial obligations to reciprocate support to aged parents, or if aged parents have stronger expectations that it be provided (Angel and Settersten, 2011).

The influence of economic crises or changes in inheritance and gift-related policies on patterns of *inter vivos* ("between the living") transfers and bequests from elderly parents and adult children have not been adequately studied and deserve further investigation. The current recession has surely reduced gift giving as retirement accounts decreased and as adult children experienced job losses and foreclosures, weakening their ability to provide resources and care. Furthermore, research is needed to precisely delineate anticipated and actual monetary and nonmonetary *inter vivos* transfers to children, siblings, and elderly parents, and to monitor how these patterns are affected by the new diversity and ambiguity of family relationships.

### RETHINKING THE MEANINGS OF RETIREMENT

As a result of demographic trends discussed earlier, "retirement" has taken on new meanings. The days of a discrete transition from full-time work to full-time retirement are long past. There is great variability in the transition to retirement, both in terms of the age at which it occurs and the pace (Ekerdt, 2010; Hardy, 2011). The rapidly changing and economically vulnerable world has made retirement uncertain for many and even impossible for some. The decision to retire for most individuals is also not an individual decision but one that is tied to a spouse and the needs of other family members. This, too, makes retirement unpredictable.

The definitions of retirement today therefore demand new exploration. Why and under what conditions do—or can—Americans retire? Will retirement become the privilege of a select few? How people think about retirement—its possibilities and constraints—must be understood in the context of their prior work history and their anticipated future goals, including what retirees expect and need, how long their health will permit them to work, and the like. Many Americans do have resources for retirement, and they expect to enjoy the "second act" or "encore" phase of their lives because of good medical advice and attention to healthful aging practices (Hardy, 2011). The emphasis now put on retirement planning

early on in work careers should also lead to greater planning for later life (Ekerdt, 2010).

At the same time, fears about the viability of retirement are real for many people and raise vexing problems—especially for women, due to persistently high divorce rates (Wong and Hardy, 2009). Women who are today in their 50s and 60s, and younger, have come to know a world in which marital disruption is common. Unlike prior generations, these women cannot count on marriage as a source of economic security (Shuey and O’Rand, 2004). And yet their economic security is threatened, especially in the long term, when marriage and parenthood lead them to opt out of or reduce their labor force participation. If their marriages last less than 10 years, women also lose the ability to draw Social Security benefits through their spouses (Meyer and Herd, 2007). The complexity of contemporary women’s marital histories, in conjunction with their work histories, will affect their security in later life in ways that must be better understood for their sake and for the sake of society. Studies are needed to assess the effect of divorce and employment history on women’s risk of downward socioeconomic mobility.

Minority group status compounds the disadvantages faced by women (Montez, Angel, and Angel, 2009). African American women are less likely to have employment-based health coverage than non-Hispanic white women, but Mexican-origin women are far less likely than any other group to have retirement income from any source. This has important implications for the economic security of large groups of women in Baby Boom cohorts who will reach retirement age in the coming decade.

Gender aside, the serious challenges to retirement for older workers and retirees amid financial disruption are similarly illustrated in the lives of members of the ethnically diverse U.S. workforce, whose social statuses and work experiences also leave their retirement vulnerable. For example, Mexican-origin immigrants who are working in low-wage jobs in the informal economy or even outside of legal labor markets are uniquely at risk of economic exploitation (Massey and Squires, 2010). Foreign-born women of Mexican origin often find jobs in the service sector, such as elder care, that are subject to low pay, few benefits, and labor violations (Angel, 2007).

Research on the sociology of aging will aid in ascertaining the risks and uncertainties of retirement planning and decision making for the growing numbers of people in the labor force who are truly disadvantaged, as well as those in the middle class whose once stable lives have now been undermined or undone by the current recession. While the “Great Recession” has affected workers of all ages, older workers (aged 55+) have fared especially poorly (Van Horn, Corre, and Heidkamp, 2011). These conditions have made it more difficult for individuals to put aside money for retirement. The difficulties of projecting life expectancy after age 65 only magnify the

challenges of retirement planning (Hardy, 2011). The longer lives known today require new ways of approaching the “quotidian choices” of individual behavior. As we will discuss next, social policies, including retirement policies, must be revised to reflect the realities of life today.

### THE NEW AGE AND PUBLIC ECONOMIES

During the 20th century, the modern welfare state became synonymous with the assurance of a wide range of individual protections, the most basic of which are retirement security and access to preventive and curative health care. Internationally, the United States is often characterized as an outlier, given the absence of universal health care (Quesnel-Vallée, Farrah, and Jenkins, 2011). Although Medicare, Medicaid, and the new State Children’s Health Insurance Program (SCHIP) provide health-care coverage for poor children and the elderly, there are significant gaps in the health-care safety net, especially for those who are no longer children and not yet old. The Patient Protection and Affordable Care Act (also referred to as the Affordable Care Act or ACA) of 2010 made coverage less expensive for individuals, families, and self-employed businesses by expanding Medicaid coverage and subsidizing health-care premiums purchased through the Exchanges. Even so, it is likely that many women, racial minorities, and chronically ill adults will spend a substantial fraction of their limited incomes to cover health- and long-term care costs (Wiener, 2010).

Historically institutionalized gender role differences in labor force attachment have created a system that places some women at a disadvantage, as noted earlier. Current debates about entitlement reform must be informed by knowledge of the structural barriers to coverage for minority and older women, including risks related to marriage (Meyer and Herd, 2007). For many married women a “window of vulnerability in health coverage” opens up in late-mid-life when they may lose coverage as the result of their husbands’ retirement and enrollment in the Medicare program (Angel, Montez, and Angel, 2011). The new health reform legislation (ACA) will close this “window of vulnerability” by providing access to affordable coverage for at least some women.

Longer lives and bigger populations come with great costs. The United States faces major challenges in financing the retirement and health-care needs of older people alongside those of defense, infrastructure, education, and economic growth. Other countries with mature welfare states, aging populations, and costly welfare programs also share these challenges. The current period of serious globalized financial crises has led to attempts to decrease the state’s role in social insurance (Palier, 2010).

Policies and laws that regulate retirement plans are one example. Today, employers are shifting their retirement plans from defined benefit to

defined contribution plans (Hardy, 2011). This means that even among those minority workers who participate in an employer-sponsored plan, their accumulated savings may be insufficient to guarantee an adequate income in old age. Given inequalities in society, some groups of people are much better positioned in health and in wealth to manage a prolonged old age. Although Social Security has reduced the most serious poverty among the elderly, health and economic security require accumulated wealth and private retirement plans. There is also a highly unequal distribution of retirement income *among* Baby Boomers (Wright, 2012).

The shrinking younger population, coupled with later entry of young adults into the full-time workforce, comes at a time when the strain on pension and long-term care systems is approaching a crisis level (Wolf and Amirkhanyan, 2010). In most superpower economies, the welfare of younger workers is at stake because their work lives are more irregular and the security offered through their wages and benefits pales in comparison to what cohorts now in their later years knew. Japan provides a good case example. The country has the largest percentage of older adults aged 65 and over worldwide, and it is the only major industrial nation with higher labor force participation rates among older workers than the United States (Higo and Williamson, 2011). As a result, Japan has had a rapidly growing “contingent work force,” creating conflict between the young (workers under 35) and older workers. Employers relegate young workers to so-called irregular or temporary jobs without any job security or benefits to protect older workers, undermining innovation and the economy. Women are less likely than men to occupy full-time positions, explained in part by cultural reasons. In the end, the young generation of highly educated Japanese workers in low-paying jobs is at high risk of compromised career mobility.

Population aging in the United States brings serious and long-term financial consequences for how individuals and employers will fund Social Security and private retirement plans, including defined contribution plans like 401(k)s. As mentioned earlier, despite the increase in retirement age to 67, the majority of male American workers in older cohorts have retired and begun to collect Social Security benefits early in the 21st century. The current global financial crisis, however, is emblematic of new concerns regarding the concept of “risk” in decision making regarding assets for members of the middle class. As the size and stability of pensions fade away, the fate of retirement for people in the early and middle phases of their work lives must be ascertained. They will find it much more difficult to save for retirement than did their older peers.

As the so-called Silver Tsunami of retirements of Baby Boomers hits this decade, their numbers will heighten existing public and political concern about the adequacy of Social Security retirement income and the viability of the Social Security program. This situation is part of a more general

crisis for municipal and state governments, independent of the federal government, which made retirement fund commitments far exceed what they could ever have realistically funded (Estes, 2011). Furthermore, the issue of whether countries with well-developed pension systems can sustain themselves as their populations age has as yet to be fully appreciated (Lassila and Valkonen, 2008). As the elderly population continues to age, it will be important to learn how, and to what extent, governments in continental Europe and the United States are shifting the burden of old-age supports to individuals and their families.

Understanding how Social Security and retirement policies and programs, and changes in them, affect the ability and choices of older people to pass on wealth to the generations beneath them merits attention and further investigation. The Survey of Health, Ageing, and Retirement in Europe (SHARE) and the Health and Retirement Study (HRS) provide a unique opportunity to compare transfer behaviors across multiple generations in different western societies. Analyses of detailed information on key predictors of intergenerational support by adult children and older parents—including demographic factors, health, personal income and assets, and government transfers—can begin to address this question. At the macroeconomic level, it is important to contextualize how the welfare state (e.g., food programs, social insurance, cash assistance, family allowance, tax credits, etc.) operates to influence the propensity to save for retirement deserves attention. Harmonizing these surveys would provide insights into the pressing political question of whether more generous old-age welfare states are associated with lower personal savings.

### Projecting a Legacy of Social Protection

The undeniable facts of aging in the United States will impact the social contract between generations. A portrait of the workforce and retirement population will look much different than it did in the past and directly affects who will pay for the oncoming wave of Boomer retirees (Angel and Settersten, 2011). In 1945, there were 40 workers for every retired person receiving Social Security. However, as a result of increasing immigration from Latin America and Asia, the changing age structure, and the aging of Baby Boomers themselves, by 2030 each retiree will depend on the contributions of slightly more than two workers. The implications of the higher old-age dependency ratio are profound.

Because of high fertility and immigration, racial/ethnic minority groups constitute an even larger share of the economically active population. While the working-age population is becoming increasingly minority, the older retired population is predominantly non-Hispanic and white. This situation is particularly pronounced in states like Texas, where, by 2040, more than

half of the labor force will be Hispanic. A failure to address the importance of race/ethnicity will bring strife and only heighten the potential of serious age-based conflicts in the decades ahead, given that racial/ethnic minority populations are also younger (Morgan, 2003).

Projecting the unintended consequences of rationing and budgeting decisions is essential to making good social policy. Future generations will be taxed at higher rates to cover the cost of these programs at the same time that their own retirement income benefit levels will erode (Quadagno, Kail, and Shekha, 2011). A system in which minority workers are taxed largely to support nonminority seniors undermines its political legitimacy and survival.

Population aging brings serious questions about the sustainability of Social Security that deserve closer scrutiny (Lee, 2011). While the magnitude of the change in population size is inexact, population scientists must forecast how the solvency balance in the U.S. Social Security Trust Fund will be affected by the whole demographic trajectory, not just the old-age dependency ratio in a particular year (Lee and Mason, 2011a). The extent to which the future generation of workers will receive a fair rate of return on their lifetime contributions to the Social Security system must be examined. How will an increasingly diverse workforce put many aging Americans at risk? Under what conditions will there be public support for Social Security reform? The negative ramifications of the current recession on the lives of older Americans are not yet understood. These years have clearly jeopardized the well-being of many older adults, especially those in the middle class who, despite having Social Security and retirement savings, may not have enough to get by.

Researchers must also investigate and understand how the old-age welfare state affects the generational dynamics in different national contexts, especially with respect to what constitutes a minimum level of human security and what responsibilities should be shouldered by those who receive it (Lee and Mason, 2011b). In a period of economic retrenchment—in which attacks on welfare programs are increasing, and in which the need to scale back (or to prevent the expansion of) income and health-care entitlements are unavoidable—young workers, among whom racial minorities are over-represented, face particular risks (Palier, 2010). The aging of Baby Boomer cohorts will also increase competition for funding among various recipient groups and the potential for conflict across cohorts. Because of limited government funding, the needs of impoverished women and children compete with those of the disabled and the elderly (Quadagno et al., 2011). Historically, federal expenditures for older people have been higher than for the young and, as a result, private investments in children are quite significant. One recent estimate is that family transfers account for more than

half (57 percent) of total expenditures on children (Issacs, 2009; Mason et al., 2006).

Although children constitute the majority of Medicaid enrollees, the majority of Medicaid funding is spent on care for the disabled and the elderly. Almost half of federal spending on long-term care comes from Medicaid (O'Brien, 2005). As the older population grows in size and average age, the need for home- and community-based long-term services, as well as nursing care, will increase, and a large share of these cohorts will spend-down to Medicaid eligibility (Wolf and Amirkhanyan, 2010). State and local governments will need to address the mix of services for the young and the old, how they are managed and delivered, and perhaps most importantly, the extent to which elder care demands may "crowd out" funding support for children owing to political and fiscal pressures.

As a result of recent health-care reform, the ACA has changed the system of health-care financing, but it is unclear how it will directly affect the cost of care for millions of Americans. As national health-care expenditures grow toward 20 percent of gross domestic product, efforts to control costs seem inevitable (Congressional Budget Office, 2012). Medicare enrollment growth is anticipated to be the major force driving public health-care spending in the future, and expenditures will be fueled largely by the new prescription drug benefit and the rapid growth of Baby Boomer cohorts as they move into and through retirement (Starr, 2011). Any changes in the new law will disproportionately affect the poor and low-income families, who are also more likely to belong to racial/ethnic minority groups. If Medicaid continues to pay less than other forms of insurance, providers may not participate unless they are forced to do so. Reducing the costs of Medicare Advantage plans could create additional disparities among low-income elderly (Berenson and Holahan, 2010). A huge issue is how much insurers should be able to vary premium rates depending on age (Starr, 2011).

Finally, because the new realities of population aging may play out differently in various cultural, economic, and policy contexts, comparative policy perspectives deserve special consideration (Kinsella and He, 2009). Arguably, one of the changing realities of global aging is that countries can no longer treat aging as a "local" (national) problem, but must recognize the increasing interdependence among nations. While any given country may choose to address economic and social challenges with a particular blend of policies, how those policies play out depends, at least in part, on how other countries configure their approaches. In the end, this may encourage more uniformity across countries or reinforce the existing divisions between high- and low-income countries. One of the most poignant examples is the Mexico-U.S. contrast. These societies are contending with multiple demands for public use of scarce resources, and they have overlapping, interdependent populations and family networks that transcend

their border. A serious global aging agenda will demand that the economic and social welfare institutions of countries interact, and that the roles of women, ethnic minorities, and new immigrants be redefined, to better ensure the social protection of vulnerable populations.

### FINAL THOUGHTS: WHY SOCIOLOGY IS CRUCIAL TO THE STUDY OF HUMAN AGING

We have addressed some of the new realities of aging as they are shaped by contemporary social and economic contexts. We summarized some of the most pressing causes and consequences of change and identified some of the most pressing issues that must be addressed in future scholarship and social policy. Given the emphases of the volume, we close by identifying some of the potential theoretical and practical contributions that make sociology central to the science of human aging.

As this chapter and our *Handbook of Sociology of Aging* (Settersten and Angel, 2011) have illustrated, sociology is particularly important in revealing important social structural factors associated with individual and population aging. Aging is a phenomenon that is heavily conditioned by social institutions, historical events, policies, the economy, cohort momentum, social interaction, and intergenerational dynamics. Social change is central to the sociologist's lens to deal with the inevitable fact that social institutions and practices do not remain static, which forces us to challenge taken-for-granted assumptions that are based on outdated theoretical models. An understanding of macro processes, too often ignored in the study of aging, must be incorporated in new models of individual and population well-being in later life. A strong focus on the individual factors associated with aging carries the risk of losing sight of how social structures both affect and are affected by aging. As sociologists we have an obligation to keep social forces and factors front and center in our inquiry.

While calling for greater attention to structural and macro forces, we reiterate the importance of individual biography and the influence of past life history on aging at the individual level. Individual life course studies have yielded many new insights into the process of aging. Among these is the recognition that aging is a lifelong process and old age cannot be understood without accounting for the many decades of life that came before. Aging is a process that is intimately intertwined with other people, institutions, and structures. It is ironic, then, that researchers often analyze aging as if it is somehow a purely individual experience. Individuals may be asked to report on the people close to them, or inventories may be taken of life events and transitions that necessarily involve other people (e.g., marriages, births, deaths). But seldom do we study the friction of human lives in action, as intimates attempt to mesh their lives together and as decisions

and goals are co-constructed through iterative and often difficult processes of negotiation. Most, if not all, of life's most important markers are built on those social interactions.

In contemplating the significance of linked lives, it is important to probe how the quantity and quality of social ties change as individuals move through different periods of life, as they enter or exit from social settings, and how they are affected by social policies. At a micro level, the linked or interdependent nature of lives creates unexpected changes and circumstances. Interdependence may constrain or foreclose opportunities, or drain individuals of important resources—just as they may open opportunities or provide important resources. Linked lives must also be understood at a higher level of analysis—across generations in a society, or across nations in the world. Sociological research on aging routinely demonstrates the high degree of variability in the social order and lives of older people, consciousness about which has also been promoted by popular theories of cumulative advantage and disadvantage. Despite this work, the field is in much need of a comprehensive treatment of variability and investigations of its *social* sources and *social* consequences. New and existing institutional contexts will influence the ways in which economic, political, and social organizations address the problems and opportunities associated with aging and the character of variability. The great focus on variability also causes us to lose sight of shared experiences of aging that are equally important to understand.

The need to keep the social in focus is heightened by reductionist tendencies in science and the contemporary focus on genomes and genetics (Angel and Settersten, 2011; Settersten, 2009). When traveling further out into social spaces and attempting to take them into account, empirical work becomes more difficult. The tendency in scientific disciplines such as psychology, economics, and biology is to dismiss external social forces as far too unwieldy to measure or as being already represented in lower-order measures. As sociologists, this means that we must make them discernable, which will also require advances in our measurement and methods (Hauser and Weir, 2010). It is our responsibility to lead the way and trace these connections across levels of analysis (see also Shanahan, this volume). The family is an especially important context on which to focus. As the National Institute on Aging (2011, p. 7) itself has recently noted, “research examining how the family serves as a context for the expression of genetic influences on health and psychological wellbeing of relevance to aging is necessary for a more complete picture of aging processes.”

A sociological perspective fills in the “black box of the actor” (Mayer, 2003) as well as the “black box of structure” (Settersten, 2009). That is, sociology can help unearth individuals' awareness of the social constraints and incentives that affect their actions, but importantly, it demands more

precise accounts of social settings *beyond* the family and interpersonal relationships that shape and set parameters on human aging (see also Diewald and Mayer, 2009). Models of individual cognitive, volitional, or emotional states will have limited explanatory power if they do not sufficiently account for how larger social settings regulate aging-related tasks and opportunities.

Aging is one of the most intricate scientific puzzles, posing many significant challenges for individuals, families, and societies. Sociological research is crucial to unlocking that puzzle and understanding the properties of social institutions, social organization, and social interaction in an aging world. As sociologists, we must remember that there are people behind the numbers, and we have an obligation to understand them both as whole people and in relation to the multiple social contexts in which they live. In the face of increasingly specialized and fine-grained empirical work, we should place more value on the tasks of integration, synthesis, reflection, and theoretical development. These points speak to the need to develop a science of greater meaning, for the people and phenomena we study are rich and complex.

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7

## Research Opportunities in the Demography of Aging

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### INTRODUCTION

Population aging has provoked a combination of acceptance and alarm as policy makers search for a reasonable set of programmatic adjustments that will address both constrained national budgets and the limited means of individuals and families to manage the risks of old age on their own. In the 1960s, the major demographic concern was overpopulation and the need to reduce fertility rates (Ehrlich, 1968). Initiatives to encourage zero population growth and replacement rate fertility coincided with the development of family planning programs, improved options for birth control, and the milestones of the women's rights movement. The longer-term consequences of fewer births were magnified by unanticipated reductions in mortality at older ages, and as fertility rates continued to fall and life expectancy to increase, populations grew older. The dilemma facing developed countries with relatively high proportions of older people will not be an easy one to resolve: How can the world's largest economies continue to offer their citizens a high quality of life when projections suggest many will experience a shrinking labor force, sluggish rates of economic growth, and a national budget increasingly encumbered by health-care and wage replacement commitments made to a segment of the population that continues to grow larger and live longer?

In the developing world, the challenge of accommodating a rapidly increasing proportion of older people occurs within very different national contexts and can be complicated by a combination of high levels of poverty,

weak infrastructure, corruption, hunger, infectious diseases, poor sanitation, limited job opportunities, or illiteracy.

The demography of aging is generally associated with a set of population statistics that emphasize the compositional changes associated with the first demographic transition, a theoretical model proposed to account for the observed declines in both birth and death rates as countries shift from agricultural to industrial economies (Davis, 1945; Thompson, 1929). The squaring of the age pyramid, increasing life expectancy, rising ratios of the older to the working-age population, and declines in total fertility rates have become common statistical referents in the media. These demographic developments coincided with changes in the gendered life course and gender roles, an expanding base of scientific knowledge, and a growing government obligation in promoting public welfare. How these processes are connected in terms of cause and effect remains a point of debate. What seems clear, however, is that fundamental demographic processes, such as birth and death; biological processes, such as maturation and senescence; social processes, such as family formation and the division of labor; and economic processes, such as employment and investment, are all intertwined. Change that occurs in any one process can ripple through other domains in both expected and unexpected ways. The ambiguity in interpreting these standard aging measures significantly undermines their utility for social policy and program development.

The macro-patterns of fertility or mortality rates result from the aggregation of births and deaths within a specific time interval. Each birth and death marks an individual transition preceded by a sequence of earlier behaviors, exposures, and social interactions. The macro-level characteristics that predict lower or higher rates for national populations are unlikely to explain the individual or subgroup behaviors that result in more or fewer children or in younger or older ages of death. Addressing within- and between-population heterogeneity in behaviors, states, and traits while attending to the broader framework of compositional differences and changing societal processes defines a research program that connects formal and social demography to the dynamics of aging and social change.

The contributions of demography within this broad research agenda can occur at multiple levels. Formal demography can provide projections based on population processes that assist planners in designing and funding policies that smooth the transitions. Social demography can provide a better understanding of the underlying behavioral patterns and micro-processes that translate into these macro-patterns. Perhaps the greatest contribution will be for demographers to begin to identify the translational mechanisms that connect the macro to the micro to trace the interrelated processes that operate at the individual, group, and societal levels.

### A GLOBAL PERSPECTIVE

Recently, the global nature of population aging has come into sharper focus. As populations grow older, demographers are expanding their research into the processes and consequences of aging. The types of societal changes that coincided with—some say fueled—the decline in total fertility rates were not occurring in the developing world. Therefore, population growth continued unevenly through the higher fertility in the developing world, but also through the lowered later life mortality rates in developed countries. National populations became distinguished by geometric shape—pyramids versus rectangles. Compared to most other developed countries, the United States is in a more favorable position. For example, although the total fertility rates in places such as Canada, China, Europe, Japan, Russia, and the United Kingdom have fallen below replacement rates, the U.S. fertility rate continues to hover close to 2. The list of the 25 oldest countries (measured by the proportion of people aged 65-plus) is topped by Germany, Greece, Italy, Japan, and Sweden; the United States does not make the list. Additional demographic features that distinguish the United States from many other developed countries include a high level of immigration (which led to increases in the number of working-aged adults as well as the total fertility rate); continuing growth in the overall population as well as in the working-aged population (a trend that is expected to continue past mid-century); relatively high rates of labor force participation for those 65 and older; and a rising average age of retirement (although a relatively recent reversal of the post-war decline in retirement age).

In many developing countries, public health campaigns, which were often targeted at stemming the AIDS epidemic, discouraged unprotected sex and encouraged the empowerment of women. Imported medical technology, vaccines, antibiotics, and the like increased the odds of surviving to adulthood as fertility rates began to decline in some developing countries. At the same time, the gains in life expectancy at birth have been unequally distributed across richer and poorer regions (see Figure 7-1). As can be seen, from Figure 7-1, the changes that occurred in mortality rates followed a very different tempo across countries. The approximate doubling of life expectancies at birth that occurred over approximately 150 years in many European countries took roughly half that time in countries such as Vietnam or Guatemala. The speed of change has given them less time to adjust their fertility to a preferred number of surviving offspring, to prepare for the impact of rapid population growth, or to prepare for the relatively rapid increase in population aging taking place in these countries. One consequence of these trends is that the proportion of young children in the global population will be surpassed by the proportion of people aged 65 and older within the next decade. These population dynamics have resulted

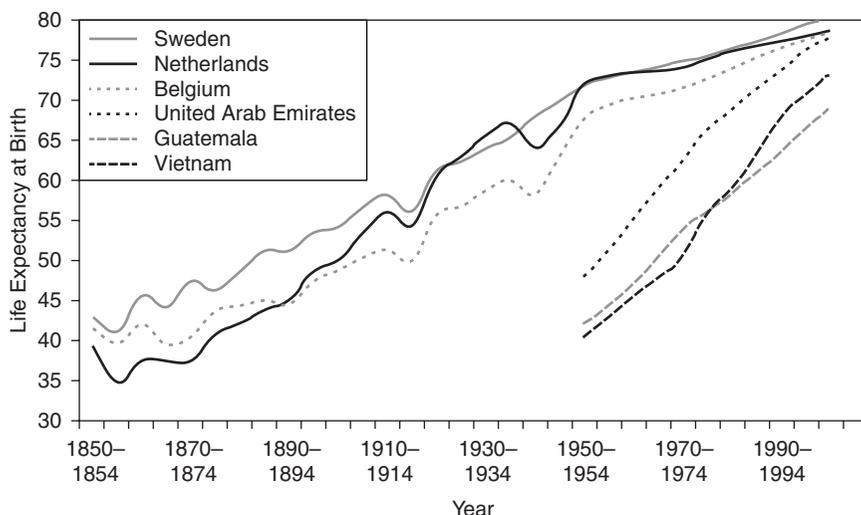


FIGURE 7-1 Gains in life expectancy for selective countries.

SOURCE: Authors' calculations based on Human Mortality Database. See <http://www.mortality.org> [September 12, 2012].

in a faster rate of aging among many developing countries than was experienced by countries now counted among the oldest.

Because of various international programs, the social dynamics of aging in developing countries are influenced by the interventions of other nations. As in the developed countries, the prevalence of chronic disease in the developing world is rising. At the same time, however, developing countries must also deal with the relatively high incidence of infectious diseases, inadequate access to drinking water, poor sanitation, a shortage of health professionals and medicines, rudimentary shelters, and rising population density. The developing world is also experiencing rapid urbanization without the infrastructure necessary to deal with the growing population, in general, and the growing urban population, in particular.

China and India have the largest numbers of people aged 65 and older, and although France, Germany, Italy, Japan, and the United States are among the top 10 countries with the largest older populations, Bangladesh, Brazil, Mexico, Nigeria, Pakistan, Thailand, and Vietnam are also in the top 25 (U.S. Census Bureau, International Data Base<sup>1</sup>). The median age in Brazil is expected to increase from the current 29 to 41 by 2040, in South Africa from 24 to 32, and in Pakistan from 21 to 32. The time frame necessary for significant growth in the proportion of people aged 65 and older is

<sup>1</sup>See <http://www.census.gov/population/international/data/idb/informationGateway.php> [July 27, 2012].

also more compact in developing countries. For example, those aged 65 and older were 7 percent of the U.S. population in 1944 and will be 14 percent by 2032. Brazil has just reached the 7 percent mark but will have 14 percent by 2032, a doubling within 21 years compared to 69 in the United States (U.S. Census Bureau, International Data Base). That the rate of change in population aging is much more rapid for developing countries than countries that have already completed the first demographic transition may not be surprising because the proportions of elderly in developing countries is now relatively small. Much of Sub-Saharan Africa, for example, will continue to have single-digit proportions of people aged 65 and older decades into the future; however by 2040, 76 percent of the world's 65 and older population will live in developing countries (Kinsella, 2000). Although the proportions of older people in the population will be higher in developed countries, their absolute numbers will be swamped by the elderly living in the developing world.

The scope of research into the demography of aging has expanded not only because populations in both developed and developing countries are getting older, but also because population aging is not occurring in isolation. Changes in family structure and living arrangements, in the accumulation and transmission of capital (human, social, and financial), and in work and retirement are changing the organization of the life course. In addition, trends in the basic population processes of fertility, mortality, and migration are transforming populations at different rates within different social, political, and economic contexts. Although statistics show evidence that population aging is a global phenomenon, the underlying processes behind increased survival and longer lives, the quality of life, the sources of social support, and the integration versus marginalization of older people are likely to vary considerably across time and place.

The conceptual framework of the first demographic transition aptly describes the trajectories of a subset of countries that are advanced industrial democracies. Those countries led the world in developing greater economic capacity, extensive systems of education, publicly funded research programs, rapid and reliable systems of communication and information technology, and improved standards of living, which has included much improved odds of survival to old age and longer lives. Should it be assumed that developing countries will evolve in similar fashion? To what extent are patterns of aging and adult development conditioned on the level of societal development?

These are some of the questions the "new" demography of aging will try to answer. But in formulating answers, demography will need to work at disciplinary intersections with the social, computational, and life sciences. The micro-processes behind the behaviors of social actors who interact in and with physical, social, and temporal contexts somehow translate into the

macro-processes that operate at a different scale and pattern of complexity. In recent decades, demographers operating at both the societal and individual levels have begun to look for mechanisms that connect the two. These attempts rely on broadly interdisciplinary research designs that embrace the heterogeneity of the aging process. Building a better understanding of how biological and social processes interact within complex systems presents a challenge to the conventional boundaries that have defined disciplines. But it is in the rethinking of conventional approaches that space for innovation is created.

In this chapter, we describe what we consider to be three promising areas of research in the demography of aging: biodemography, the changing life course, and simulations and projections. Each one can generate many research questions at different levels of social organization, and each one requires a different set of collaborations. We rely on some common themes in discussing these areas. We emphasize the importance of studying cohorts and generations to better understand the underlying social processes. Both approaches classify people relative to historical time and provide some comparability in exposure to trends or events, but they differ significantly in the level and type of connectivity. Cohorts link people largely unknown to each other whose experiences of aging are similarly framed by history and cultural context. Generations link people through a common lineage and shared social and physical environments, although family members of the same generation often are born in different years. We stress the power of quantitative analysis techniques, large national samples, and innovative measurement. We believe in the importance of comparative research and the need to study aging at different levels of economic development and in different cultural contexts, which may require initial qualitative investigations to better understand these contexts. The emphasis on the comparative study of people born at different times, in different places, and in different social circumstances underscores the need for creative measurement and data collection strategies that allow such comparisons.

### COHORTS, GENERATIONS, AND THE LIFE COURSE

Three temporal concepts play a central role in demographic research by providing different ways to organize interrelated behaviors and linked lives. At the population level, fertility and mortality combine to define a metabolic process through which populations expand, contract, and age. People born in the same time and place enter the population at once and create sequential developmental pathways into adulthood, while at the same time, people born at earlier times are moving into senescence and death. Research on the connection between the regular replacement of “older” cohorts by “newer” cohorts and social change contributed to the

development of the life course perspective, which links life experiences to broader societal features. Mannheim (1952) wrote of generations; Ryder's essay (1965) shifted the focus to birth cohorts; Cain (1964) and then Elder (1975) demonstrated how cohort similarities in the timing of major life transitions were shaped by social structure. All three concepts—generation, cohort, and life course—are useful for understanding the social production and transformation of populations.

Cohorts introduce the temporal connection between life stage and historical time under the argument that external events will impact people in different ways depending on their developmental stage (the timing of exposure). Compositional differences in cohorts can be created by internal or external processes: Whereas changing fertility rates can produce larger or smaller cohorts as a reflection of shifts in reproductive choices, a health event that significantly reduced the likelihood of reproduction would also result in smaller cohorts despite individual preferences. The process of cohort formation and replacement is continuous, although characteristics across cohorts can display discontinuities. Even so, compositional differences among cohorts that signal a trend toward or away from a behavioral pattern will seldom occur in only one birth year. More often, cohort-specific proportions will illustrate rates of change over some time span. Examination of individual choices in cohort-specific samples may characterize leaders (for example, women who used birth control pills as soon as they were available) or laggards in the process under study.

Whereas birth cohorts organize regional populations relative to historical exposure, generations perform a similar function in families. Alterations in the generational structure of families reflect the transformation of society's age structure and typical family size. For example, with increasing longevity and fewer children per household, a "longer" multigenerational family structure replaces a "wider" generational structure. On the other hand, as family dissolution and reformation patterns become more complex, so does generational structure, with several sets of grandparents and step-grandparents, parents and step-parents, and the like. The span of a cohort is determined by some accounting convention—one-year birth cohorts, five-year birth cohorts—whereas the temporal span of a generation is modified by delays in the age at first birth. As age of the first child is delayed, generations become longer (Goldstein, Lutz, and Scherbov, 2003). Later-born cohorts inherit the institutional arrangements put in place by earlier cohorts—periods of stability or volatility, opportunities and constraints, levels of resources, degrees of distributional inequality, possibilities and capabilities (Sen, 2007). In an analogous way, parents and grandparents endow their offspring with genetic, human, social, and financial capital; intergenerational transfers can provide resilience in difficult times; and economic inequality can be reproduced through the intergenerational

transmission of wealth and resources. Finally, the life course describes the typical nature, timing, and sequencing of transitions from one status to another (e.g., single to married), from a period of dependence to independence (moving from parental to one's own household), and from one stage to another (schooling to employment) (Billari and Liefbroer, 2007; Hogan and Astone, 1986). The life course experienced by the parent generation often varies from that of both their parents and their children, and siblings may differ in their attempts to reproduce or deviate from family patterns. Newer cohorts may change the nature, the timing, and the sequencing of life transitions. Further, cohort differences can be apparent in “typical” timings and sequences as well as in the shape of distributions in which the “typical” is embedded.

### PROMISING AREAS

The three promising areas for the new demography of aging we discuss below include (1) biodemography and the study of micro-processes that attempt to link cells and physiological systems (through genetics, biology and biochemistry) to cohorts and populations using the individual (and individual behaviors, dispositions, and attitudes) as the nexus; (2) the demography of the family, systems of stratification and inequality, and gender, which includes the study of social change in the life course and explores the intersections of changing behavioral patterns and variability in individual trajectories within changing environments and disparate circumstances using the cohorts and generations as the organizing concepts; and (3) the development of new approaches to projections and simulations that attempt to translate the changing composition of successive cohorts and the changing micro-processes that transform successive cohorts into macro-level features and population characteristics.

#### Starting Small:

##### **Biodemography, Chronological Age, Health, and Disability**

Understanding the aging process requires learning more about health and mortality and the connection between the two. Although it is tempting to assume that a population queue can somehow form—especially of those in old age—from good to poorest health and expect that those in the poorest health will be first to die, the association between health and mortality is not that simple. Further, how increased longevity has changed the overall health distribution of the older population remains a point of debate. In living longer lives, population health trajectories can be reorganized in a number of possible ways (Crimmins et al., 2009; Zeng and Crimmins, 2006). People can enjoy more years of good health and a delayed onset of

illness or disability; can experience the same *number* of years of good health and a longer period of illness and disability; can spend the same *proportion* of their life span in good health, which thereafter declines until death; or can alternate between intermittent spells of health, illness, and recovery, with peaks and valleys becoming more or less pronounced over time. Researchers have demonstrated that as life expectancy has increased, the fatal impact of a number of diseases has been reduced. Have these changes made the population healthier or less healthy? How and why do health trajectories differ across time and space, among people with the same diagnosed conditions, between men and women or among people of different races? Although good health is being reported at older ages, recovery from health setbacks is occurring at older ages, and more people are surviving to old age and living longer lifetimes, a clear explanation of the mechanisms that have produced these successes remains elusive. One goal is to construct profiles of health risks, illness trajectories, the combinations of conditions that are amendable to intervention, and the types of interventions with the greatest probability of success. Achieving that goal requires finding a balance between the individual-level details and definable risk groups. This task will be difficult to accomplish without knowledge of the contingencies of social and biochemical responses, genetic and environmental factors, and gene-environment interactions—a task that cannot be reasonably tackled by any single discipline, but one that does require a methodological approach that translates conclusions into a broader population profile.

When comparing the demographic profiles of nations, measures such as median age, percentage of the population aged 65 (or 85) and older, and average life expectancy are reported. Chronological age seems a straightforward measure to calculate. But for countries without systematic registries of births and deaths, measuring even age can be a challenge. In making geographic or temporal comparisons or in establishing trends or regional differences, estimates can be generated to document how populations have aged over time or how different regions of the world are aging at different rates. However, expected increases in the number or proportion of people in older age groups provide an incomplete and potentially misleading picture, because the societal implications of population aging are often framed relative to functionality, health-care needs, medical expenses, disability, retirement income, and the like. In creating rules of eligibility for social programs, societies have relied on age as a quick and easily implemented criterion, but chronological age masks considerable population heterogeneity in capabilities. The standard indicators of population aging mean little if the content of those chronologically based measures, the health and functional status associated with any given age range, changes over time and place.

The need for standardization in other measures is recognized when making comparisons across time and place. For example, in reporting

the number of U.S. households with income less than \$20,000 per year by decade, there is quick recognition of the need to adjust for inflation (to compare “real” versus “nominal” dollars); for different tax rates and social welfare benefits (because states or years with higher tax rates would yield lower after-tax income, while more generous in-kind benefits or subsidies would improve living standards, although these effects would likely influence different portions of the income distribution in different ways); perhaps for differences in purchasing power (the cost of living is higher in California than Arkansas); or even household (or family) size (to adjust for how many adults and children the income must support). But speaking of population aging generally makes no comparable adjustments. Are median chronological age and the proportion of people aged 65 and older the best measures for the questions asked?

As life expectancy increased, researchers began to focus not only on the number of years, but also on the quality of life in the latter stages of the life span. Increased longevity could imply a prolonged period of decline, or the longer time span could be accompanied by a delay in the onset of health limitations. Policy makers’ concerns about population aging were grounded in the historical connection between age, labor force withdrawal, and the onset of disability. But, if people were living longer lives, perhaps they were also living more years in good health, with the onset of disabling conditions being pushed to older and older ages. Assessing age structures within the context of health and independent living required some adjustment to measurement.

Various indicators with different sorts of data demands have been proposed for comparisons across nations as well as across subpopulations within nations. Many are based on making adjustments to overall life expectancy to produce health expectancy, where “health” is defined in different ways. This family of measures can adjust for the disablement process, chronic morbidity, functional limitations, difficulties performing activities of daily living (ADLs), physical dependency, and cognitive functioning (Molla, Wagerner, and Madans, 2001). Active life expectancy cordoned off years of functional ability, using activities of daily living to accomplish the segmentation (Katz et al., 1983; Laditka and Wolf, 1998). Disability-free life expectancy, disability-adjusted life expectancy, years of life lost to premature mortality, and years of life lived with disabling conditions offer summary measures of the “burden” of disability and mortality (Mathers, Lopez, and Murray, 2006; Murray and Lopez, 1997a,b). Another approach is to compare the ages associated with a specific survival time, thereby contextualizing chronological age relative to longevity (Lutz, Sanderson, and Scherbov, 2008).

Because policy entitlement is often defined by age, and demographic estimates (and projections) are used to prepare budgets and to forecast

program costs in the future, chronological age distributions matter. But if the goal is to estimate how demand for long-term care may change over the next 30 years, a measure that is more informative and better incorporates related processes, such as the development of disabling health conditions or the decline in cognitive functioning, is preferable. The measure should not only take into account likely changes in the compositional characteristics of the elderly over the next 30 years but also allow for judging the level of uncertainty associated with these predictions.

Differences in life expectancy are one aspect of within-country inequality that also change across time. Race and ethnicity, education, and income are among the factors that structure mortality rates. For example, during the latter part of the 20th century, education-related gaps in mortality rates grew substantially, particularly in the last decade (Cutler et al., 2010). Relative access to medical technology, vulnerability to infectious diseases, and public health investments in preventative care also can create longevity gaps within as well as between countries. Therefore, variation in life expectancy within national populations but across subgroups can be as important a feature as average longevity for nations as a whole.

### *Measuring Health*

Better conceptualizations of health must precede the development of better measurement of health. Self-reported health (an ordinal measure of perceived health status), disability status (reporting a health condition that prevents working, being entitled to disability benefits, or being unable to perform certain activities), health limitations (reporting a health condition that limits the kind or amount of work one can do), number of ADLs (self-reported limitation in ability to perform basic activities or an external assessment of whether someone needs help in performing these activities), chronic disease (reporting a disease diagnosis, entry on a medical record of a diagnosis, or experiencing symptoms associated with a disease), and comorbidity (reports of more than one chronic disease) are common measures. These measures better address the consequences of poor health—on any given day, a person may feel “fair” rather than “excellent,” can no longer do certain tasks, or have been diagnosed with certain illnesses or syndromes—rather than the underlying processes that create these health-related problems. They most often rely on thresholds (which vary), ordinal categories or counts (which produce limited variability), and respondent reports (which are subject to error and varying levels of sensitivity and frames of reference). Comparisons based on these measures often have an uncomfortable amount of ambiguity in interpretation. For example, what one person defines as “good” health may be deemed “excellent” health by another; how people make those distinctions may differ by cohort, by

culture, and by the information they have from various medical tests and family histories. A particular configuration of blood biomarkers that had been viewed as nonproblematic 20 years ago may now trigger a diagnosis of early-stage disease or high risk of developing that disease, the same disease may produce symptoms or influence overall health differently across people, and counts of chronic diseases mask variability in severity of disease. Further, the connection between pathology and how societies sort people relative to levels of disablement may also be changing (Freedman, 2008). How are the trajectories of disease pathology, disablement, and mental health interrelated, and what are the key inflection points that effective interventions might target?

In projecting the age and sex composition of future populations, the populations at risk and their mortality hazards are recognized as heterogeneous. The trends in age at death may vary across these subgroups. Projections that cannot incorporate information on both changing composition and different social processes across cohorts and across regions may create a false sense of stability or crisis. Cohort-specific health trajectories that incorporate multiple measures may allow a better sense of interrelated processes, such as the interplay between biological and behavioral processes that damage health or facilitate resilience, repair, or recovery and how these processes are influenced by differential exposure to positive or negative social or physical environments, advancements in medical treatment or adaptive technologies, or increases in social support and interaction.

Approaching health measurement with biological data has linked demography with biology, medicine, biochemistry, and genetics. Assaying levels of various hormones, markers of inflammation, the presence of specific alleles, and the like have linked the collection of biologically enhanced survey data to the routine blood work ordered by physicians for diagnostic purposes. Rather than analyzing them on a case-by-case basis, however, their use in national samples provides another method for assessing risk factors in the population. Connecting biomarker profiles to risks of death or illness or more complex health trajectories requires an understanding of the mechanisms that link the two, as well as a formulation of how other personal characteristics or exposures may moderate these relationships.

### *Heterogeneity of Risk*

Demographers have identified a number of factors predictive of health risk, such as gender, race, marital status, level of education, and socioeconomic status (SES). Associated with many of these factors are “puzzles” or “paradoxes.” For example, although men appear healthier and less prone to chronic disease, women survive longer, but the reasons why are not fully understood (Luy, 2009). Married people tend to be in better health, but this

marriage benefit is stronger for men than it is for women; although selection into marriage may be part of the story and the quality of the marriage also plays a role, the underlying mechanisms continue to be debated. If the benefit to women is economic, will an increase in gender parity in earnings reduce this effect? If the benefit to men is carried through women's caring activities, will parity in gender roles eliminate this gap? And as marriage rates decline, will health in old age decline as well? In the United States, African American men have the shortest life expectancy among various demographic groups, but can this longevity gap be attributed to lifestyle and SES, or is the story more complicated? Without a better understanding of mechanisms, these questions have no answers.

Studies of health have tended to focus on different life stages—infancy, childhood, adolescence, young adulthood, midlife, and old age. Studies of health in older age have emphasized conditions associated with the major causes of death or a need for long-term care, such as stroke, cardiovascular disease, dementia, or Alzheimer's. Some explanations for increased life expectancy point to advances in early childhood health for part of the story. Vaccinations against common childhood diseases and better treatment for infections may have reduced levels of inflammation at younger ages. Combined with improvements in nutrition, these factors may have been important in reducing health risks at older ages (Crimmins and Finch, 2006). However, because mortality and late-life health research is necessarily cohort-specific, and the cohorts studied were born and came of age as medical technology was being transformed, the variability and correlates of exposures, medical treatments, and prophylaxis also may have been reconfigured.

Certain risk factors can be reduced through healthy behaviors and lifestyle changes, although adopting and maintaining these changes has proven difficult. Both gender and education have been linked to health behaviors, with women and those with more education more likely to make healthy choices. While access to quality health care, nutritional foods, social support, and healthy behaviors may be reducing health risks across cohorts, the amount of stress that people routinely manage as more responsibilities fall into their laps may be working in the opposite direction. All of these observations point to possible connections between larger environments, cognitive styles, physiological reactions, coping techniques, and other types of resources on which people may draw. Understanding health trajectories will require identifying the complex connections among these dispersed but interrelated processes.

### The Changing Life Course: Family, Socioeconomic Status, and Inequality

The processes of fertility and mortality jointly create a population metabolism through cohort succession. Cohort differences in the life course have been a strong focus of demographic research, which has documented changes in educational attainment, delay in entry into full-time employment, the early and mid-20th-century decline and late-20th century increases in average retirement age, changes in family structure and family formation, and changes in home ownership, household income, debts, and assets. Pension wealth (the expected value of future benefits from defined benefit and defined contribution plans) has become a standard component of any financial profile and, as in other sources of income or wealth, provides a clear advantage for married couples versus singles, whites versus nonwhites, the more educated versus less educated, and men relative to women. Individuals and families are expected to absorb more of the risks of economic downturns, the need for expensive health care, and the financing of retirement, leading some to observe that the era of early retirement has passed. What these trends will mean for the process of aging is difficult to predict. Both family and education are regarded as core institutions by the social sciences. The family household is viewed as the basic unit of consumption, decision making, socialization, and social cohesion. Education serves as a primary element of SES, the key to upward mobility, entry into a favorable career, and the ability to master the technology necessary to navigate an increasingly complex environment. Both have been linked to improvements in health and the standard of living at the societal level and to better health and a higher standard of living at the individual and household levels. Exactly what roles do they play in shaping the underlying processes that drive health maintenance, survival, and longevity?

#### *Education*

Cohort and generational differences in educational attainment reflect the adoption of compulsory schooling and the elaboration of systems of public education. At the individual level, those with more schooling enjoy a competitive advantage in launching and sustaining stable and rewarding careers, higher levels of compensation and accumulated wealth, and longer and healthier lives. At the same time, more highly educated regions attract business and industry, and more highly educated countries boast higher levels of worker productivity, higher standards of living, and healthier populations along with lower total fertility rates, longer life expectancy, and a national infrastructure to promote social welfare.

Expanding educational opportunities was a primary goal of the 20th century and was seen as the pathway to a better and more fulfilling life. Persistent inequities by gender and race were often discounted on the basis of differences in education and experience, which were proposed as the “true” sources of the inequality. Gender and race differences in these qualifications provided a partial explanation for the disparities in the types of jobs and levels of compensation. The historical educational advantage of men relative to women, however, is disappearing. Among recent cohorts, the proportion of U.S. women with at least a high school education now exceeds that of men (Samir et al., 2010). Societal trends toward more highly educated populations and the expected growth in the proportion of educated women are expected to continue. Educating women in the developing world is a major initiative in slowing population growth, because more educated women not only desire fewer children but also are better able to realize their fertility aspirations by having fewer children than less educated women. Research on women in Africa also points to the importance of empowering women to make decisions about their own lives. The social and political environment that values education, improves women’s rights, promotes the importance of schooling for girls, and expands employment opportunities for women may also be the environment that encourages a reduction in family size and the utilization of contraception at the discretion of women rather than men.

Countries with more educated populations also boast more productive workers, and the higher rates of productivity have been attributed to the enhanced skills—both general and job-specific—learned by those with more schooling. Recent research has demonstrated that cognitive ability also predicts worker productivity better than any other observed personal characteristic (Neisser, 1997; Schmidt and Hunter, 2004; Spitz-Oener, 2006), a relationship that is found in both high- and low-income countries (Behrman, Ross, and Sabot, 2008; Tansel, 1994). In place of using life expectancy to adjust indicators of population aging (Lutz et al., 2008), the old age dependency ratio could also be adjusted for cognitive functioning (Skirbekk, Loichinger, and Weber, 2012). Countries with more educated populations also demonstrate higher levels of cognitive functioning among those aged 50 to 85, using immediate recall of 10 words as the cognitive measure. Comparing Figure 7-2 with Figure 7-3, the ordering of countries is similar. Northern and Central Europe and the United States have more than 90 percent of their populations completing lower secondary education or more, with rates above 70 percent even at older ages. Southern Europe, China, and Mexico show sharp educational differences between their older and younger cohorts, with the majority of younger cohorts completing lower secondary schooling, but completion rates less than 30 percent at older ages. Word recall is also highest in Northern and Central

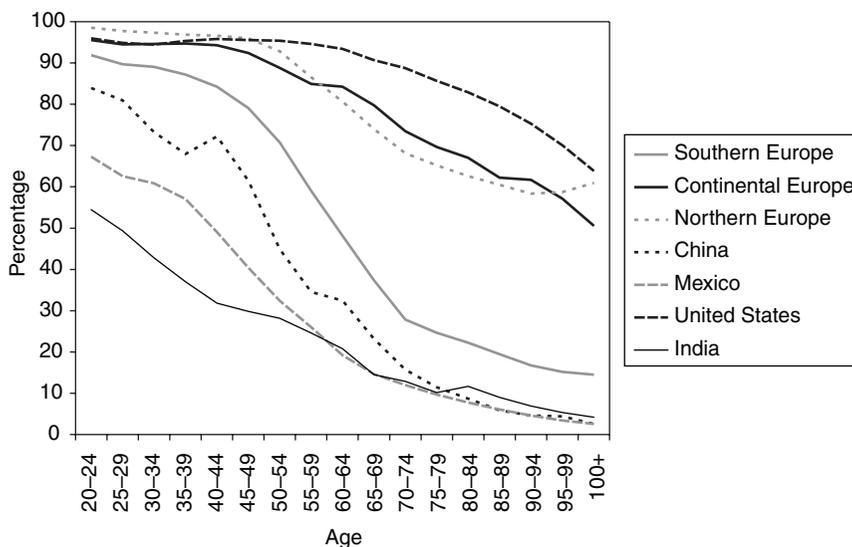


FIGURE 7-2 Population share with at least lower secondary education, 2005.  
SOURCE: K.C. et al. (2010).

Europe and the United States. For example, a 53-year-old respondent in Mexico functions at the same level as a 78-year-old in the United States, on average (Skirbekk, Loichinger, and Weber, 2012). Research has linked variation in cognition at older ages to a range of factors including education and literacy, nutrition, vaccinations, and physical and mental activity levels, which can provide at least part of the explanation for why seniors perform worse in some countries relative to others (Kagitcibasi and Biricik, 2011; Khaleefaa, Abdelwahidb, and Addulradic, 2008; te Nijenhuis et al., 2011). In addition, better cognitive performance has been attributed to occupational complexity, increased mental activity, and increased synaptic density resulting from increased mental stimulation. Cohort differences in cognitive ability at younger ages had been documented for those born in the first half of the 20th century (Flynn, 1987; Tuddenham, 1948). The process of cohort replacement will gradually supplant earlier-born cohorts with later-born, more highly functioning cohorts, and if the trend toward improved cognitive functioning continues, so will this replacement process.

Given the positive correlation between education, health, and longevity, substantial improvement in life expectancy and in cognitive and physical health might be expected as these better educated cohorts move into old age. Although education has clearly operated as a primary sorting mechanism in developed countries, the cause-and-effect connections between SES, genetic traits, cognitive performance, and later life outcomes remain

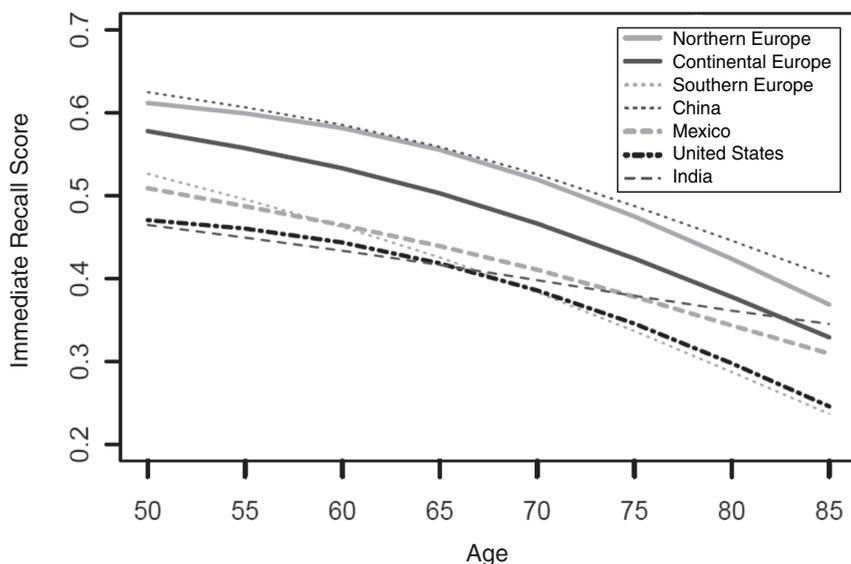


FIGURE 7-3 Mean age-group-specific immediate recall scores.

NOTES: Immediate recall score (values between 0 and 1, where, e.g., a score of 0.4 means being able to recall 40 percent of the given words). Curves are smoothed by using spline interpolations. Logistic regression is used to test for significant age-related decline, significance levels  $P < 0.001$ . Analysis of variance is used to test for differences between countries, significance levels  $P < 0.01$ .

SOURCE: Skirbekk et al. (2012). Reproduced with permission.

unclear. Sociologists have long recognized the interplay of status and early cognitive development in these dynamics, but the nature and persistence of that interplay remains a point of disagreement. Variants of the status attainment literature emphasize the importance of family background (and the transmission of advantage or disadvantage), quality of school, capabilities, habits, dispositions, social connections, orientation toward the future, and health in placing and sustaining people on certain pathways. Parents were responsible for successfully launching their children into adulthood, but the nature and timing of this function has also been changing. On the one hand, some researchers argue that the importance of school placement and social connections has been moved earlier and earlier in the child's life (a "winner take all society"). On the other hand, the age at which children shift to a status of independence from their parents seems to be getting older, as more adult children move back in with parents, rely on parental help with finances and childcare, and struggle to gain stability in their lives. This extended period of parenting (and grandparenting) fundamentally redefines

family dynamics, and it has been proposed as an explanation as to why the human lifespan extends so far beyond the end of reproduction (Lee, 2008).

Socioeconomic differences in educational attainment have been demonstrated repeatedly throughout the developed world (Shavit and Blossfield, 1993), and the likelihood of completing a given level of education and advancing to the next favors the more affluent. Status differences are observable not only in the level of performance but also in the types of choices made by people whose performance is the same (Boudon, 1974; Erikson et al., 2005; Marks, 2005). Why choices differ—whether or how status difference shape aspirations—moves the question to an earlier stage. If societies benefit most when those with the best performance and the highest aptitude fully develop their potential, then the inequality embedded in this process diminishes the social benefits of the outcome. Do societies want capable people to eschew higher education because such aspirations seem too lofty given their background?

### *Family*

Declining fertility rates and increased longevity have reshaped family structure for recent cohorts, but family dynamics have also changed, and the implications of these changes for how future cohorts will experience aging are unclear. Younger cohorts are marrying at later ages, often after a period of cohabitation, having children later in life, and relying more on reproductive technologies to conceive (Waite, 2005). The proportion of people ever having experienced a divorce has increased as people spend more years of their lives outside of marriage or in sequential marriages. Various dimensions of these patterns are being studied as definitions of family, marriage (or partnering), gender roles, and patterns of intergenerational exchange evolve.

These cohort differences have also produced family differences in intergenerational structure. The first demographic transition was characterized by increasing marriage rates, younger ages at first parenthood, and a decline in fertility outside of marriage (Lesthaeghe, 1977; Lesthaeghe and Neels, 2002). As a result, the generational structure of families—through consanguinity and affinity—was reinforced. Each sibling's or offspring's marriage expanded the familial network, and the average age at which daughters had a first child established an average length of a "social" generation. Family gatherings were occasions for intergenerational exchanges. In fact, families provided routine opportunities for intergenerational contacts that contrasted with the otherwise dominant pattern of age-homogeneous social networks. During recent decades, the length of a generation (the time gap between the birth of a woman and her first child) has grown wider and differences across nations have increased. Family variability in generational

structure has increased in other ways as well, with step-families, more births outside of marriage, and a wider distribution of age at first birth. Relationships between children and their parents will extend further into adulthood, with the progress in media technology allowing more frequent contact. Although the emphasis has been on the caregiving role played by adult children for their elderly parents, a key aspect of the informal care that complements the long-term care industry, the flow of assistance from parents to adult children, is more substantial (Swartz, 2009).

Women constitute a growing share of the U.S. labor force, because their labor force participation rates and the career aspirations of new cohorts of women have increased. Although women's employment and their contributions to household income have increased, the gendered household division of labor, including caring for young and elderly family members, encouraging spouses to engage in healthy behaviors, performing household chores, and managing the household have been slower to change, requiring more time from women than men. How are these family dynamics linked to the changes in family structure? Societies clearly have an interest in healthy, well-adjusted, well-educated children, stable families, reliable workers, and networks of care that allow older people to remain in their communities. At the same time, women's financial security has been increasingly linked to training for, building, and sustaining stable careers and reducing their dependence on their husbands. How will these increasing demands be reflected in women's physical and mental health trajectories and mortality rates? The health benefits of marriage, women's longer life expectancy, and the informal networks of family caregiving reflect the experiences of specific cohorts in specific regions of the world. The cohorts studied were fulfilling the expectations of a gendered life course—one that differed by race/ethnicity and one that has been revised in some dramatic ways. How will these revisions reshape the health advantages or disadvantages that have been linked to gender and marital status?

### *Interrelatedness of Family and Socioeconomic Status*

One trade-off between social welfare programs and a reliance on market mechanisms for building financial security occurs at the intersection of cohorts and generations. Public policy can create (as in the "windfall" benefits for early Social Security beneficiaries) or ameliorate (as in the wage indexing of earnings histories in 1977 to standardize earnings replacement rates) inequalities across cohorts and, through tax policy, facilitate or interfere with the intergenerational transmission of wealth. At the same time, as cohorts come of age, the decisions they make combine with the societal conditions they inherit to set the circumstances later-born cohorts will face and expand or limit the degrees of freedom with which they can operate.

Cohort variability exists both within and across cohorts, because populations are organized not only by age, but also by a range of other factors, some of which stratify while others simply diversify.

At the macro level, changing economic circumstances can give some cohorts a relative advantage compared to cohorts born in an earlier period. For example, the periods of young adulthood and midlife for the Baby Boom cohorts coincided with a period of strong economic growth, rising standards of living, increases in real wages, and relatively strong returns on investments. In addition, after the Vietnam War, compulsory military service was eliminated for men, and access to higher education increased for men and women. In contrast, their children and grandchildren are coming of age in a period of economic uncertainty, global competition, stagnated or falling wages for much of the labor force, and less articulation between educational credentials and job opportunities. These types of inequities across cohorts have been common. Some cohorts face famines, wars, epidemics, natural disasters, depressions/recessions and the like, while more fortunate cohorts experience surplus, peace, medical breakthroughs, discovery of natural resources, and growth. One rationale for federal programs is to ameliorate the effects of the downturns, at least at a national level, but accomplishing that goal requires redistribution. When the advantaged cohorts are working-aged and the disadvantaged cohorts are older, these inter-cohort transfers can be funded from wage growth; however, when working-aged cohorts feel disadvantaged relative to the receiving cohorts and wages are stagnant, intergenerational transfers are reevaluated. Familial inheritances, growing income, wealth inequality, and the importance of endowments for sorting people onto different trajectories have received growing attention as sources of cumulative advantage over the life course. To the extent that the transmission of advantage and opportunity follows familial (or generational) lines, equality of opportunity within cohorts is called into question.

### **The Big Picture: Forecasts, Projections, and Simulations**

An important role of demographic research is to provide policy makers with information about likely futures so they can anticipate the changes that may be required and (perhaps) opt for more gradual and less disruptive adjustments than would be necessary without advance notice. Absent this kind of data, policy makers remain reactive and at least one step behind where they need to be. This type of structural lag (Riley and Riley, 2010) may be unavoidable, because attitudes and behaviors often seem slow to change and demographic foresight does not necessarily translate into timely action.

In making projections, the focus of descriptive information tends to be on the axis variables of the standard lexis diagram—age and year—rather than birth cohort. Comparing the age structure from 2010 to that of 2020, for example, will illustrate differences in the relative sizes of the age “steps”; however, the figure is silent on how the compositional characteristics of that age group may differ, given that the birth cohorts occupying that step have changed. Furthermore, how the people in different age groups are related—through family ties or living in the same household—is beyond the kind of detail these sorts of projections can communicate. Even so, the ways in which cohorts change (and differ from earlier cohorts) in compositional characteristics are expressions of the nature, timing, and sequencing of key life transitions. Understanding the interrelated processes generative of those transitions provides leverage for forecasting these compositional transformations, projecting how future cohorts may transition at older ages given their earlier behavior, and simulating how the introduction of constraints or supports may change transitional behaviors and population outcomes.

For example, fixing the width of the youngest age group requires an estimate of the cumulative success of women—those who have decided they want a child, to conceive, and to give birth, as well as women who become pregnant without intending to—to carry the baby to term; also reflected in this calculation is the frequency of multiple births, both as a “natural” event and as the byproduct of fertility treatments. In addition, this sequence of events—the decision, the conception, the birth—are all subject to any number of contingencies affecting the biological process and the broader societal context. Which women—married or unmarried, in their 20s, 30s, or 40s, white or nonwhite, more or less educated, carrying genes associated with intelligence or addictive behavior—give birth has important implications for the future society.

In Figure 7-4, we depict the standard age pyramid with some added dimensions of complexity that derive from differential rates of fertility, mortality, migration, and transitions by SES. Using similar types of multi-state population forecasts allows us to see population-level consequences of cohort differences, aging, and historical trends. Age and period serve as proxies for the many different forces that cause people to change. Figure 7-4 describes the basic concept behind multistate population projections using a dichotomized set of attitudes, *A* and *B*, where the initial composition is given in the pyramid on the left. In the next period (on the right), differential migration, mortality, and age/sex-specific transitions between attitudes alters the relative and absolute size of *A* and *B* in the population. Fertility differentials and the degree of intergenerational transmission of attitudes determine the attitudinal composition of the youngest age group. In this example, differences in fertility and transmission that favor those

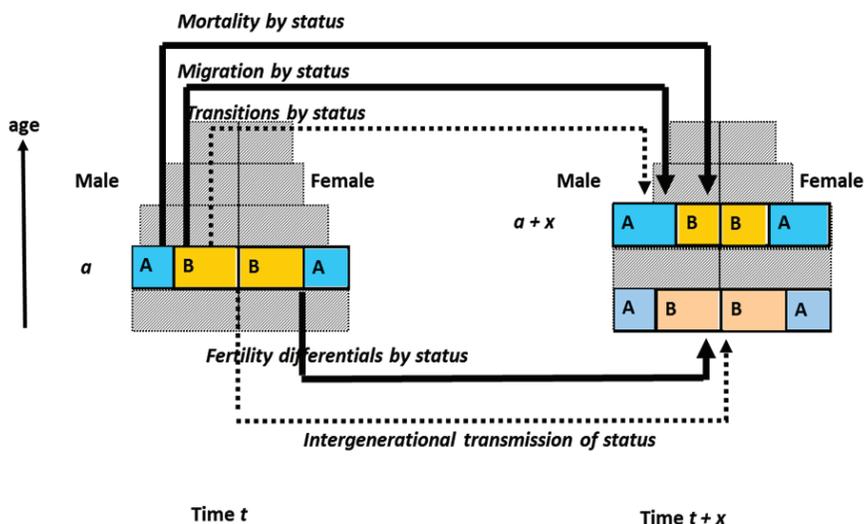


FIGURE 7-4 Multistate cohort component model, stylized diagram.

holding attitude A result in a higher rate of growth for group A and a subsequent realignment of the population relative to that attitude.

The typical strategy used to make demographic forecasts has been to invoke a series of assumptions about the likely rates of future behaviors and apply them to the current population. Because any set of assumptions can be challenged, different combinations of possible rates are packaged as high, medium, and low scenarios. The outcome is little more than an extrapolation of past patterns using current population distributions and assumptions about vital rates. Recent advances in demographic techniques have introduced greater range and flexibility in the types of forecasts, projections, and simulations that can be generated with greater emphasis on theoretical and empirical insights and a better understanding of how processes are interrelated. For instance, the four major scenario groups developed by the International Panel on Climate Change are focused on storylines rather than the continuation of current trends (Giroda et al., 2009; Rounsevell and Metzger, 2010).

These developments point to three directions that hold much promise for improving the information available to policy makers and for testing various theories about the interrelated ways in which processes at various levels of aggregation operate. Extensions of the cohort component model, the linkage of projections to their level of uncertainty, and the creative use of data-based and agent-based micro-simulation models can transform the

demographic approach by directly incorporating the strengths of both the social and computer sciences.

### *Cohort Component Approaches*

Demographic rates vary by age, and these different rates may interact with population structure in determining the dimensions of future populations. Cohort component projection models apply age-specific rates to different birth cohorts, thereby producing an expected size, sex, and age structure for future populations. When an historic event significantly changes age-specific fertility and/or mortality rates for a segment of the population, projections should take the effects of this event into account (Schoen, 2006). Multistate extensions of the cohort component approach (Heuveline and Timberlake, 2003; Lutz and Goujon, 2001; Rogers, 1986; Schoen and Canudas-Romo, 2006) allow this elaboration by further classifying the population relative to exposure to that event. In theory, the multistate life table approach allows the joint classification of a population across any number of useful dimensions. Not only age and sex, but also race, marital status, living arrangements, region, level of education, employment status, income, beliefs, and ideological views would provide useful detail to projections. However, as the cells multiply, so do the data demands and the difficulty in generating reliable estimates of group-specific distributions and transition rates, although work on mitigating this issue continues (e.g., Lynch and Brown, 2005). A more intractable complication stems from the processes that continue to unfold. Defining racial/ethnic groups has become a much more difficult enterprise given the growth in multiracial identities and the partnering of men and women from different racial/ethnic groups. In addition, characteristics such as marital status and employment are not fixed at birth and do not change on a predictable schedule. Taking these demographic factors into account requires not only the ability to estimate mortality rates, for example, for different marital states, but also to compute transition probabilities across marital states (e.g., from unmarried to married, married to divorced). Theoretical work must accompany these technical extensions, because the way factors such as marital status or living arrangements are introduced into calculations depends on how, why, and under what conditions they are believed to matter.

An additional quandary in expanding projections to joint classification by living arrangements stems from the convention of assigning households to one sex. Progress has been made on this front, as well (see, e.g., Keilman, 2003; Schoen, Landale, and Daniels, 2007; Wilson and Rees, 2005). The extended cohort-component model represents one strategy for including family structure and living arrangements in projections. Using groups of individuals as the unit of analysis, invoking assumptions of stochastic

independence and limiting when some transitions can occur, using the harmonic mean to ensure consistency, and using a model standard schedule with a few “tuning” parameters provide one framework for introducing more complexity (Zeng and Crimmins, 2006).

### *Forecasting Uncertainty*

Recent research that explicitly addresses uncertainty in projections adds a new dimension to this field. Standard approaches to projections incorporated uncertainty in the underlying assumptions by providing different scenarios that tended to bracket the favored prediction; however, unlike the bracketing of a confidence interval, these alternative scenarios were not associated with probability distributions. In addition, the details of the underlying assumptions were too often unsystematic and poorly documented (Booth, 2006). Weaknesses of this approach have been well documented (Lee and Tuljapurkar, 1994; National Research Council, 2000).

Probabilistic projections account for uncertainty in a less ambiguous way. Two approaches that are being pursued rely either on expert opinion or on the statistical analysis of historical time series data. The former combines subjective probability distributions for predictions from a field of experts to produce a set of “likely” values for vital rates (Lutz et al., 1998). These expert predictions are presumably informed by past structural changes as well as expected future developments, with experts acting as a kind of filtering mechanism for many and disparate sources of information. In contrast, the time series analysis approach relies on the statistical properties of the estimators to generate probability distributions for population size or vital rates (Lee, 1998). One can also model the error structure comparing similarly generated projections for an earlier time period with observed rates. Assigning probabilities to a range of possible outcomes provides policy makers not only with possible futures but also with the likelihoods of the alternatives.

Any student of statistical inference understands the value of linking parameter estimates with error estimates. Making these calculations relies on how the sample was generated as well as variability in the distributions of interest. Providing analogous measures for projections is more complicated, however, because no observations are made beyond the present, and the further the attempt to see into the future, the more errors that were made early in the series can be compounded. Errors emanate from a variety of sources, including the unavailability or poor quality of data, the underlying models used to generate the projections, the expert judgments, and the parameter estimates themselves.

Although the Frequentist perspective has been prominent in this literature, research on Bayesian approaches to probabilistic projections also

holds promise. For example, Bayesian estimation has been used to project demographic components when data were sparse, as is often the case for developing countries (Alkema et al., 2008). Bayesian time series approaches using autoregressive models and parameters that allow the variance to be time-varying have also been developed (Abel et al., 2010). In general, these newer Bayesian methods attempt to address uncertainty in the model and uncertainty in the parameters; incorporate uncertainty in model choice through model averaging techniques; incorporate expert opinion through Bayesian priors; circumvent the intractability of complex integrations by generating samples from the posterior and predictive distribution using methods such as Markov Chain Monte Carlo simulations; and use these samples to construct empirical confidence intervals (Alkema et al., 2008; Bijak, 2011; Thomas and Clark, 2011).

The desire to make projections more accurate often involves introducing additional complexity, which requires innovative methodologies for implementation. Multidimensional extensions of the cohort-component approach, approaches that take into account regional variation, techniques that allow disaggregated rates into their components, and the ability to construct conditional projections that allow answering important “what if” questions would significantly enhance the utility of projections. However, each extension will require pushing the boundaries of the science.

### *Simulations and Agent-Based Models*

As useful as accurate forecasts can be, they remain extensions of a methodology of extrapolation. Based on certain assumptions about the trends in transition rates, some idea is gained of how these processes will “play forward.” The dynamic micro-to-macro articulation between changes in cohort composition, changes in social structure, and the nature, timing, and sequencing of transitions remains a black box. Simulation techniques can be applied to large national samples or to “manufactured” data to demonstrate how social processes may unfold over time. When based on statistical models, the judicious use of counterfactuals, and Monte Carlo algorithms to adjust parameters of the time trend, simulations can extend the methodology of cohort component projections in useful directions (Raftery and Bao, 2010).

Micro-simulations can incorporate a larger number of covariates, interactions among covariates, and a wider range of link functions in specifying social processes and tracing their effects. Static versions of these models, which begin with baseline data and a set of accounting rules, have been eclipsed by dynamic alternatives that do a better job of incorporating time into the calculations. These data-based approaches draw heavily on techniques of event history analysis and differ in how they model transitions

and whether they rely on discrete or continuous time approaches. Building these models requires a substantial initial investment, and the level of detail and reliability of the estimates depends on the quality of data used to generate the parameter estimates of the statistical models that drive them. Their strengths include a capacity to assess the effects of policy changes on both the decision-making process and on the consequences of the decisions taken; flexibility in aggregation, which makes distributional outcomes measurable; and the stochastic basis of the modeling exercise, which incorporates elements of uncertainty and precision into the results. Although they are individually based, the “actors” in these models do not “interact” in social space. Further elaboration of event history techniques, such as estimation of diffusion models or a melding of event history with network analysis, may create more flexibility; however, even those developments would not change the fundamental data-driven, equation-defined nature of these approaches. Because of their high level of detail and large number of calibrations, equations, and interactions, these models invoke “black box” approaches at intervening steps, thereby exchanging an intuitive understanding of the simulated process for computational feasibility.

The third wave of social simulation research is represented by agent-based models (ABMs), which provide a different strategy for modeling emergent properties of social systems (Macy and Willer, 2002). Social science has traditionally had to weigh the design trade-off between experimental and survey methodologies. On the one hand, experiments carried the loss of external validity, limitations in the number of factors that could be explicitly considered at any one time, and ethical concerns for the protection of participants while they allowed manipulations, treatments, a tight focus supported by random assignment, and the assumed controls for unobserved heterogeneity it afforded. On the other hand, surveys were compromised by the selective sorting of people into social categories, participant refusals and attrition, reporting error, and the inability to dismiss the confounding effects of unobserved population heterogeneity. ABMs combine advances in artificial intelligence, theories of social process and social behavior, and “agents” that are autonomous, interdependent, adaptive rule followers to create computerized thought experiments. Rather than emphasizing the forecasting role of microsimulations, ABMs allow a test of possible mechanisms that, through their operation in social space, produce patterns of outcomes. These models thereby provide leverage in illuminating fundamental processes, such as the emergence of social structure, unintended consequences of policy “treatments,” or the societal ramifications of rapid technological change.

By design, ABMs fit well with demographic research on the life course, because the agents in ABMs are “located” in social time and space, socially integrated through networks of interaction, capable of strategic

goal-oriented actions integrated across time, and able to adapt by adjusting the timing or sequencing of key transitions, for example. Consistent with their experimental nature, ABMs are “artificial” in design and thereby subject to questions of validity. Even so, they provide demographers with another tool to gain a better understanding of how the micro level links to the macro level in ways more complex than aggregation.

## CONCLUSIONS

During the mid-20th century, the scientific study of aging and the aged was organized into the discipline of gerontology. Proposed as an interdisciplinary study of the experiences, characteristics, and behaviors of a marginalized subpopulation, this area of scholarship remained on the margins of traditional scientific disciplines. The interdisciplinary nature of gerontology was more a juxtaposition of the various “systems” that needed to be addressed when studying aging and the elderly. Understanding the biological and psychological changes that accompanied aging allowed societies to better confront the social problems of elder poverty, unaddressed needs for long-term care, and increased vulnerability. The claim was that the biology of aging put years into lives, and the sociology of aging put life into the years. That division is not as clear-cut as previously thought.

The demography of aging provides a valuable counterpoint to person-centered studies of the aging process. As more is learned about how environments shape the way people change over time, demography can contribute to an understanding of how changes in the aging process at the person-level translate into population changes in salient compositional characteristics. But as appreciation grows about the variability in the aging process across time and space, better ways to translate key dimensions of that variation to the macro level must be developed. The traditional measures of population aging implicitly assume homogeneity in the aging process, and temporal comparisons based on these traditional measures assume that the societal implications associated with skills, abilities, functionalities, and behaviors linked to chronological age operate in the same way across time. There is ample evidence that neither of these assumptions is correct. Those over age 65 are not uniformly dependent, retired, on fixed income, or unhealthy, nor are those in their 20s uniformly independent, employed, and healthy. Nevertheless, policy discussions continue to rely on measures that have increasingly ambiguous, and arguably erroneous, interpretation.

Demographic techniques of standardization, event-history analysis, cohort projections, and simulations are the foundations of quantitative techniques that will help build the bridges across levels of aggregation. But the task is about more than statistical estimators with desirable properties; also central to this enterprise is the development of comparative criteria that

allow us to extend our measures across time and space and across cohorts and cultures. This task requires strong conceptual grounding in cross-level linkages, careful consideration of the way these measures can be, will be, and should be used, and a sensitivity to the vectors of social change that will inevitably shift the terrain on which our measurement is based.

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8

Networks, Neighborhoods, and  
Institutions:  
An Integrated “Activity Space”  
Approach for Research on Aging

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The concept of community, both physical and social, has been central to social science inquiry on aging. Notions such as aging-in-place are predicated on the assumption that older adults would prefer to continue residing where they have established social ties and routines and where they have experienced seminal events over the life course. Research suggesting these preferences (Evans, Kantrowitz, and Eshelman, 2002; Rowles, Oswald, and Hunter, 2003), coupled with a burgeoning literature on neighborhood context effects across age groups (e.g., Sampson, Morenoff, and Gannon-Rowley, 2002), has led researchers on aging to examine the features of neighborhood context most salient for older adult well-being. In this chapter, we focus on the conceptualization and measurement of the social space that older adults inhabit, exploring implications for research on residential context. We approach this review broadly, incorporating research on social networks and institutional contexts that bear on the interpretation of “neighborhood effects.” Our initial aim is to illustrate that community can take many forms, and that networks, neighborhoods, and institutions, independent or interdependent, combine to shape the social environment in which older adults are embedded. Our subsequent aim is to argue that neighborhood effects research would benefit from alternative conceptualizations of the relevant spatial unit of analysis. We argue that residents, through their actions, define the activity space that they traverse and collectively constitute communities of routine interaction. This approach requires both new theory and new methods, which we elaborate on later in this chapter.

We begin by reviewing literature focused on the dyad or network in social interaction. We then shift to the neighborhood-level, describing select work that has been influential in the field and that brings insight to neighborhood-aging analyses. Next we review literature on the role of institutions and their import in understanding how networks and neighborhoods may be connected. This concludes our initial aim. We then turn to an overview of a multi-contextual theoretical perspective on the social context of aging anchored on the concept of “activity space” (that is, those places and spaces in which one engages in routine activities). We close with suggestions for future directions in context-related research in aging.

### SOCIAL NETWORKS

Extant research suggests that the quality, extent, and type of social network ties are consequential for health. Reviews and theoretical expositions of this extensive literature can be found elsewhere (e.g., Berkman et al., 2000; Uchino, 2006) so we highlight the literature most relevant for older adults. Focusing first on the quality of social network ties, Thomas’s (2010) analysis of data from the Social Networks in Adult Life Survey indicates that receiving and providing social support are associated with better well-being among adults ages 50 and older, although these associations vary by the type of relationship to the alter (i.e., nominated network member) and the number of alters supported. Using longitudinal data from the Midlife in the U.S. Study, Seeman et al. (2010) find that frequency of social contact and social support are positively associated with cognitive function.

An expanding literature has emphasized patterns of change in network size as adults age and the implications of the extent or quantity of social ties for health and well-being. For instance, Cornwell, Laumann, and Schumm (2008), using data from the National Social Life, Health and Aging Project, find that older respondents report smaller networks and decreased closeness with network members. The volume of contact with network members also varies by age; contact volume tends to decrease with age until adults reach their mid-60s, at which point the association between age and contact flattens. Beginning in their mid-70s, however, the authors observe a positive association between contact volume and age. This U-shaped relationship may reflect changes in ties to social institutions—such as work—and an increased need for care late in life. Aartsen et al. (2004), based on a Dutch sample, find that as adults age, their networks increasingly consist of family members, although network size interacts with cognitive and physical decline to determine the network replacement of neighbors and friends with family members.

Finally, using longitudinal data from the Health Professionals Follow-up Study, Eng et al. (2002) find that over a 10-year period, older adult men

are at a greater risk of mortality across multiple causes of death if they have fewer social ties. They also find socially isolated men have an increased risk of fatal coronary heart disease. Differences in network size across the life course may have significant implications for health and well-being. Loneliness may be one manifestation of decreased social ties, and the concepts of loneliness and social isolation have received increasing attention in research on aging (e.g., Hawkey et al., 2008). A meta-analysis of research on adults' loneliness suggests social contact, especially the quality of contact and contact with friends, is protective against loneliness (Pinquart and Sorensen, 2003). Cacioppo et al. (2006) find that loneliness is positively associated with subsequent depression net of initial depressive symptoms.

Recent research has also emphasized the type and structure of social networks within which older adults are embedded and their implications for health. Litwin and Shiovitz-Ezra (2006), for instance, find that the association between network type and mortality was important primarily to persons aged 70 and older; those in diverse, friend-focused, and, to a lesser extent, community-clan networks experienced lower risk of all-cause mortality. Cornwell (2009) examined patterns of network bridging among older adults (an individual acts as a "bridge" if he or she connects two otherwise disconnected individuals). Individuals who occupy bridge positions within their networks are hypothesized to benefit from improved access to diverse resources and better control over the exchange of information and resources between network members. Cornwell finds that older adults are more likely to serve as bridges if they exhibit good cognitive and functional health.

Research on networks and aging has also considered the potential downside of network embeddedness. Cornwell and Laumann (2011) find that the frequency of contact between a man's female partner and his network members (i.e., partner betweenness) contributes to male sexual dysfunction, arguing that overlapping networks between heterosexual partners undermines a man's independent control of social resources—contrary to traditional notions of masculinity. These findings are consistent with research emphasizing the potential for detrimental effects of social connections (Baum, 1999; Browning, Feinberg, and Dietz 2004; Lynch et al., 2000) and relates to a developing literature that emphasizes contingencies in the impact of social ties depending on features of the relationships and networks in which older adults are embedded.

## NEIGHBORHOOD CONTEXT

Research in psychology suggests that attachments to place grow stronger with age (Zingmark, Norberg, and Sandman, 1995). The immediate neighborhood environment is typically understood to play an increasingly

important role in shaping daily life as retirement and mobility limitations diminish the radius of routine activity, although the claim that neighborhood exposures grow more relevant with age has not been directly tested (Cagney and York Cornwell, 2010). Older adults also experience comparatively lower rates of residential mobility. In 2000, only 4 percent of adults aged 65 and older changed residences in the past year compared to 15.6 percent of the younger population. As older adults age in place, the opportunities and constraints presented by their neighborhood environments become increasingly relevant to health and well-being (He et al., 2005). The findings below are consistent with the claim that neighborhoods are consequential for older adult health, with patterns of influence varying by individual-level factors such as stage in the life course, gender, and race. Drawing on key theoretical approaches that have been used to frame research on neighborhoods, we review health-related implications of neighborhood social structural and social process environments for older adults.

Research on the neighborhood context of health across the life course has drawn heavily from social disorganization theory—a long-standing theoretical approach with roots in the Chicago School of Sociology. Social disorganization theory proposes that neighborhood structural characteristics—concentrated economic disadvantage, racial/ethnic heterogeneity, and residential instability—influence the shared capacity of residents to achieve common goals and maintain effective social control (Sampson, 2003; Shaw and McKay, 1969). Poverty limits the availability of resources (including time and material) that can be deployed toward local ends; residential instability hampers the development of neighborhood social networks and weakens incentives to participate in voluntary organizations serving the community; and racial/ethnic heterogeneity may inhibit the development of ties across communities divided by language and customs—although typically not shared values regarding community functioning (e.g., norms regarding a crime-free environment). Although originally used to explain the differential distribution of crime and delinquency rates across urban areas, social disorganization theory has been enlisted to better understand the clustering of poor health outcomes, with increasing attention to older adult morbidity and mortality (Cagney, Browning, and Wen, 2005; Wen and Christakis, 2005).

Of the three structural factors emphasized in the social disorganization approach, research on the effects of concentrated economic disadvantage is most common in studies of health and older adult well-being (e.g., Freedman, Grafova, and Rogowski, 2011). Poverty and other indicators of socioeconomic disadvantage are associated with greater risks of mortality (Diez Roux et al., 2004) and morbidity (Merkin et al., 2007), as well as declines in mental health (Aneshensel et al., 2007), mobility (Lang et al., 2008), and self-rated health (Cagney, Browning, and Wen, 2005). Although

this research consistently finds detrimental effects of neighborhood structural disadvantage, Cagney et al. (2005) find that the prevalence of affluent residents exhibits more robust associations with self-rated health than does disadvantage. Regardless of the operationalization, a growing body of evidence suggests that neighborhood socioeconomic status (SES) matters for the health of older adults, with some research finding evidence that neighborhood SES explains older adult health disparities between race groups (Cagney, Browning, and Wen, 2005; Yao and Robert, 2008).

Increased attention to neighborhood context has led researchers to consider the conditions under which neighborhood structural factors exert more pronounced influence. For instance, research suggests that individual-level SES (Wen and Christakis, 2005) and race (Diez Roux, 2004) may moderate the relationship between neighborhood SES and older adult health outcomes. Yao and Robert (2008) find that neighborhood disadvantage explains baseline differences in self-rated health but not changes over time. Robert and Li (2001), however, find that neighborhood SES has the strongest effect on adult health at middle ages, its effect diminishing during early and late adulthood. Some research also suggests that neighborhood SES has little or no effect at older ages (Waitzman and Smith, 1998), perhaps due to selective mortality or study outcomes—such as mortality—that often are rare at younger ages (Glass and Balfour, 2003). Finally, LeClere, Rogers, and Peters (1997) find the changing influence of neighborhood SES across ages may vary by race.

Findings on the effects of racial/ethnic composition of neighborhoods have been equivocal. The Latino Paradox suggests that despite typically socioeconomically disadvantaged communities, Latinos tend to benefit from residence in highly immigrant or Latino-concentrated neighborhoods. Research suggests that such high concentrations may be protective against stroke, cancer, hip fracture, and mortality (Eschbach et al., 2004), as well as depressive symptoms (Ostir et al., 2003). Yet research also finds that the proportions of blacks and Hispanics in a neighborhood are positively associated with depressive symptoms (Aneshensel et al., 2007). Alternatively, some studies suggest that black concentration has no effect on depressive symptoms (Subramanian et al., 2006) or on self-rated health (Hybels et al., 2006; Kubzansky et al., 2005).

Residential instability generally has been shown to be detrimental to health, including outcomes such as self-rated health (Subramanian et al., 2006) and disability (Beard et al., 2009). Research also suggests that residential instability may influence perceived social environmental stress (Schulz et al., 2008). In contrast, Hybels et al. (2006) find no association between residential instability and depressive symptoms.

A fourth structural factor also has been considered in research motivated by the social disorganization framework—age (Cagney, 2006). Studies

show that older adults benefit from high concentrations of older adults in their neighborhoods. Elevated concentrations are associated with better self-rated health (Subramanian et al., 2006), mental health (Kubzansky et al., 2005), and are protective against older adult mortality during disasters (Browning et al., 2006). But as with residential instability, Hybels et al. (2006) find no effect of neighborhood age structure on depressive symptoms. A related finding suggests that for older widowed adults, aspects of neighborhood composition such as the proportion of widowers shape opportunities for interaction, social connectedness, and, ultimately, mortality (Subramanian, Elwert, and Christakis, 2008).

Finally, a related structural construct focuses on characteristics of the built environment, including physical features of the environment as well as the quality of local amenities. We include discussion of the built environment within the larger body of research on structural features because the type and quality of infrastructure can either facilitate or inhibit social interaction. Research suggests that heavy traffic, excessive noise, inadequate lighting, and poor sidewalks may discourage physical activity among older adults (Balfour and Kaplan, 2002; Gallagher et al., 2010; Giles-Corti and Donovan, 2002; Mendes de Leon et al., 2009; Strath, Isaacs, and Greenwald, 2007). Older adults may be particularly responsive to specific aspects of the built environment (e.g., walkable sidewalks, curb cuts) since physical limitations are more prevalent; mobility declines or inability to drive may mean that neighborhood conditions favorable to walking become more salient for older adults' healthful living (Clarke, Ailshire, and Lantz, 2009). The press-competence model suggests that individual competencies interact with environmental conditions to influence health outcomes (Glass and Balfour, 2003).

Relatively few studies of neighborhood influences on aging-related outcomes have directly measured the social processes thought to mediate the influence of neighborhood structural characteristics on older adult health. An emerging literature, however, draws on recent data collection efforts that attempt to assess the social climate of (largely urban) neighborhoods in which older adults reside. Findings from this incipient literature suggest that features of the social environment such as characteristics of neighbor networks and "collective efficacy"—the level of mutual trust and willingness to intervene on behalf of shared local goals—may independently contribute to older adult well-being. Wen and Christakis (2005), for instance, find that a higher quality social environment—as measured by levels of collective efficacy, social support, participation in voluntary associations, and (lower levels of) perceived violence—prolongs survival following disease onset. Browning et al. (2006) find that collective efficacy protects against mortality among older adults, although this effect fails to persist under extreme conditions (i.e., during a heat wave). In contrast, however, Mendes de Leon

et al. (2009) find neighborhood-level social cohesion is not associated with walking after accounting for individual-level perceptions of social cohesion.

Some investigators have examined the extent to which social process measures and perceptions of them vary by key demographic indicators such as age. For instance, Galinsky, Cagney, and Browning (2012) compare two measures of collective efficacy, one originally developed through the Project on Human Development in Chicago Neighborhoods (PHDCN) and the other through the Neighborhood Organization, Aging and Health Study (NOAH). The measure developed for NOAH substituted some of the original collective efficacy items of the PHDCN related to informal monitoring of children with those believed to be more relevant for older adults (e.g., neighbors shovel snow, neighbors check on older adults during a heat wave, neighbors intervene to protect a threatened older adult). Both the original and older adult versions performed well, but item non-response was much improved with the measure tailored for older adults (suggesting that respondents were more interested in, or better able to answer, questions when the substance resonated with their experiences).

Research on the neighborhood context of older adult health remains incipient, but suggests the importance of neighborhood environments in shaping health outcomes. Neighborhoods may create opportunities for positive social network influences to take hold, as described earlier, and may foster the presence of institutions that promote older adult well-being. We now turn to a description of these institutions, highlighting the type and form that bear on the lives of older adults.

## INSTITUTIONS

Institutional settings, both formal and informal, can be critical to older adult social integration and may have downstream effects for health. Sociological research like *Slim's Table* (Duneier, 1994) illustrates the import of local gathering places, such as restaurants, for the maintenance of social connections. And Hochschild's classic *The Unexpected Community: Portrait of an Old Age Subculture* (1973) intimates that community can be created through any number of institutional forms.

In this chapter, we consider institutions to be physical locations where some form of organized social activity takes place. Our focus is on institutional settings that promote social integration and social and physical contact. When initially considering institutional settings that may be important to aging, care arrangements such as formal long-term care facilities, home care services, and hospitals and other health services may come to mind. While we acknowledge that these institutional arrangements are critical for the well-being of older adults, their reason for being stems from health and long-term care service delivery. We choose instead to focus on the types of

institutions that might not readily be identified with older adults or care provision, but that serve to link older adults to one another, and to the community, and indirectly influence health and well-being.

The density and quality of the institutional environment may have important implications for older adult health and may also mediate the influence of residence in a disadvantaged neighborhood context on aging-related outcomes. We consider institutional involvement and access across a continuum from more formal organizations, to availability and quality of local businesses, to informal and unstructured but patterned interaction. For instance, older adults' involvement in religious organizations has been the subject of extensive inquiry (e.g., Dupre, Franzese, and Parrado, 2006; Norton et al., 2008). However, a wide variety of institutions may be relevant to shaping the quality of daily life for older adults and providing access to ongoing sources of support (e.g., community-based senior centers) (Miner, Logan, and Spitze, 1993). Participation in voluntary organizations and even regular but informal gatherings in local restaurants, clubs, or recreational facilities may contribute to a richer social experience.

Increasing evidence suggests that organizational and institutional involvements have beneficial effects for older adults. York Cornwell and Waite (2009) find that social connectedness based on personal and group-oriented ties is positively associated with self-rated health and mental health. Shankar et al. (2011), with cross-sectional data from the second wave of the English Longitudinal Study of Ageing, find that increases in loneliness as well as increases in a combined measure of social isolation from family, friends, organizations, religious groups, and committees are associated with greater likelihood of inactivity, a heightened risk of smoking, and higher systolic and diastolic blood pressure. And, Eng et al. (2002) find religious service attendance and participation in social groups each is associated with a decreased risk of all-cause mortality.

Caveats in this body of research include cohort differences that are not examined and results related to age that are equivocal. Some research (e.g., Putnam's *Bowling Alone* [2000]) suggests that successive cohorts will neither have the taste for organizational involvement nor the range of formal organizations to join. On age, Bukov, Maas, and Lampert (2002) examined social participation among adults aged 70 and older. They find that social participation is more likely among those with greater educational and occupational resources and that declines in participation are explained, in part, by aging and declines in health. In contrast, Cornwell et al. (2008) find that age is positively associated with religious service attendance and volunteering. Collecting more precise data from older adults on their specific institutional involvements could potentially contribute to an understanding of disparate findings related to age.

Evidence pointing to the role of institutional and organizational participation in older adult well-being highlights the need for a better understanding of the processes that shape access and opportunity. Critically, geographic isolation may limit access to beneficial health-related facilities, food outlets, recreational activities, and other amenities. Such isolation is pronounced in rural areas (Durazo et al., 2011), although differences within urban and suburban areas also exist. Pearce, Witten, and Bartie (2006) found substantial variation in proximity to health-related institutions—including shopping, education, and recreation—between rural and urban areas and within urban areas of New Zealand. In the United States, low SES neighborhoods are less likely to have recreational facilities (Moore et al., 2008) and free-for-use physical activity resources (Estabrooks, Lee, and Gyurcsik, 2003) than are higher SES neighborhoods. Research also suggests that residents in predominantly white neighborhoods are more likely to have better access to healthful food outlets, such as supermarkets, than those residing in predominantly black neighborhoods (Morland et al., 2002; Zenk et al., 2005). Finally, Yamashita and Kunkel (2011) assessed older adults' access to healthful food outlets in Hamilton County, Ohio. They find older adults are concentrated in areas with lower densities of healthful food outlets and conclude that the majority of older adults in the county do not live within walking distance of such an outlet.

Institutional and organizational involvement appear consequential for older adult health, but differentially accessible by geographic location. Although individuals' predispositions to avail themselves of local institutional opportunities clearly differ, teasing out the interrelationships between opportunity, inclination, and participation is difficult. The role of institutions, and the social network connections they provide, may be better understood with better data. For instance, more precise information could capture not only the institutions frequented but also their physical location, as well as the extent to which other social network members spend time there.

## CHALLENGES

Despite the substantial promise of research on the social context of aging, this area of inquiry has faced a number of challenges. Although the criticisms directed at contextual research are not unique within the social sciences, addressing these issues has proved particularly vexing given the nature of the questions and the data typically involved. We focus on three major challenges to the literature: (1) the tendency for contextual research to be “silo'd” with respect to both theoretical formulation and empirical execution; (2) difficulties in establishing the causal impact of context on health; and (3) the substantial data and measurement shortfalls of existing resources. These challenges may apply to contextual research more

generally, but specific aspects are particularly consequential for research on aging and will be discussed in detail accordingly.

### **Silos in Contextual Research and Implications for Theoretical Integration**

As suggested in our review of the extant literature on the social context of aging, the role of network, residential neighborhood, and institutional contexts in shaping aging-related processes cannot be easily disentangled. For example, theories of neighborhood effects on health often invoke the influence of local institutions and access to neighbor networks as key mechanisms (Sampson, Morenoff, and Gannon-Rowley, 2002). Institutional influences are difficult to understand in the absence of information on the local embeddedness of these organizations and their capacity to extend influence beyond the most formal aspects of organizational involvement through informal network processes. In addition, face-to-face social network interactions always occur in a geographic and more or less structured social setting. Understanding the emergence and quality of social networks as sources of support for older adults may require richer information on the settings that shape and sustain social networks.

These points highlight the inherent limitations of “uni-contextual” theoretical approaches to understanding social influences on health. Indeed, as Cook (2003) argues, the restricted scope of contextual studies leads to a number of potential concerns about the nature of extant findings. First, focusing on an arbitrarily limited set of contexts precludes assessment of the combined effects of multiple relevant contexts on aging-related outcomes. A joint contextual effect may be substantially greater than the effect of any given context in isolation. As noted, studies that simultaneously incorporate information on networks, neighborhoods, and institutions are exceedingly rare. Second, accounting for only a subset of older adult exposures may lead to biased contextual effects (i.e., if effects of measured contexts on individual outcomes are confounded with omitted characteristics of unmeasured contexts). Third, simultaneous assessment of multiple contexts allows insight into inter-context mediational processes that more limited-scope approaches cannot detect. Fourth, research designs that incorporate a limited number of contexts restrict the capacity to assess the influence of inter-context interactions on older adult outcomes (e.g., the negative impact of a disadvantaged neighborhood may be buffered by participation in highly supportive institutions such as churches or community centers). These concerns point to the need for theoretical approaches and data collection efforts that explicitly consider the multiple contexts relevant to older adults.

Although our review highlighted emerging areas of research that attempt to combine contextual influences, these efforts remain the exception. In some instances, this may be due to a tendency to underemphasize

theoretical motivation. For instance, although some neighborhood research has drawn on theory to combine an emphasis on the effects of social structural characteristics on older adult health with attention to the mechanisms—such as social cohesion—that may explain structural effects, this literature remains incipient. Indeed, some have argued that neighborhood research on older adult populations has tended to neglect theory (Macintyre and Ellaway, 2003). In their comprehensive review of articles published between 1997 and 2007, Yen, Michael, and Perdue (2009) identified 33 articles on neighborhoods and older adult health. Only three of these publications explicitly mention a theoretical model.

Incorporating theory in contextual research more generally will help better elucidate the processes that link contexts with health for older adults and draw attention to the inherently interconnected nature of social contexts as they shape older adult outcomes. Substantial advances in this area, however, will require more complex theoretical models that explicitly acknowledge the multifaceted nature of social contextual influence. Extant theoretical models point toward this insight, but few efforts to understand the simultaneous and interactive effects of social network, geographic, and institutional influences have been attempted.

### Causality and Selection

A second challenge relates to the seemingly intractable problem of establishing causality in studies of social context effects on health. Such studies face the inevitable criticism that individuals who select into disadvantaged contexts may be at high risk for poor health outcomes at the onset. One could argue that selection is an even more intractable problem for research on older adults because it could be compounded by time and residential history in ways we cannot address with available data (e.g., Li and Ferraro, 2005). In the neighborhood literature, for instance, substantial attention has been devoted to determining whether observed effects of neighborhood variables are compositional or contextual in nature. Compositional effects are attributable not to the context itself, but to the aggregation of similar individuals who consequently have comparable health outcomes. If only compositional effects exist, then relocation to a new context would not produce different health outcomes as individual-level traits persist. Compositional effects may be observed because individual traits that influence health also help determine where people live either through selective migration or through constraints on mobility. Furthermore, selection or constraint criteria may change over the life course. Compared to younger adults, older adults benefit less from services such as public schooling, and they likely have less flexible budgets if retired. It is therefore not surprising that low property taxes, for example, help determine whether

and to where older adults move (Duncombe, Robbins, and Wolf, 2001; Sabia, 2008). Neighborhood residence also may be determined by an individual's health. Relocation or the expectation of moving is associated with changes in physical limitations, self-rated health, cognitive impairment, and proximity to a child (Sabia, 2008; Silverstein and Angelelli, 1998).

Unlike compositional effects, contextual effects are not attributable to aggregated features of individuals; hence, similar people may experience different health outcomes depending on their contextual exposures (Curtis and Jones, 1998; Macintyre and Ellaway, 2003). Multilevel modeling techniques enable researchers to better distinguish compositional from contextual effects. These analytic strategies allow context- and individual-level effects to be modeled simultaneously, thereby allowing researchers to distinguish variance in individual outcomes attributable to neighborhood versus individual characteristics (Diez Roux, 2004).

Yet, multilevel models are no panacea in the absence of adequate control for the individual-level factors associated with selection into neighborhoods. Unfortunately, the perennial challenge of estimating unbiased contextual effects is extremely difficult to overcome with standard research designs. Studies such as the Moving to Opportunity (MTO) Demonstration have attempted to approximate an experimental design in an effort to understand the "treatment" effect of moving from a high- to a low-poverty neighborhood among younger populations. The capacity of these approaches to isolate the treatment effect of interest has been questioned (Sampson, 2008). A major concern in the case of the MTO study surrounds the extent to which the residential move from a high- to a low-poverty neighborhood actually resulted in sustained differences in the routine exposures of study participants (Clampett-Lundquist and Massey, 2008). As we describe below, targeted data collection efforts motivated by multicontextual theoretical approaches offer some promise for improved estimation of contextual effects.

### Data and Measures

Theory cannot be adequately tested, nor can efforts to address problems of selection and causation, in the absence of high-quality data collection efforts. An obvious advance would be to incorporate social contextual measures into ongoing, longitudinal investigations of older adult well-being. Despite the advantages of over-time data, Yen, Michael, and Perdue (2009) identified only eight longitudinal studies of neighborhoods and older adult health. Typically, longitudinal investigations of aging populations focus on individual-level characteristics. Thus, changes in neighborhood characteristics are unobserved and their potential influence impossible to assess.

Effective measurement of social context is a significant challenge. Boundary specification problems are endemic to this research, often resulting in arbitrary or convenience-based decisions regarding the operationalization of the context of interest. For instance, neighborhood research faces the ongoing challenge of defining the “neighborhood.” Neighborhoods have been defined by individual perceptions, administrative boundaries, and sociogeographic landscape. Although theory and the specific research question should inform the size of the relevant boundary (Raudenbush, 2003), available data usually restrict researchers to using predefined boundaries, such as the census tract, and consider only residential location.

Research also is limited by the relative lack of data on whole (as opposed to ego-centered) networks. Many studies rely on ego-centric networks that bound networks based on first-degree connections. Such studies often use measures of perceived levels of support or weight network ties based on the level of intimacy. But as Granovetter’s (1973) work suggests, weak ties may have important consequences as well. Smith and Christakis (2008) argue that health research should consider characteristics of the whole network. For example, Christakis and Fowler (2007) identified obesity clusters using over-time whole network data. They find that direct connections to obese alters (i.e., friends), as well as connections to individuals separated by up to three degrees, influence the ego’s likelihood of becoming obese. Although this research has been criticized on methodological grounds (Lyons, 2011), findings from these studies have sparked substantial interest in the health effects of embeddedness in network structures and raise important questions regarding the appropriate measurement of networks to capture health influence.

Finally, research has not fully explored the intersection of geographic location and global (or complete) networks, and their effects on health. As we discuss later in this chapter, individual-level reports of sociospatial ties can be combined to identify aggregate patterns of interaction. The interrelationship between social ties and social interaction, and the exact location in which ties are maintained, could potentially inform neighborhood-based interventions for older adults. If it is known, for instance, that certain neighborhood institutions create consistent opportunities for interaction, and that ties formed there are of some consequence, then efforts can focus on protecting or sustaining those institutions. The frame to describe institutions may also be extended; perhaps they need not exist in a formal sense or even under a roof. For instance, Chicago’s Hyde Park neighborhood is able to sustain more than one location (generally, a park) where older adults gather on a regular basis to play chess. The ability to efficiently identify this form of activity may be possible with newly designed social survey and tracking methods—we turn to a description of these below.

## NEW DIRECTIONS

Despite the substantial challenges facing investigation of social context effects on aging, emerging directions in conceptualization and measurement hold the promise to significantly advance research in this area. Specifically, we focus on the concept of activity space as an integrative approach to capturing older adult spatial, social, and institutional exposures. Activity spaces may be understood to encompass all of the locations that individuals come into contact with as a result of their routine activities (Golledge and Stimson, 1997). Below we describe how incorporating activity space exposures into theoretical models and data collection efforts may aid in addressing the challenges facing contextual research on aging.

### Reorienting Theory

First, theoretical approaches that emphasize the effects of one or another set of contexts on aging-related outcomes would benefit from conceptualizing individual exposures through the concept of activity space. For instance, research on neighborhoods, aging, and health largely has focused on the residential location. But individuals travel outside of their residential neighborhoods as they carry out routine activities, such as work, grocery shopping, health and dental care, and recreation. It is plausible that these nonhome contexts also influence individual outcomes (Kwan, 2009). Moreover, the degree of exposure to these contexts varies. Thus, research should consider characteristics of residential and nonresidential environments as well as the time spent, activities performed, and social interactions occurring at these locations. This approach is explicitly multicontextual, acknowledging the potential for substantial inter-individual variability in daily routines.

Consideration of activity space may help explain differential effects of neighborhood characteristics across individuals. For example, the protective effects of high immigrant concentration within the residential neighborhood may be attenuated if individuals spend considerable time outside their neighborhoods. Conversely, the harmful effects of concentrated disadvantage might be alleviated when individuals are routinely exposed to more affluent or pro-social contexts. Although advanced age and disability may limit the potential to travel beyond the residential neighborhood, as noted earlier, the assumption of age-constricted routine activity spaces has not been investigated empirically (Cagney and York Cornwell, 2010). Although it is likely true that, on average, the circumference of turf declines in size with age, inter-individual variability in this process may be substantial (and life course theory suggests that we might expect even greater heterogeneity at later ages [Elder, 1975]). Research thus should consider how

individuals' activity spaces change as they age, and whether these changes shape the influence of traditionally emphasized contexts such as residential neighborhoods.

### Attention to Institutional Interactions

As with neighborhood contexts, consideration of activity spaces could help improve understanding of older adults' interactions with various institutions. By collecting data that directly assess older adults' exposures to institutional contexts, the impact of such exposures can be more precisely estimated. Activity space data also may provide information on the specific venue where an individual spends time, offering the opportunity to capitalize on rapidly expanding publicly available data on institutions and public space (e.g., Google Maps, Street View, etc.). An emphasis on activity space data marks an important shift from the dominant survey-based approach to understanding institutional participation that relies on abstract categories of institutional participation (e.g., church attendance or membership in clubs and voluntary organizations, broadly construed) without observing actual social and spatial exposures. These methods do not replace survey-based approaches, which are still critical to gleaning perceptions, but suggest that surveys can be combined with Global Positioning System (GPS) technology and other space-time tracking systems to situate older adults in their social and geographic space.

Moreover, activity space information allows for assessment of the geographic proximity of institutions with which individuals are actually involved. Do residential neighborhoods provide institutional exposures or do older adults travel outside their immediate neighborhood contexts for some institutional involvements? The typical approach to estimating the impact of neighborhood institutional environments is to simply enumerate the presence of relevant organizations, businesses, and local facilities in a neighborhood and estimate the impact of institutional density on aging-related outcomes. Although this approach may tap potential opportunities or the community's orientation toward pro-social organizations, it does not assess actual participation in local institutions by older adult residents and therefore cannot accurately measure the impact of institutional participation.

Activity space measures also allow researchers to disentangle the primary and secondary benefits of institutional presence. For instance, institutions may exert beneficial influence on participants directly, but also may indirectly influence the outcomes of other neighborhood residents through second- and third-order network ties (e.g., information passed through informal gatherings at a local coffee shop is passed on through neighbor networks), social psychological influences (e.g., a successful local youth organization engenders trust and a sense of security among older adults),

or ecological processes (e.g., a new store brings conventional activity and “eyes on the street” to the surrounding area, promoting monitoring and informal social control [Browning et al., 2011; Jacobs, 1961]). By incorporating direct exposure to geographically identified institutions into theoretical models of social context effects, researchers will be encouraged to think about the complex influences of institutions through participation, social networks, and proximate spatial processes.

### Multicontextual Analysis Opportunities

In addition, a multicontextual approach to social network influences on aging would allow for detailed assessment of network partner characteristics while simultaneously capturing the embeddedness of network interactions in geographic, institutional, and social settings. The characteristics of settings in which network partnerships are enacted (e.g., local, public, accessible) may have important implications for the extent to which network interactions translate into actual and perceived social support (Small, 2009). Moreover, the availability of public or casual social ties—e.g., those ties that are routinely available through local public venues, such as restaurants, coffee shops, and parks—may provide a source of security and informal network-based monitoring that more intimate but less regularized family ties may not offer. The pioneering work of Jane Jacobs (1961) highlighted the critical role of overlapping routines and casual contact among neighborhood residents in developing public trust. In the absence of activity space information, the potential for such contact characterizing a given residential area is difficult to observe. To our knowledge, research on the social context of aging has not sought to integrate network information with data collected in real time on activity space and routine activities.

Framing theoretical approaches and analyses using the activity space concept may also help develop research designs that are better equipped to infer causal effects of social contexts. Clearly, the challenge of establishing causal effects of social contextual variables is one that social scientists will not easily overcome. However, activity space data provide a means of improving on standard approaches. Precise exposure data offer the opportunity to determine whether a specific “treatment” has occurred and the duration of exposure, where relevant. For instance, hypotheses regarding the role of institutions in the lives of older adults might capitalize on exogenous changes in the institutional environment to determine whether and how such changes influence older adult well-being. The impact of opening a recreation center with older adult programming on the activity patterns of local elderly is an obvious example, but other institutional changes could matter as well. For instance, a new elementary school in the neighborhood could renew life on the street and encourage older adults to leave their

homes more often. Research questions examining the impact of time spent with social network partners in fostering older adult well-being (along a variety of dimensions) could benefit from more accurate assessment of network dynamics through space-time data on social network interactions. Although the challenges associated with inferring causation from analyses of social context effects are exceedingly difficult to surmount, activity space data will offer an opportunity to, at a minimum, assess theoretically relevant characteristics of a contextual treatment with greater accuracy.

### Promising Technological Advances

Finally, the data collection and measurement requirements of precise activity space information clearly extend beyond the traditional survey interview but are becoming increasingly feasible with new technologies. GPS technology is now a standard feature of cellular telephones, and most smartphone operation systems can accommodate applications to collect relatively precise location data. Smartphones also are increasingly used to collect real-time information from respondents on settings, social interactions, mood, and other phenomena using Ecological Momentary Assessment (EMA) (Cain et al., 2009). EMA uses smartphones to directly contact respondents with questions that can be answered, in the moment, using the device, limiting problems associated with recall of events and locations (potentially more effective if short-term memory is compromised). Question content can be crafted such that respondents are queried not only about what they are doing, whom they are with, and how they feel in the moment—three typical foci of EMA-based data collection efforts (Shiffman et al., 2008)—but also about the nature of the social exchange and the quality of it (Stafford et al., 2011). Moreover, the content of exchanges, personal or material, is rarely collected in traditional survey-based approaches because detailed recall of activity and context would be too onerous. Although older adult populations are less familiar with smartphone technology, a number of studies have successfully used these devices to collect EMA data (Cain et al., 2009). Moreover, the rapid spread of mobile phone technology ensures that each new cohort of older adults will experience fewer burdens associated with smartphone-based data collection. Apart from technological familiarity, EMA and GPS tracking may be less invasive (particularly the passive tracking of respondent movements) so may be well suited for older adults who lack the comfort or stamina to interact with interviewers and recount interactions and locations.

Sampling activity spaces in a geographically contained population also may allow investigators to measure the extent to which neighborhood residents share activity locations within a given boundary or more generally. Consistent with Jacobs' (1961) approach, patterns of residential

interconnection through shared activity locations may capture important features of the social organization of a neighborhood. For instance, the pattern of these actor-location ties or “co-location networks” may have consequences for neighborhood processes such as social network formation and sustainability, the emergence of trust and neighborhood attachments, and shared expectations for informal social control and action on behalf of the local community (Browning et al., 2011). These factors have been linked with older adult health and well-being in the extant literature (e.g., Cagney, Browning, and Wen, 2005), but the social and ecological dynamics that tend to promote these features of neighborhood social organization have remained elusive. Moreover, by measuring the co-location network more precisely, researchers may be able to leverage social network analysis techniques to characterize routine activity patterns using sophisticated global network measures and identify an individual’s location in the network (e.g., through various measures of centrality) (Browning et al., 2011). We include a stylized example of just such potential. The network diagram (see Figure 8-1) illustrates how individuals (the circles) interact with places (the squares) in a hypothetical community. The sizes of the circles and squares suggest the network centrality of the person or the place. We could imagine that the larger squares could be churches, parks, or shopping centers—places that are central to routine activity. Graphically representing where people go, and how they may co-locate, could indicate both places that are successful at bringing together disparate groups and potentially identify shared tastes and norms. Rich measures of activity space may help uncover the social structure of community embeddedness that older adults experience.

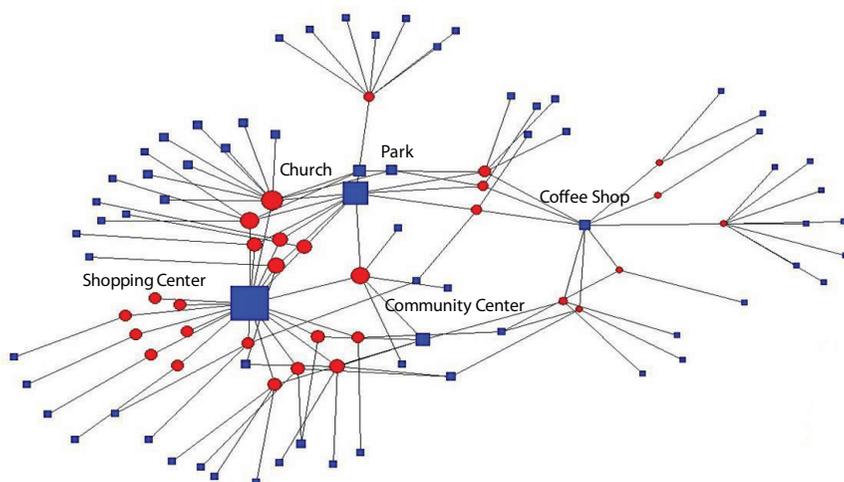


FIGURE 8-1 Affiliation network of older adults and neighborhood places.

These advances represent the frontier, but they also come with unforeseen challenges. The sheer volume of data points that will be available from data collection processes such as GPS tracking is one example of the emerging challenges of “big data” (Nyerges, Couclelis, and McMaster, 2011). Investigators could benefit from establishing “best practices” for how to manage, store, and clean these data so they are useful for analytic purposes. Another area that deserves attention is that of human subjects, how to protect their data and how to ensure their confidence in researchers’ ability to do so. Older adult participation in activity space research will be contingent on the field’s grasp of these sensitive issues.

### CONCLUSIONS

We have spent a significant portion of this chapter building a case for activity space approaches in contextual research on aging. These approaches hold promise because they release us from predetermined boundaries of influence and allow respondents to reveal where they go and how they share their social spaces. We believe this is the next “turning point” in neighborhood effects research and that aging-related scholarship will particularly benefit. We think this is so because relatively little is known about older adults’ routine activities and the extent to which they are altered with life course transitions and changes in health.

Research on the social context of aging faces a variety of challenges and opportunities in the coming years. Significant advances have characterized research on specific social contexts, demonstrating the role of social networks, neighborhoods, and institutions in shaping trajectories of older adult health and well-being. Nevertheless, capitalizing on these advances will require increasingly integrated, multicontextual theoretical and methodological approaches and concomitant data resources. We suggest that studies incorporating the concept and measurement of older adult activity space hold substantial promise for advancing contextual research on older adults and will benefit from ongoing rapid innovation in technologies for the collection of real-time data on spatial and social exposures.

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9

## Constrained Choices: The Shifting Institutional Contexts of Aging and the Life Course

*Phyllis Moen*

### INSTITUTIONS AS CONTEXTS AND PROCESSES

Institutions are taken-for-granted schemas about “appropriate” behavior—formal and informal rules and conventions representing collectively developed patterns of living that often reflect organizational and community answers to past problems and uncertainties (Biggart and Beamish, 2003; Sewell, 1992). According to Scott (1995, p. 13), institutions are “cognitive, normative, and regulative structures and activities that provide stability and meaning to social behavior. Institutions are transported by various carriers—culture, structures, and routines—and they operate at multiple levels of jurisdiction.”

This chapter proposes that institutional theory constitutes an important prism through which to advance understanding of the range and impacts of patterned social arrangements channeling age and aging processes, although its use is underdeveloped in the study of aging. While there are a multiplicity of social institutions (policies, programs, practices, and conventions) structuring the expectations and choices, transitions and trajectories, risks and resources of aging adults, they tend to serve as background “givens” in the existing research literature on aging, that is, as contexts and/or “neighborhood” effects (Angel and Settersten, 2013; Bengtson et al., 2009; Binstock and George, 2011; Cagney et al., 2013; Settersten and Angel, 2011; Shanahan, 2013), or else as social roles shaped by unique historical events experienced by different cohorts (see, Baltes and Baltes, 1990; Elder, 1974; Elder and Johnson, 2002; George, 1993). The closest ties to an institutional approach in the current aging field lie along three lines of

inquiry: (1) critical political economy and feminist approaches examining how existing institutional arrangements (norms, policies, and practices) are developed and maintained by those in power to promote their own positions of advantage, thereby preserving the existing distribution (across gender, race, and class) of resources (see Acker, 1992; Arber and Ginn, 1991; Estes, 2004; Harrington, Meyer, and Herd, 2007; Pampel, 1994; Quadagno, 1988); (2) age stratification/life course frameworks underscoring how social welfare and labor market policies have “institutionalized” the age-graded life course (Kohli, 2007; Kohli et al., 1991; Mayer, 2004, 2009; Meyer, 1986; Moen and Spencer, 2006; Mortimer and Shanahan, 2003; O’Rand and Henretta, 1999); and (3) sociological (c.f. House, 2002) and social epidemiological (c.f. Berkman et al., 2000) theorizing of *socially structured conditions*—more than individual attributes—as key to health and well-being, generating an emphasis in the interdisciplinary public health literature on the social causes of illness and health (Aneshensel, Rutter, and Lachenbruch, 1991; Berkman et al., 2000; Link and Phelan, 1995; Marmot and Wilkinson, 2006; Mechanic, 2000; Moen and Kelly, 2009; Moen et al., 2011; Siegrist and Marmot, 2006; Syme, 2007; Turner, Wheaton, and Lloyd, 1995; Wheaton, 2001; Wheaton and Clarke, 2003; Wickrama et al., 1997).

Institutional theory “asks questions about how social choices are shaped, mediated, and channeled by the institutional environment” (Wooten and Hoffman, 2008, p. 130). This is in sharp contrast to classic economic models emphasizing choice as a (rational) function of perceived advantage or preferences (c.f. Becker, 1981; Gruber and Wise, 2004). Although institutional theory is rarely explicitly invoked, sociological, demographic, and social epidemiological understandings of age, health, and the life course are implicitly if not explicitly about institutional forces, since scholars increasingly emphasize the embeddedness of individuals in particular social-structural contexts (see Figure 9-1). These contexts are replete with rules, claims, risks, and resources serving to open up or constrain choices, thereby shaping family-level and individual-level beliefs, behaviors, health, and life quality (see Berkman and Kawachi, 2000; Fry and Keyes, 2010; House, 2002; Kawachi and Levin, 2004; Link and Phelan, 1995; Lutfey and Freese, 2005; Phelan and Link, 2005; Phelan et al., 1998; Turner, Wheaton, and Lloyd, 1995). Nevertheless, the state of the field is such that the preponderance of research on aging examines *individual-level predictors of individual outcomes*, not the *institutional-level contexts and processes* shaping both.

Three things make something an institution: language, customs, and a body of rules and laws—and all serve to “regularize” behavior (Biggart and Beamish, 2003). What is key is that all three are in flux around aging processes, pointing to the importance of institutional change and even deinstitutionalization across cohorts and history. Thus, Boomers (born

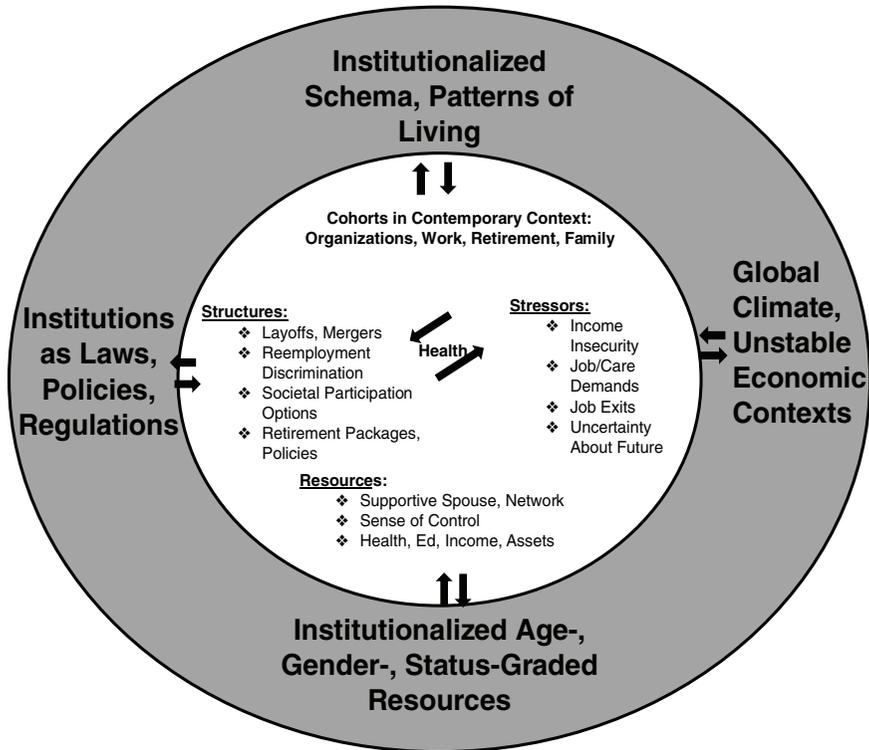


FIGURE 9-1 Multilayered institutionalized contexts shaping aging.

1946-1964) now moving to and through the retirement years are confronting unraveling labor market exit and pension expectations, policies, and practices that their parents and grandparents took for granted. In this way, cohorts responding to outdated policies and new circumstances become the engines of social change (Alwin and McCammon, 2007; Ryder, 1965). It is now members of the Boomer cohort who are reshaping what it means to retire and grow old in contemporary society.

Consider how taken-for-granted *language* (about elders, the aged, seniors, retirement, being/becoming old) is being redefined or challenged. For example, Gilleard and Higgs (2005, p. 157) conclude: “to be done and outside the labour market is no longer to be old. Old age is a status conferred by others. . . . For the majority, what continues is the symbolic connectedness of individualized lives.”

In terms of *customs* as well as a body of *rules and laws*, systems of educational, labor-market, corporate, retirement, social-welfare, family, and health-care policies and practices constitute a web of age-graded

institutionalized regimes (social structures of resources and schema) based on a very different workforce and “retired” force in the middle of the past century (de Vroom and Bannink, 2008; Ebbinghaus, 2006; Kohli, 2007). These regimes continue to define and shape age, aging, the life course, and health with different logics (and not always internally consistent ones). Moreover, note that such institutional arrangements cannot usefully be studied separately, because they are closely connected and interdependent. They both constrain and facilitate individuals’ options as they confront emerging 21st-century risks and realities in family life, the economy, and life expectancy. Consider, for example, the mismatch between presumed institutionalized protections and the disappearing employment contract. Today older workers confront the off-shoring of jobs, heightened job insecurity, unemployment, and nonstandard employment—all of which have been shown to affect health (c.f. Price and Burgard, 2008).

But institutions need not be seen as immovable. Some also provide impetus for change (see, Friedland and Alford, 1991; Sewell, 1992), such as the ways higher education as an institution has equipped many Boomers with the tools to redefine age in their own biographies and rewrite their own scripts around the aging process. And social forces—a tumultuous global economy, an aging population, technological shifts, and other social dislocations—are challenging taken-for-granted institutionalized conventions and practices around work exits, retirement timing, life post-retirement, Social Security, pension policies, and health care. This means that social actors (individuals, groups, organizations, governments), facing often contradictory rules, laws, and realities about labor market and retirement exit and entry portals, pensions, and health-care eligibility, must make *strategic adaptations*, which can then become the seeds of innovation and institutional change. For example, a competitive uncertain global economy has increased concerns of older workers about their job security, retirement timing, and future pensions, including whether they can “afford” to retire. This is the impetus for the development of bridge and part-time jobs, self-employment, and delayed retirement options for a growing older segment of the workforce. Another example is the rising costs of a currently institutionalized arrangement for long-term care—nursing homes. Such facilities are being challenged as unsustainable in their present form, in light of the coming age wave of Boomers. Arrangements like continuing care retirement communities, home care, and new technologies to facilitate aging in place are among proposed alternatives.

Institutions may seem static and intractable, but they are transformed through nonconformity, negotiation, improvisation, institutional entrepreneurs, and social movements (DiMaggio, 1988). It is often the *mismatch* or *structural lag* among existing institutional logics, or between institutions and the social forces rendering them obsolete, which generates

opportunities for social change. Such mismatches (lag) help to deinstitutionalize conventional arrangements and legitimate new institutions, often through a recombination or reconfiguration of existing elements.

This chapter illustrates the value of a program of future research using a combined institutional and life course approach to advance understanding of aging as a social process *embedded in multilayered institutional contexts*, with both individuals *and* institutions *changing over time*. It provides an overview of (1) current concepts and research in the sociology of aging, demography, and social epidemiology that articulate (although not always explicitly) with institutional theory and the ways institutions target and/or impact different subgroups of the population; (2) how institutions intersect and change over time in intended and unintended ways as a result of both social actors' behavior and other large-scale social forces; and (3) potential scientific and societal pay-offs of an innovative program of future research crossing levels of analysis to address ways (taken-for-granted, age-graded) institutions systemically open up *and* constrain life chances and life quality for those at different ages and life stages, often in distinctively gendered ways. The chapter is organized around several major social science constructs that, when married with an institutional/life course approach to age and aging, offer a promising agenda for a program of research over the coming decades: (1) *stratification and inequality* (including cumulative disadvantage and the life course); (2) *risk and uncertainty*; (3) *social support, integration, isolation*; (4) *agency, control, and adaptive strategies*; and (5) *time and place*. It concludes with a section on future directions.

## STRATIFICATION AND INEQUALITY OVER THE LIFE COURSE

One hallmark of sociology is its emphasis on the effects of social environments on behavior, resources, and health, the seemingly fundamental social structure of inequality (House, 2002; Link, 2008; Link and Phelan, 1995; Lutfey and Freese, 2005; Phelan and Link, 2005; Phelan et al., 2004; Phelan, Link, and Tehranifar, 2010). Some social structures—such as gender, race, education, and income—are markers of location in (institutionalized) status hierarchies. Social environments tied to these attributes produce and reproduce enduring inequalities (Tilly, 1998). Scholarly analysis of disparities associated with these social locations has been essential in spotlighting the role of existing and emerging social arrangements in the production and reproduction of inequalities. But while race, gender, and even education are enduring factors, other aspects of social structure, such as neighborhoods, work, and social networks, *do* change with age, as individuals select or are allocated to different social ecological niches (see also Brooks-Gunn et al., 1993) over the life course. Moreover, the deleterious effects of social-locational markers can be lessened or exacerbated by

events (such as the Great Recession of 2007-2009) or with age, in light of institutionalized age-graded policies and practices (such as Social Security and Medicare) offering an income and health-care safety net for older Americans that in the past century served to legitimize retirement as normal life transition (see Atchley, 1982; Costa, 1998; Han and Moen, 1999; Hayward and Grady, 1990; Henretta, 1992; Wise, 2004). Social forces, as well as deliberate policy *changes*, can also shift social structures, challenging taken-for-granted institutionalized expectations and practices that disadvantage some segments of the population while advantaging others (Blossfeld and Hofmeister, 2006; Blossfeld, Buchholz, and Hofäcker, 2006; Hudson, 2009; Warner, Hayward, and Hardy, 2010; Williamson, 2011). Consider, for example, public and corporate policy directives aimed at reducing age and/or gender discrimination (Shuey and O'Rand, 2004) or the development of "bridge" jobs as a way of gradually easing older workers into retirement (Kim and Feldman, 2000; Quinn and Kozy, 1996).

### Age and Gender Stratification

Age and gender are not simply characteristics of individuals shaping their preferences; rather, they are themselves social institutions, key axes organizing social life and "channeling" social choices, such that women and men of different ages and life stages are both *allocated* to and *socialized* to expect distinctive roles, resources, and relationships (Dannefer, 2011). While concerns about gender stratification are deeply embedded (institutionalized) in social research on inequality (c.f. Grusky, 2001), Riley (Riley, Riley, and Foner, 1994) also emphasized the importance of *age stratification*: age as a key marker of unequal access built into existing institutions (e.g., the labor market, education, social-welfare policies) that perpetuate age differentiation and inequalities within and across organizations, communities, and societies. (See also Settersten and Lovegreen, 1998, for the ways that education is constrained to certain ages and stages.) Others point to the *intersection* of age and gender stratification as institutionalized in families as well as public and organizational policies (Allen and Walker, 2000; Harrington Meyer and Herd, 2007; Harrington Meyer and Parker, 2011; Moen, 1994, 2001; Moen and Chermack, 2005; Moen and Spencer, 2006). The ways work and retirement are organized through legislation, regulation, and convention are based on a (male) breadwinner model presuming full-time, full-year investment in one's job, with family responsibilities off-loaded to someone else (a wife). These built-in assumptions make it difficult for women (or men) with family care obligations to work continuously throughout adulthood in "good" jobs that provide high wages, pensions, and security (Han and Moen, 1999; Moen and Roehling, 2005). Moreover, Social Security in the United States is predicated on this lock-step

model, presuming one's highest wages just prior to retirement. But women's movement in and out of jobs, in and out of the labor force in light of their family responsibilities, has meant lower wages, lower pensions, lower Social Security benefits, fewer assets, and great risk of economic insecurity in old age, especially for widows and divorcees (Budig and England, 2001; Budig and Hodges, 2010; Harrington Meyer and Herd, 2007; Harrington Meyer and Parker, 2011).

Gendered scripts also guide relationships with organizations and institutions. For example, among dual-earner couples, it is wives who tend to time their retirements around their husbands' retirement plans (Moen et al., 2005, 2006).

The processes by which people are allocated to different roles, resources, and relationships and socialized to expect and choose different life paths depending on their age and gender (as well as their race and class) are the direct result of social policies as well as cultural conventions—norms and practices—related to them. European scholars have pointed to the ways social-welfare policies have constructed and institutionalized the life course as a series of patterned role entries, trajectories, and exits based on men's occupational careers in the mid-20th century (Guillemard and Rein, 1993; Kohli, 2007; Kohli et al., 1991; Krücken and Drori, 2009; Marshall, 2009; Mayer, 2009; Meyer, 1986).

Thus the institutionalized life course is in reality a *gendered* life course (Arber and Ginn, 1991, 1995; Harrington Meyer and Herd, 2007; Harrington Meyer and Parker, 2011; Moen, 1994, 2001; Moen and Roehling, 2005; Moen and Spencer, 2006; Pavalko, 2011; Venn, Davidson, and Arber, 2011), grounded in gendered norms and social policies about work, family, and social relations that intersect with age. As an example, in the United States, unemployment insurance is typically based on men's experience of being laid off. People (women) who have spent time out of the workforce raising children are not "eligible" for unemployment insurance when they re-enter the labor market but cannot find jobs. And women who "work" at home taking care of children or infirm adults do not earn Social Security credits.

The distinctive life courses of women and men tend to disadvantage older women, in particular, in light of the gendered nature of their care-work obligations, along with discriminatory practices in the labor market and in welfare distributions throughout the life course (such as the ways part-time jobs do not provide pensions, unemployment insurance, or even health insurance). Family obligations and gender discrimination made it unlikely that current cohorts of older women followed the conventional lock-step of continuous full-time work, often for the same organization, that became the "hook" for the development of labor market and social welfare policies (Barley, 1989; Moen and Roehling, 2005). The result?

Older women find themselves with no or low pensions, Social Security payments based on lower wages, and caregiving obligations for ailing spouses or infirm parents that often precipitate unexpected and early labor market exits (Dentinger and Clarkberg, 2002; Harrington Meyer and Herd, 2007). But institutional innovations in the form of greater flexibility offering employees greater control over the time and timing of work and opportunities for more customized careers (Benko and Weisberg, 2007), together with the greater proportions of women attending college and having fewer children (along with men's declining wages), mean that some women's career paths are becoming more continuous than discontinuous, suggesting that future cohorts of older women may have different sets of resources. However, women's greater engagement in the labor market is occurring even as both men and women are increasingly at risk of (1) discontinuities due to layoffs and forced early retirement buyouts and (2) declining pension/income security (Shuey and O'Rand, 2004; Sweet, Moen, and Meiskins, 2007). Whether this has implications for narrowing gender differences in aging processes (compared to gender disparities among prior cohorts) in future cohorts is an empirical question. Similarly, Bonilla-Silva (2006) proposes a racialized social system framework emphasizing racism as a structure and a set of social practices developed to maintain the advantages of the dominant group, not merely a set of ideas or beliefs, with this system of racialization developing "a life of its own" (p. 32) (see also Jackson, Govia, and Sellers, 2011; Mutchler and Burr, 2011). Future research is necessary to identify the ways women and men of different minorities, immigrants, and other disadvantaged subgroups are aging, and whether institutionalized safety nets narrow or accentuate inequalities within and across gender in intersection with these identifiable subgroups.

An institutional/life course theoretical approach points to the ways the social, economic, and political institutions of particular societies—public and business policies and practices embedded in work, career paths, family, unemployment, pensions, retirement norms, and disability regimes—were developed based on the everyday experiences of mostly white-collar and unionized blue-collar men in the middle of the 20th century, but then came to organize the lives of everyone, including women who entered the workforce, along with other displaced and disadvantaged groups. These outdated templates continue to shape the lives of those in new cohorts now working, retiring, and aging in the 21st century in gendered ways. The range of institutionalized options in the wake of certain biographical events (such as illness, retirement, divorce, death of a spouse, or long-term unemployment) depends on a person's age, gender, and education (see also Dannefer, 2011). For example, there are both *pull* factors (such as Social Security, Social Security's Supplemental Security Income [SSI], and pensions) and *push* factors (corporate hiring, training, firing, pension, health insurance, and retirement

policies) that shape the timing of and pathways through the retirement transition (Ebbinghaus, 2006; Guillemard and Rein, 1993; Henretta, 1992; Kohli et al., 1991; Rix, 2011; Williamson, 2011; Wise, 2004), but these may well operate in different ways for men and women. Future research is needed on the different resources and experiences of different cohorts as they age—and on the heterogeneity of resources and experiences depending on one's gender, but also on one's race/ethnicity, nativity, education, occupation, and disability status—in the context of both outdated and innovative institutional arrangements.

### Cumulative Advantage/Disadvantage

A key theoretical and empirical question that could benefit from an institutional/life course approach to advance the study of aging is: Does growing older *amplify* or *reduce* existing disparities (by gender, socioeconomic position, race/ethnicity, and their intersections) in stressors, health risks, and material or emotional resources? *Cumulative advantage/disadvantage* theory proposes that the amplifying process has been the case historically (Dannefer, 2011; O'Rand, 1996; Wilson, Shuey, and Elder, 2007). A variant of cumulative advantage/disadvantage proposes heightened disadvantage as a result of a cumulation of adverse risk factors (Ferraro, Shippee, and Schafer, 2009), and the fundamental cause approach holds that existing social-locational inequalities persist throughout adulthood despite medical advances that are disproportionately allocated to or adopted by those with higher levels of education (Link and Phalen, 1995). But an alternative, *age as leveler* hypothesis suggests that institutional arrangements advantaging older Americans may help to attenuate economic and health disparities with age (Berkman, Ertel, and Glymour, 2011; Herd, Robert, and House, 2011). However, studies of age as a leveler need to take into consideration the differential mortality of different subgroups.

Life course scholars have shown that rewards in later adulthood accrue to those following the standardized lock-step life course of first education and then continuous full-time work, an option available to increasingly fewer individuals and never a reality for most women, the poorly educated, or minorities (Han and Moen, 1999; Moen and Roehling, 2005). As an example, Elman and O'Rand (2004) find that those Boomers who went back to school to obtain college degrees in midlife (typically women and minorities) did not receive earnings commensurate with those who obtained their degrees prior to beginning their full-time labor market participation. An important question for future research: Is it still the case that being "off-time" in transitions continues to matter, in light of the fact that labor market and family transitions no longer adhere to strict templates as to timing, sequence, or duration?

In contrast to the medical model focusing on helping individuals who are already sick, a growing body of scholarship emphasizes illness prevention, and with it the value of theorizing inequalities in illness and dependency as the consequence of existing, but *modifiable* social conditions (Berkman and Kawachi, 2000; Syme, 2007). Health is improved or hindered by age- and gender-graded paths and possibilities embedded in existing systemic arrangements shaping family, education, work, retirement, religion, health care, and communities. An example, Medicare insurance becomes available only at age 65, constraining the health care of those older Americans (often women) out of work or without work-related health insurance. Future research advances can come from understanding the ways institutionalized social factors affect health, as well as from investigations of the health impacts of emerging innovative arrangements. This promising research agenda could capture the significance of existing—and emerging—institutional conventions and conditions for both life chances and life quality over the life course.

### RISK AND UNCERTAINTY IN THE CHANGING LIFE COURSE

An example of ways institutions reflect past solutions to past social problems: earlier 20th-century concerns about economic insecurity and mortality hazards produced historically organized ways of insuring against risk in old age, in the form of the taken-for-granted institutionalization of life insurance, Social Security, SSI, disability policies and long-term care insurance (see also Costa, 1998; Gruber and Wise, 2004). In the middle of the past century, Social Security provisions (such as linking levels to earnings histories), mandatory retirement ages, and the development of defined benefit pensions served to institutionalize retirement as a taken-for-granted one-way, one-time status transition protected from extreme income insecurity (Costa, 1998; Henretta, 1992; Kohli, 2007). But, as an example of unequal distribution of risk in later adulthood, Quadagno (1994) describes how domestics and farm workers were initially excluded from Social Security policy, thereby fostering racial disparities. Scholarship reinforces that insurance against risks continues to be unevenly distributed, with a distinction between public policies framed as “insurance” and policies framed as providing (often means-tested) “assistance” (Estes et al., 2009).

### Aging as a Risk for Society

Research underscores that risk is also a way policy makers and practitioners are framing the “problems” of an aging society, producing a focus on older individuals as inherently “at risk” (Carr and Muschert, 2009). This risk approach to later adulthood defines old age (and population

changes producing rising numbers and proportions of older people) as a *social problem*, creating challenges for the larger society. This framing, in turn, sets the stage for a politics of aging grounded in a scarcity model of intergenerational conflict and a medical/biological model of the inevitability of disability and dependency with increasing age (Estes and Associates, 2001; Estes et al., 2009; Hudson, 2005, 2009; Pampel, 1994). It also produces social arrangements (such as health-care practices, residential facilities, and the potential privatizing of Medicare and Social Security) that both diminish the autonomy of older adults and emphasize the dependence of frail older adults, often ignoring others in the same age group who are not at risk.

Another potentially rich area for inquiry involves the ways age is being socially constructed (Berger and Luckmann, 1966) to take on biomedical, commodified, privatized, and rationalized aspects (Estes, 2004; Estes and Associates, 2001; Estes et al., 2001, 2009). The biomedicalization of aging emphasizes aging as a *medical problem* associated with disability and dependence, along with the behavioral and policy implications of this medicalization approach. “Commodification” of old age relates to services and goods that are bought or sold. What Estes and Associates (2001) call the *aging enterprise*—pension programs and businesses focused on older people—further serves to differentiate older from younger adults through the use of age thresholds and programs that effectively “commodify” old age. Commercial efforts amplified in the mass media create age groups and cultures as “cultural fields,” such as the youth culture, a set of products and practices of young people (especially related to their leisure and buying of goods and services; see Capuzzo, 2001) that continue to define the beliefs and behavior of the large Boomer cohort. “Privatization” has to do with the financing of health insurance, social services, and health care through the private sector, a trend that may promote rather than reduce inequality. “Rationalization” of old age refers to the provision of care in the most efficient ways, with cost concerns and cutbacks often trumping the quality of the care provided, even in nonprofit organizations providing medical and social services.

### Exposure and Vulnerability

In another body of literature sociologists, demographers, and social epidemiologists theorize *exposure and vulnerability* to the risks of poor health and mortality as systematically stratified by age, gender, and other social-locational markers (such as education, income, labor force status, nativity, occupation, race/ethnicity, and marital status). Pearlin’s (1989, 2010) stress process model theorizes the importance of the structural contexts of lives contributing to disparities in the risks of chronic stress exposure and

in the personal and social resources and capabilities with which to deal with both chronic and acute stressors. Life course epidemiologists model the health impacts of risk exposures at different ages and life stages (Davey Smith and Lynch, 2004; Kuh and Ben-Shlomo, 2004), as well as the accumulation of risks through the life course. However, Syme (2007) warns against an exclusive focus on classifications of health risks, encouraging scholars to focus instead on the social, environmental, and community forces contributing to them.

Most existing social institutions are (deliberately or not) designed to produce age-graded distinctions that affect the allocation of goods, services, income, risks, and opportunities for those of different ages. (Thus, educational scholarships are available for “college-age” young people; entry-level jobs are expected to be filled by “young” adults; academic tenure is based on both productivity and years in the system; pensions are “earned” through years of service.) These arrangements can exacerbate, perpetuate, or reduce age, gender, or socioeconomic inequalities in health and other outcomes. For example, there is some evidence that age-graded policies (such as Social Security and Medicare) actually mitigate prior disparities in income, health care, or health outcomes. An empirical example: Herd, Schoeni, and House (2008) drew on census data to investigate whether within-state changes in maximum SSI benefits lead to changes in disability among those aged 65 and older, theorizing that changes “upstream” in socioeconomic status through income supports would reduce subsequent health problems. They found that more generous state benefits—specifically a \$100 increase in SSI benefits—produced lower disability rates (in terms of reporting having a mobility limitation). This provides tantalizing support of the idea of *age as a leveler*, in that modifications with age to individuals’ socioeconomic position (in the form of increasing income supports in later adulthood) can improve health, among even the poorest Americans.

An important theoretical focus with potential for future research advances is on “upstream” risk factors very early in the life course (such as parents’ education and childhood deprivation) affecting older adults’ life chances and life quality. However, this framing could result in scholars paying insufficient attention to (1) the ways people’s *current* social location moderates or exacerbates risk factors at every stage of the life course; (2) the disparities in exposure, duration, and vulnerability to risk factors and disparities in actual health outcomes, not only across, but also *within* social groups; (3) the ways biographical pacing and pathways (trajectories and transitions in employment, family, education, military service, neighborhood residence) change income, knowledge, perceived mastery, and other psychosocial resources, and, in doing so, perpetuate, exacerbate, or moderate risk exposures and vulnerabilities; and (4) how risk exposures and vulnerabilities are shifting within as well as across larger populations,

including the increasing risks of downward mobility among previously “advantaged” groups. An empirical example of how risks change is a Health and Retirement Study (HRS) showing that, unlike with younger workers, job strain is not related to older workers’ (average age 60) alcohol misuse, though it is related to their depressive symptoms.

In line with these considerations, Kuh and Ben-Shlomo (2004, p. 458) argue for the need for life course epidemiologists and policy makers to move beyond childhood interventions to “identify opportunities to break adverse chains of risk at other life stages” (see also Berkman et al., 2011). Their emphasis on the need for policies around adolescent and early adulthood transitions “to provide not just safety nets but springboards to alter life course trajectories with benefits for subsequent health” could also be applied to transitions throughout older adulthood. Consider, for example, the effects of taken-for-granted policies that limit access by age (such as Medicare at 65) or age discrimination related to limiting the rehiring of laid-off older workers.

Risk is also rooted in the theory of socioeconomic position as a *fundamental cause* (House, 2002; Link and Phelan, 1995, 2002) of health disparities. A promising future sociological research agenda on age, health, and well-being would build on a growing body of work emphasizing the embeddedness of individuals in particular social structures with corresponding risks, rules, claims, and resources that shape their beliefs, behaviors, health, and life quality *over the life course* (see House, 2002; Link and Phelan, 1995; Lutfey and Freese, 2005; Phelan and Link, 2005; Phelan et al., 2004; Tilly, 1998; Turner, Wheaton, and Lloyd, 1995; Wheaton and Clarke, 2003).

The fundamental cause theoretical approach suggests that changing the allocation and distribution of key socioeconomic resources (such as education and income) early in life may well be the best way to prevent health and mortality risks and to reduce disparities in them (Hasse and Krücken, 2008; Hayward and Gorman, 2004). But adult development and aging are not simply *path dependent*, unfolding as a result of childhood experiences and early adult choices. (Related to this focus on the early life experience, Kuh and Ben-Shlomo [2004] suggest that “magic bullet” policies of a particular pill or early biological programming of fetal or infant growth are deeply suspect.) Rather, development throughout adulthood takes place within interdependent structures and schemas of interpretation (institutions) guiding its progression and possibilities through processes of allocation, socialization, and strategic adaptation throughout the life course. A promising area of future inquiry concerns *institutionalized mechanisms*: how the social organization of education, occupations, neighborhoods, consumption, and health care perpetuates differential access to and quality of information, medical treatments, income, stress, self-esteem, and other

resources, along with different lifestyle behaviors (such as smoking, exercise, and diet/eating habits).

Stress process and life course scholars (e.g., Avison et al., 2010; Elder, 1974, 1998; Moen and Chesley, 2008; Pearlin, 1999; Pearlin et al., 1981, 2005) underscore the fact that both resources and claims shift with time, altering the social environments in which lives play out. For example, it has been well established in observational research that social conditions of work matter for health and life quality, including positive self-conceptions, depressive symptoms, and behavior, as well as heart disease (e.g., Kahn, 1981; Karasek, 1979; Karasek and Theorell, 1990; Keyes, 1998; Kohn and Schooler, 1982; Mirowsky and Ross, 1998; Muhonen and Torkelson, 2004; Ross and Mirowsky, 1992; Ryff and Keyes, 1995; Thoits, 1999; Wheaton, 1990). But how are favorable social conditions of work *and of retirement* distributed by age and social location? Much is known about healthy work and the psychosocial job conditions promoting physical and mental health, but the impacts on health and well-being of psychosocial *retirement conditions* have *not* been as fully investigated.

Rather than focusing on health care or the treating of medical conditions once they have arisen, scholars are increasingly pointing to the value of social and economic policies as “health” policies, in terms of the potential for policy initiatives lessening the risks of socioeconomic, gender, racial/ethnic, age, and other inequalities at all ages and life stages. This opens up a fertile future research agenda when prevention is framed as social and economic policies, such as those shaping labor markets, social welfare, housing, and pensions, not only health-care policies (Hedge and Borman, 2012; Mechanic, 2006; Schoeni et al., 2008; Syme, 2007). Even ostensibly “age-neutral” policies and practices are often age-graded. For example, a cable company has launched an initiative to “Bridge the Digital Divide” by providing poor households with a computer and Internet connection for a low monthly fee. But “eligibility” is defined by whether the household has a child who qualifies for free breakfasts at school, effectively removing the households of older adults from the pool.

### A New Risk Environment

Scholars are increasingly theorizing “risk” as characterizing the contemporary life experience, concomitant with an uncertain global economy, new information technologies, and the unraveling of conventional employee protections around job security and conventional retiree protections around health insurance and income security (Beck, 1992; Blossfeld, Buchholz, and Hofäcker, 2006; Neumark, 2000; Quadagno, Kail, and Shekha, 2011; Schmid, 2008; Taylor-Gooby, 2004; Williamson, 2011). Taylor-Gooby (2004) defines new social risks as “the risks that people now face in the

course of their lives as a result of the economic and social changes associated with the transition to a post-industrial society” (pp. 2-3). One set of risks emerges from the need for two incomes to support a family and the attendant difficulties of integrating work and family obligations. Another comes from the rising numbers of older people, along with gendered and family-based patterns of care (Daly, 2001; Pavalko, 2011; Saraceno, 2008). Third are changes in a labor market that has become globally competitive, interdependent, and unpredictable. The risk concept has moved beyond simply safety nets, given that existing safety nets are both increasingly costly and eroding, producing a need for future scholarship capturing the escalation of uncertainty and risk now being institutionalized in the form of temporary jobs, the erosion of the contract linking seniority with job security, and the dismantling of economic security in the move from defined benefit to defined contribution pension programs.

A combined institutional and life course research agenda theorizing and investigating age-graded risk would emphasize the ways both the structures and cultures of society (and the social policies and processes they generate) operate so as to unevenly distribute risk across social groups and how these disparities shift with age, life stage, and across cohorts. Research is needed on how established protections for older adults are at risk of diminishing or even unraveling (being deinstitutionalized) and how *institutional entrepreneurs* might be responding with the development of new arrangements. Sociologists, demographers, and social epidemiologists can make real contributions to science and society by investigating whether and under which conditions deliberate *shifts* in social structures—including policy regimes shaping retirement, civic engagement, education, housing, income supports, and paid work—produce corresponding shifts in exposure to and durations of risk factors contributing to poor health and mortality. Income and insurance supports (such as Social Security and Medicare aimed at later adulthood), SSI programs (aimed at those with a disability), and private-sector pensions and disability insurance can be key mechanisms for reducing socioeconomic disparities in health and risks among adults as they age. Required are systemic programs of research similar to that by Herd, Schoeni, and House (2008) showing that later-life income supplements can reduce self-reported disability. A first step is investigating existing institutionalized social environments to locate antecedents, exacerbators, and moderators of later adulthood disparities in risks and protective factors. Second is documenting how policies, risks, and protective factors *change* over the life course, across cohorts, and *over* historical time (c.f. Van Dalen and Henkens, 2002). These are especially promising directions for future research and theory development. Most fruitful would be *multilevel, longitudinal* analyses and randomized field experiments in organizations and communities incorporating policies and practices into the dynamic analysis

of risk processes and mechanisms by locating individual (micro-level) risk behaviors and other outcomes within the shifting macro-level contexts of nations, states, regions, or cohorts (and/or more meso-level forces across workplaces, work groups, local government agencies, social networks, voluntary associations [such as Senior Centers], neighborhoods, or medical clinics) (see also Silverstein and Giarrusso, 2011).

A promising future research agenda on risk based on a combined life course and institutional theoretical framing would draw attention to the multilevel factors shaping the processes culminating in risk behaviors, such as obesity, smoking, or insufficient sleep. It can also help to identify other age-graded institutionalized pathways and mechanisms promoting health and well-being. Scholarship to date often seeks *individual-level* explanations, ignoring the larger socioeconomic, policy, and organizational systems shaping them. Considerable future study is needed as to why and how risks and risk-related behaviors are socially distributed by education, race, gender, *and* age (and their intersections), and how institutionalized age-graded policies and practices can *reduce* as well as exacerbate risk.

### SOCIAL INTEGRATION/SUPPORT/ISOLATION

Closely aligned with themes of age stratification and health risks are the concepts of *social integration* (and related concepts of engagement and participation), *social support*, and *social isolation*. These, too, are institutionalized in terms of role allocations and expectations; as individuals age, they exit the traditional adult roles of gainful employment and childrearing—both key sources of social integration—typically without moving into other public or family roles (other than that of care-provider for infirm relatives and grandparenthood). Some (Berger and Luckmann, 1966; Durkheim, 1897 [1951]) see institutions like the family, religion, and community organizations as key *intermediary mechanisms*, mediating institutions buffering individuals from the larger bureaucratic forces of markets and governments (see Figure 9-2).

But fundamental changes in the institutions of marriage and the family (c.f. Cherlin, 2009) and changes in family demography (in the form of fewer children, parenthood initiated at later ages, increasing divorce and remarriage, growing legitimacy for same-sex marriages, the high proportion of unwed pregnancies, and marriage or parenthood forgone) are challenging established norms about filial responsibility and reducing (or sometimes expanding) the networks of kin available for and willing to care for ailing older relatives. Extended durations of family relationships as a result of increasing longevity also change the nature of kinship ties, meaning that generational roles are lasting longer than ever (Saraceno, 2008), increasing the odds of older adults becoming care-providers for even older aging

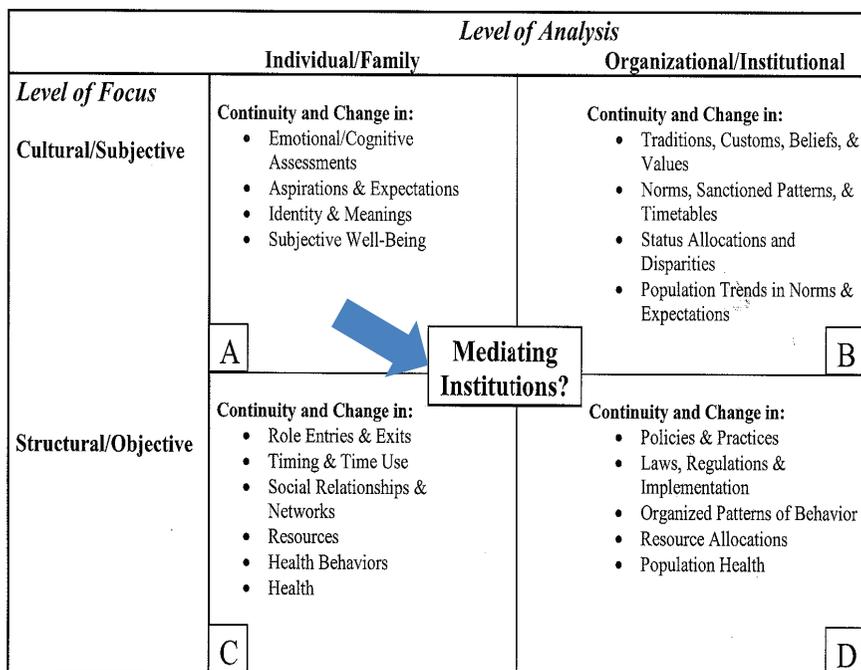


FIGURE 9-2 Different levels of analysis and focus.

parents/infirm spouses as well as sources of economic support for their adult children. Marriage is an important form of social support and has been linked to reduced illness and increased longevity. But divorce and step-families, along with lower fertility rates, have increased the odds that older adults will move through their later years alone, with little family support. Women are more apt than men to be or become single (due to different widowhood, remarriage, and mortality rates). An extended kinship system, long believed to be key source of support for African Americans, may no longer be operating as such (see Brewster and Padavic, 2006; Franklin and Ragoné, 1998; Moller, 2006; Wilson, 1987). What is not known is under what conditions kinship and/or personal ties promote greater stress or support, or some mix of both, how this changes over the life course, and the consequences for individual health and well-being.

Essential for future theory, research, and policy development on aging in the 21st century is recognition that institutionalized policies and norms undergirding the standardized life course (based on education in youth, childrearing, and employment through earlier adulthood, and withdrawal from these roles in later adulthood) mean *progressively fewer*

*institutionalized options with age for meaningful public engagement*, even as the proportion of (healthy) older Americans is expanding exponentially (Freedman, 2011). The primacy of paid work and the (male) career mystique are reified in policies that support and reward (with pensions and Social Security as well as income) the lock-step patterns of continuous full-time work followed by the continuous full-time leisure of retirement, based on middle-class, white, married men's experiences in the middle of the 20th century. What opportunities do exist for continued public engagement in later adulthood are not evenly distributed; for example, an HRS study found that educated older adults are more apt to be engaged as formal volunteers for organizations than those less advantaged (McNamara and Gonzales, 2011; see also Cutler, Hendricks, and O'Neill, 2011; O'Neill, Morrow-Howell, and Wilson, 2011).

A life course/institutional approach also points to the potential payoffs of innovative scholarship on changes in social integration as a result of life transitions resulting in the movement of individuals into, out of, or through institutions, occurring in the contexts of both expectations and large-scale transformations. Transitions out of paid work, the onset of disability, or chronic health conditions can trigger changes in network ties, possibly precipitating greater isolation (Cornwell, Laumann, and Schumm, 2008; Smith and Christakis, 2008). A turbulent economy, unexpected layoffs, and spells of long-term unemployment limit opportunities for paid work in later adulthood, even as paths to other public roles (such as unpaid community service) are not always clear. Because research evidence underscores the importance of social relationships and meaningful activity for health and well-being (see Berkman and Breslow, 1983; Berkman and Syme, 1979; House, Landis, and Umberson, 1988; Rowe and Kahn, 1998; Umberson, Crosnoe, and Reczek, 2010), there has been a focus on productive engagement in later adulthood (Morrow-Howell, Hinterlong, and Sherraden, 2001). But this approach is often based on a choice model and can lead to blaming individuals who are not engaged for their own social isolation. As Estes, Mahakian, and Weitz (2001, p. 194) observe: "The use of the productive aging concept obfuscates what is a macro problem—a society that stigmatizes and 'throws away' a particular age segment (and more) of its people—and redefines it as a micro problem of individuals who are aging."

### CONSTRAINED AGENCY: CONTROL CYCLES, ADAPTIVE STRATEGIES

Loose coupling between institutionalized rules, policies, and conventions, on the one hand, and organizations, families, or individuals on the other, opens up opportunities for agency in the form (individual, family, or organizational) of nonconformity, noncompliance, lip service, innovation,

and change. The concept of agency is defined by Emirbayer and Mische (1998, p. 970) as “temporally constructed engagement by actors” operating through “the interplay of habit, imagination and judgment.” Similarly, Mortimer and Shanahan (2003) define agency as the ability to exert influence on one’s life. Sociologists’ attention to agency parallels the importance psychologists and social psychologists place on the concept of *control* or *mastery* (c.f. Bandura, 1976, 2001; Gecas, 2003; Pearlin et al., 2007) and the emphasis by epidemiologists and occupational health scholars on the importance of (job) control for health and well-being. Sociologists point to the unequal distribution of control (agency/mastery), with life course scholars in particular emphasizing “cycles of control” that ebb and flow over the life course (Elder, 1974, 1985, 1998; Moen and Spencer, 2006; also Shanahan et al., 1996).

Importantly, agency (mastery/control) is not simply the absence of constraining social structures; rather, *degrees of choice and control are institutionalized within the social organization of and power distribution in roles and relationships*. Some policies, practices, and conventions permit greater opportunities for agency than others (see, for example, a workplace innovation giving employees greater control of their work time in Kelly, Moen, and Tranby, 2011; Moen et al., 2011). For example, children cannot “choose” whether or not to attend grade school, but older adults with sufficient economic resources can choose to go back to school, whether formally in colleges or informally in institutions like Elderhostels. Thus, agency is itself a variable, with individuals having more or less control over their lives depending on their location—within history (Hitlin and Elder, 2007), within institutionalized social structures (Marshall, 2005), and within existing age-related exigencies (such as level of income or poor health).

Control (mastery/agency) operates within the cultural dimensions of institutional *logics* (Thornton and Ocasio, 2008; see also Friedland and Alford, 1991; Meyer, 2008; Meyer and Jepperson, 2000; Scott et al., 2000), the principles and vocabularies of motive defining the meaning, beliefs, and practices of institutions. Individuals and organizations are embedded within different (and sometimes contradictory) institutional logics dictating both legitimate goals/values and the legitimate means with which to achieve them. What is important is that these very contradictions can open up opportunities for greater agency and institutional change. Moreover, actors reproduce or change structures in “interactive response to the problems posed by changing historical situations” (Emirbayer and Mische, 1998, p. 970). When there is *loose coupling* or *decoupling* (deliberate disconnects) between institutionalized means and goals (Boxenbaum and Jonsson, 2008), or across what Settersten and Gannon (2005) call “adjacent” institutions (such as government and business, or work and family), there is sometimes greater room for discretionary action (see also Merton, 1968).

An innovative research agenda investigating the links between institutions, age, and the life course should attend to two promising concepts—*control* and *strategies of adaptation* as worthy of further theoretical development and analysis.

### Control

While agency is often discussed broadly as a philosophical issue (Meyer and Jepperson, 2000), analogous concepts of mastery and control have been theorized and empirically tested as key components of risk (the absence of control) and resilience (control or mastery as a protective factor (see Avison et al., 2010; Fry and Keyes, 2010; Pearlin, 2010; Pearlin et al., 2005, 2007). In his job strain model linking stress and negative health outcomes with high psychosocial demands and low job control, Karasek (1979, p. 290) describes job control as an employee's "potential control over his tasks and his conduct during the working day," operationalizing job control as having two related components: "decision authority" and "intellectual [or skill] discretion." Building on Karasek (1979) and Karasek and Theorell (1990), scholars have theorized the importance of job control for health, demonstrating empirically in observational studies (cross-sectional and longitudinal) that job control (over how work is done) has both direct and buffering effects in reducing the risks of strain and the impacts of stress on health and well-being. Job control has been empirically linked to exhaustion and depressive symptoms (e.g., Mausner-Dorsch and Eaton, 2000), happiness (e.g., Argyle, 1999), psychophysiological stress responses (e.g., Lundberg, 1996), blood pressure and mood (e.g., Rau and Triemer, 2004), alcohol use (e.g., Tinney, 2003), heart disease (e.g., Bosma, Stansfeld, and Marmot, 1998), mental and physical health (e.g., D'Souza et al., 2003), work-family conflict and strain (e.g., Thomas and Ganster, 1995), and a more integrated concept of organizational wellness (e.g., Bennett, Pelletier, and Cook, 2003). Thus, there is ample evidence in the occupational health literature linking job control (decision latitude and skill discretion) with health and well-being (see also Van Der Douf and Maes, 1999). Note that this research is on working-age populations, with age considered only as a control. But this body of work suggests the importance of future research on control among older adults, both in the form of a sense of mastery and in terms of control over the amount and type of their engagement in employment, (grand)child care, caregiving for aging spouses and parents, and the timing of retirement.

Congruent with this approach, there is a great deal of research in the occupational health literature looking at person-job "fit," as well as the role of job control in moderating the effects of job demands (Muhonen and Torkelson, 2004), suggesting a potentially fruitful research agenda on "fit"

in older adulthood. In his Effort-Reward Imbalance Model, Siegrist (1996) broadened the job strain model to theorize the impacts of the mismatch between workloads and control over long-term rewards (such as job security, self-esteem, and income, as well as opportunities for advancement), a mismatch that may push older workers out of the workforce or require them to put off a retirement they cannot afford.

While *job control* is theorized as a key risk factor impacting mortality and health, *retirement control* may encompass control over the timing of retirement and control over the nature of the exit (voluntary/involuntarily, a gradual or a sharp exit, multiple exits/re-entries), as well as control over the *conditions* of life in retirement. But this has not been theoretically developed. Do older adults have real control over the tasks, scheduling, and conduct of their days and the use of their skills? How is control institutionalized and distributed across subgroups in the later adult years? These are fertile areas of future inquiry.

Control over work time and over the timing of the retirement exit from paid work has received little attention in this literature. And yet temporal work conditions that offer older employees greater *schedule control* in the form of greater flexibility and work-time options, and greater *retirement control* may be especially important for older employees, given the increasing time pressures, time speed-ups, and time conflicts characterizing a global risk economy (see Ganster, Fox, and Dwyer, 2001; Hochschild, 1989, 1997; Kelly and Moen, 2007; Moen and Kelly, 2009, as well as Lesnard, 2008; Thomas and Ganster, 1995). An Amsterdam study (Cooper et al., 2011), for example, shows complex links between mastery and disability, which suggests a rich topic for future research.

A sense of mastery or control is both a function of the institutionalized social environment *and* a contributor to individuals' decisions to *change their environments*. It is also part of the "vocabularies of motive," in terms of how individual actors define their situations and their past actions. To understand individual and organizational behavior requires understanding of the institutional contexts that not only define appropriate behavior but also provide explanations or accounts of that behavior, often couched in the language of choice and control (Friedland and Alford, 1991; Sewell, 1992). This attention to meaning and control is crucial in the study of aging, health, and life course trajectories and transitions, in that individuals define and assess their age-graded behavior (such as retirement, employment, and residential mobility) as voluntary or involuntary, expected or unexpected, with corollary health outcomes. For example, a retirement exit can be seen as a passage to (well-deserved) leisure, the unwanted result of downsizing and accompanying (early) retirement packages, the result of a health condition, a necessity in order to care for spouses or parents, or a transition to

a new career (as in exits from a military career into a “civilian” one), with adults perceiving different degrees of choice.

### Adaptive Strategies

Life course scholars (e.g., Elder, 1974; Elder and Johnson, 2002; Elder, Johnson, and Crosnoe, 2003; Marshall, 2005; Moen and Wethington, 1992; Settersten and Gannon, 2005) describe how individuals and households confronting situational exigencies typically respond according to institutionalized blueprints. But in times of social change and in the absence of relevant blueprints, or else when different sets of rules associated with different institutions (such as work and family) seem to contradict one another, or when there is loose coupling between goals and means (see also Elder and O’Rand, 1995), actors try out various *strategies of adaptation* (Moen and Wethington, 1992) in seeking to meet the challenges of their lives. One of Elder’s key life course principles is that people fashion their own life courses, making choices within the confines of the times and circumstances of their lives (Elder and Johnson, 2002). An institutional/life course perspective suggests that the *toolkits of possible adaptive strategies* are themselves constrained at different ages and life stages by existing structures (schematic and material resources; see Sewell, 1992), with the degree of personal control socially stratified and unevenly distributed across the life course.

An example of the way institutional arrangements limit or expand adaptive strategies in later adulthood (and in doing so affect geographical population distributions and compositions as well as health and well-being) is in decisions around residential shifts versus “aging in place” (Haas and Serow, 2002; Krout and Wethington, 2003; Longino, Perznski, and Stoller, 2002; Streib, 2002). Consider the development and proliferation of residential communities for “active adults,” typically aged 50 and older, an emerging institutional arrangement specifically commodifying old age that is selectively available to those who are both healthy and well-off. Older adults with sufficient wealth and income may choose to move to such communities or simply to apartments or condos in warmer climates. These are what Gilleard and Higgs (2005, p. 132) call “silver-agers,” poised to “transform the chilly landscape of later life” by making what Longino terms “amenity” moves (Longino, Perznski, and Stoller, 2002). By contrast, older adults with low incomes have few choices as to whether or not to relocate except to nursing homes or subsidized group residences or else to move in with their adult children. Other recently institutionalized housing arrangements are Continuing Care Retirement Communities (see Krout and Wethington, 2003; Krout et al., 2002), but these, too, are only available for those who can afford them. Programs established in the 1960s, such as

“meals on wheels,” aim to facilitate older adults remaining in their own homes. But, older singles who “choose” to live alone in their own homes can be especially at risk of social isolation even as they may feel a greater sense of agency. Future study of how institutions articulate with the choice and nature of living environments may be increasingly significant for understanding aging processes.

### TIME, PLACE, AND SOCIAL CHANGE

Sociologists can promote understanding of both behavior and life quality in the aging process by investigating the ways time, age, and the life course are socially organized; institutionalized time and age regimes are both simultaneously invisible *and* fundamental to the human experience. The concepts of “time” and “place” point toward institutionalized regimes defining where and when different behaviors should occur; they also serve as markers of the (institutionalized) contexts of history, political regimes, cohorts, and cultures, both as they exist and as they change over time. Temporal structures of some sort are, of course, essential for coordination and regulation. Durkheim (1912) observed the regulatory aspects of the calendar as an expression of “the rhythm of collective activities, while at the same time its function is to assure their regularity.” And Merton (1968) highlighted the importance of socially structured durations. But little is known about the temporal regularities and socially expected durations of those older people whose lives are no longer organized by paid work.

When scholars locate individuals within existing institutions, there is the danger of treating the organized structural environment as fixed, the background or stage upon which the experiences of social actors (individuals or families) play out. It is hard but essential for innovative research over the coming decades to study changing lives *and* changing structures, as well as the links (including mismatches) between the two. For example, what does it mean to grow old in a society that is itself growing older? Gilleard and Higgs (2005, p. 147) suggest that changing norms and practices potentially free individuals from outdated arrangements: “The weight of neighbourhood, work and family traditions has become less heavy.” Another example, the increasing proportion of the older population who are healthy challenges traditional images and identities associated with growing older. It also suggests the future importance of a powerful interest group of older voters that is already shaping social policies (Campbell, 2009).

As Riley (1998, p. 151) points out, “changes in lives and changes in social structures are fundamentally interdependent.” Promising future research directions lie in capturing the power of social life in influencing individual development and aging even as “social contexts, no less than individuals, are continuously reconstituted in social activity” (Dannefer,

2011, p. 12). Scientific and social advances can occur through theory development and policy analysis of the ways policy makers' efforts to respond to 21st-century realities of an aging population are having both deliberate and unintentional (as well as sometimes contradictory) effects on the multilayered, overlapping social structures shaping age, aging, and the life course paths. For example, the shift to delay full Social Security benefits to age 67 and the movement away from defined benefit private pensions are transforming the taken-for-granted clockworks of retirement. In what ways is the Age Discrimination in Employment Act of 1967 together with changes in the tax code facilitating post-retirement employment?

Lives are lived upon a multilayered moving platform of change that is either (1) reproducing or reconstructing existing institutionalized assumptions or arrangements, (2) challenging existing institutionalized assumptions and arrangements, or else (3) constructing and legitimizing new ones. Hargrave and Van de Ven (2006) describe four modes of institutional change: (1) *institutional design*, deliberate efforts at changing policies and practices; (2) *institutional adaptation*, changes made in order to conform to external environmental forces; (3) *institutional diffusion*, as when some arrangements are widely adopted and spread; and (4) *collective action*, when political behavior leads to the development of new institutions. It is the fourth form that is the least understood. Studies promoting understanding of *changing social institutions and contexts* shaping the aging process, therefore, need to be incorporated into a research agenda investigating the links between social structures, aging, and individual outcomes in order to identify promising interventions to promote life quality and life chances.

## FUTURE DIRECTIONS

There is a multiplicity of social institutions (policies, programs, practices, conventions) structuring the expectations and choices, transitions and trajectories, risks and resources (including health and well-being) of adults as they move through later adulthood. This chapter has provided an overview of fundamental concepts in sociology, demography, and social epidemiology that, when combined with an institutional and life course framing, suggest potential for major theoretical and empirical advances.

Studies of the aging process could be considerably advanced through conceptual, theoretical, and methodological reformulation that incorporates and infuses both institutional and life course framings with central social science theories and constructs. The result? A fruitful research program encapsulating both *institutional embeddedness* and multiple layers of individual, family, organizational, policy, and societal *change* (as depicted in Figure 9-1). I propose four ways of organizing scholarly inquiry with

possible payoffs for the development of new knowledge about the aging process and the promotion of policy agendas.

### Moving Beyond Individuals as the Unit of Analysis

Theory and research on aging to date tend to focus on proximal *individual* predictors of outcomes, not larger (institutionalized) contexts, processes, and mechanisms (Syme, 2007). To address larger questions about the impacts of the conventions, policies, and practices institutionalizing social life requires comparative, ecological, panel, and/or intervention research designs looking at multilevel collective properties and empirical social processes. Sampson (2010, p. 72) notes that survey research with an emphasis on precise population estimates for individual parameters continues to rule the roost. He proposes: “The basic idea is take the measurement of ecological properties and social processes as seriously as we have always taken individual-level differences.” Sampson (2010, p. 72) also points to the need to “take seriously the study of community-level processes in their own right.” To that I would add to take seriously organizational, occupational, associational, regulatory, family, and governmental policies and conventions as well, as they intersect with individual lives in later adulthood to shape health and multiple aspects of the aging process.

A research program of comparative cross-cultural and cross-cohort analysis is essential for revealing the *socially constructed nature* of (within country and within cohort) age- and gender-based divisions and supports, as well as understanding the impact of existing *and emerging* institutional regimes on individual experiences, such as gendered employment paths and the timing of retirement (Blossfeld and Hofmeister, 2006; Ebbinghaus, 2006; Kohli et al., 1991; Schmid, 2008).

### Studying Social Change Within and Across Cohorts

A rich research agenda lies in understanding agency in the form in which individuals negotiate conflicting institutionalized norms and arrangements as they age, as well as the ways social actors are changing both norms and policies in light of increasing life expectancy and a turbulent global economy. Tied to this agenda is understanding the impacts of these changes on the experiences, risks, and resources of different cohorts and different subgroups of the population.

Institutionalized beliefs, expectations, practices, and structures shaping later adulthood risks and possibilities are both deliberately *and* inadvertently changed in transaction with other social forces, including the aging of the population, the Boomers swelling the ranks of older workers, new technologies, and an uncertain global economy. Important future research

questions are as follows: What are the impacts on aging processes of a global information economy combined with the new flexibilization of work that is destroying the conventional social contract linking seniority with security? How is the deinstitutionalization of “normal” retirement affecting the self-concepts, expectations, preferences, and decision making of older workers and retirees (men and women) in different cohorts at different ages and stages? Studies are needed investigating how changes in the structure of the employment relationship are articulating with other structural changes in the economy to reshape the job insecurity and retirement exits of older workers (see also Neumark, 2000).

Another fundamental matter for future research on aging is whether and to what extent *deliberate changes* in social structures (such as loosening the time/age cages around retirement and employment) can produce corresponding changes in the health and well-being outcomes of older Americans. Deliberate policy shifts can also change social structures, challenging taken-for-granted expectations and practices (*structural leads* rather than *lags*). I see four possible avenues for change that might delay exits from the workforce, all requiring considerable lines of investigation:

1. Reframe the standard duration of work days, work weeks, and work lives to include more options.
2. Develop new standards or norms regarding work *sabbaticals* for workers in a range of occupations, as well as possibilities for *scaling back* on time demands.
3. Facilitate possibilities for *second, third, or fourth acts* in schooling, civic engagement, and employment for people of all ages.
4. Modify *social insurance policies* and promote *training and skill upgrades* for older workers to respond to the risks and transitions of a turbulent labor market, reduced job stability, and chronic job insecurity.

Fundamental questions for a course of future research have to do with such structural changes in schematic and material aspects of aging and social entrepreneurs fashioning *structural leads*: What organizations and agencies are introducing transformative innovations in career paths, retirement options, education/training opportunities, civic engagement, and illness prevention? What innovative policies regarding work time, retirement timing, health care, education, and income would promote alternative and flexible employment paths that might promote the mastery, health, and well-being of older Americans?

Urie Bronfenbrenner (2005) often said (quoting his own mentor, Charles Dearborn) that if you truly want to understand something, try to change it. Kuh and Ben-Shlomo (2004, pp. 454-456) and Berkman, Ertel,

and Glymour (2011) point to the importance of intervention studies and natural experiments that can provide the best evidence in terms of causality, direction of effects, and the importance of factors not commonly considered in public health research, noting the potential value of systematic literature reviews and meta analyses. Important topics for aging research within and across cohorts include how peoples' sense of efficacy, mastery, or *control* over their lives shifts behavior (such as the incidence and timing of employment and family transitions); how (expected and unexpected, voluntary and involuntary) *transitions* alter older adults' sense of control; and whether unraveling institutional arrangements promote or detract from feelings of control.

### Capturing Social Heterogeneity, Risk, and Inequality

There is increasingly a range of diverse paths by which people age, but insufficient scholarship theorizing and empirically assessing whether and under what conditions taken-for-granted, institutionalized age-graded regularities continue to operate, as well as the costs of deviating from the standardized life course. For example, Social Security provisions reward the typical adult life course of uninterrupted employment, thereby privileging those (often educated men) who have historically been able to follow such a path (Wise, 2004). But contemporary cohorts of older workers now include large numbers of women as well as men, and both women and men are making their final labor market exits in a variety of ways. More research is needed on the order of the scholarship on earlier cohorts by Henretta (1992); Warner, Hayward, and Hardy (2010), who examine different retirement exit patterns of women and men; and Wise (2004), who links the labor force participation of older workers to particular social policies.

Another concept, risk, may also benefit from a combined life course/institutional approach—from studies of age as a risk factor in social policy development to risk exposure, vulnerabilities, and experiences (including employment, economic, and retirement insecurity) addressed by social psychological theories of the stress process and social epidemiological emphasis on (institutionalized) social conditions directly and indirectly impacting health throughout the life course. The new “risk” economy, for example, may be lessening the advantages of middle-class adults, given that both public and private benefits and job security protections are eroding (de Vroom and Bannink, 2008; Schmid, 2008; Taylor-Gooby, 2004).

Importantly, age and gender persist as key organizing principles shaping society through existing and emerging institutional arrangements. Studies of mortality, health, and other outcomes that statistically “control” for age and gender, along with studies that do not consider the historical context or the cohorts being investigated, cannot capture the ways institutionalized

opportunities and constraints—stratified by both of these locational markers and by history—affect the outcomes being studied. Treating gender, socioeconomic status (such as educational level), race/ethnicity, nativity, and disability status as individual attributes potentially ignores the ways they *systematically structure* the experiences of individuals and families (such as by defining care as a family [and specifically women’s] obligation and through the differential wage rates and advancement opportunities advantaging white, college-educated men) throughout the life course, culminating in disparities in life chances and life quality in later adulthood. A research agenda on inequality by race, class, gender, and age (as well as other markers) as *embedded in institutions* suggests intervention possibilities and policy solutions, rather than simply documenting inequality across these attributes.

Most existing social institutions are (deliberately or not) designed to produce age-graded distinctions that affect the allocation of goods, services, risks, resources, and opportunities for those of different ages. Promising future research could document how these arrangements can exacerbate, perpetuate, or reduce age, gender, or socioeconomic inequalities in health and other outcomes in later adulthood.

The Mathew Effect, the idea that the rich get richer and the poor get poorer that is the basis for the cumulative advantage/disadvantage theory, is about long-term disparities. But there are also age-based disparities and protections that emerge in tandem with growing older, a consequence of the setting up of later adulthood as a distinctive stage of the life course separated from “prime” adulthood through images, meanings, and values (culture), as well as social organization and policies (structure) that serve to create and sustain social group distinctions (seen as “seniors,” “the aged,” “pensioners,” “retirees,” the “young-old,” the “old-old,” and increasingly, “the third age”). Whether the age-boundaries around these groupings are becoming more blurred, and whether they are more or less blurred for individuals differentially located in the social structure (such as by gender, class, race/ethnicity, nativity, or disability status) are important theoretical and empirical questions for future scholarship. The answers may well turn on labor market, income support, and residential policies, as well as the health and disability statuses and family circumstances of individuals within particular subgroups of the population (see also Hudson, 2011). Considerable future study is needed as to why and how risks and risk-related behaviors are socially distributed by education, race, nativity, disability, gender, *and* age, and how institutionalized age-graded policies and practices can *reduce* as well as *exacerbate* risk.

Social policies, cultural norms, and everyday practices effectively categorize and reify age groups (such as “60 and over”) and statuses (such as retired, not retired), *as does social science theory and research*, even though

there may be more heterogeneity within than across categories. Future directions should emphasize the considerable heterogeneity within age groups that make analyses of binaries (such as “55 and older” versus “under 55,” or even “70 and older” versus “under 70”) less useful than more fine-grained age categories (operationalized with ceilings as well as floors) or categories based on ability or life stage. Future research is needed on the conditions under which family, health, career, or retirement course stage matter more in predicting behavior, resources, life chances, and life quality than simply age. For example, a 58-year-old father of a preschooler may behave far differently than a 58-year-old grandfather of a preschooler in terms of labor market/retirement expectations and behavior.

Other binaries are not inclusive, especially of the rising proportions of unstandardized circumstances falling outside of conventional institutionalized structures. Consider, for example, the employment/retirement dichotomy. It omits those with no “career job” to retire from, the increasingly common “working retirees,” or what Gibson (1996) refers to as the “unretired retired”—those 55 and older who define themselves as not working and not retired. What is needed is a fuller conceptualization of the range of conditions older Americans experience, and their consequences.

Thinking about sample selection is another major theoretical as well as methodological issue. Who is “selected” into or out of research samples is critical in estimating the implications of the findings. For example, there is selective mortality in the fact that those with the most health problems die at earlier ages, meaning that older populations always consist of more healthy survivors. And studies of the retirement expectations or behaviors of “older workers” of a certain age omit those who are not in the labor force as well as those who have *already* retired, suggesting the value of future studies capturing the dynamics of trajectories and transitions over a period of time.

Future directions should include comparative and multilevel studies across cohorts, historical periods, regions, organizations, and policy regimes to highlight the ways differences and/or shifts in social policies and conventions affect patterns and processes of population and individual aging, as well as the mechanisms involved. Natural and randomized field experiments of changing policies and practices are promising research methodologies permitting scholars to assess the micro-level impacts of changing meso-level contexts or changing macro-level forces.

Another vital topic for future research in the coming decades is: Which and under what conditions do families, social networks, and community organizations *buffer* older adults from institutionalized state and market bureaucracies (see also Figure 9-2). For example, marriage has been shown to have a protective effect on survival (Rendall et al., 2011) even as loneliness has negative consequences (Cornwell, Laumann, and Schumm, 2008;

Luo et al., 2012). As Lutfey and Freese (2005, p. 1,332) argue, there are very likely “massively multiple mechanisms” linking structures with health. And there are also other moderators beyond age, gender, race, and class. Investigating potential moderators of the links between institutions and individuals and how these change over the later life course are fruitful avenues for future research.

### Investigating Cycles of Control, Adaptive Strategies, and Meaning

One important future contribution of the social sciences is in clarifying the relationships between structured experience, agency, and self-concepts (e.g., Gecas, 2003) over the aging process. The earlier half of the adult course has been high on research agendas (c.f. Arnett, 2004). There is ample evidence that going to college, getting a job, marrying, having a child, and serving in the military change identities in terms of how people see themselves, and how others see them. But there is insufficient scholarship on how later adult role exits and entrances (as well as their duration and timing) shape self-concepts, feelings of mastery or control, or the perceptions of others.

The lock-step structuring of first education, then full-time employment, then retirement can also affect subjective experiences of cycles of control and stress. Research is needed on the patterns and rhythms of the days and weeks of individuals of different ages and life course stages, as well as how these patterns and rhythms relate to the identities, health, and life quality of older Americans. Current scholarly emphasis on older workers' labor market participation and retirement exits ignores the multidimensions and processual aspects of the life course—that older adults, whether or not employed, are simultaneously community members, friends, family members, and possibly students, with identities, narratives, and expectations associated with their pasts, presents, and futures.

To understand individual and organizational behavior requires seeing institutional contexts as not only defining appropriate behavior but also as providing older individuals with *explanations or accounts* of that behavior that helps them to make sense of their lives (Friedland and Alford, 1991; Sewell, 1992). This attention to meaning is crucial in the study of aging and life course transitions, in that it captures whether age-graded behavior (such as retirement, employment, caregiving, and residential mobility) is voluntary or involuntary, expected or unexpected, all of which are aspects that may well shape health risks. Studies need to be designed to capture subjective assessments. A single case in point: the Current Population Survey asks respondents whether their part-time employment, but not full-time employment or retirement, is voluntary, reinforcing the “normalcy” for

full-time paid work and retirement. But people may be working full-time or retired involuntarily.

Sometimes there is loose coupling or decoupling (deliberate disconnects) between the ways older adults *and organizations serving them* define goals and the means to achieve them (Boxenbaum and Jonsson, 2008). In “Social Structure and Anomie,” Merton (1938) theorized the relationship between widely accepted, socially legitimate goals and the institutionalized means available to attain them, with some segments of the population lacking the means and thus unable to achieve certain goals (or else doing so in less legitimate ways) and others seeking different goals but without the institutionalized means of achieving them. But in later adulthood, are goals typically clearly articulated, much less the means with which to achieve them? A fertile field of sociological, epidemiological, and demographic inquiry consists of studies of the ways (1) older individuals differently located in institutionalized organizations and social structures tend to have different (or any) goals, as well as differential access to institutionalized means of achieving them, and (2) investigations of the ways older adults’ goals and means are related to exposure to and duration of health risks, vulnerabilities, and protective factors.

In sum, this chapter points to the need to theorize and operationalize structures as contexts, that is, institutionalized schematic and material patterns of living (Sewell, 1992) shaping the aging process in myriad ways. Some contexts are physical, such as the absence of sidewalks in certain neighborhoods inhibiting the exercise of older adults. Others constitute built-in inequalities, such as the paucity of medical information for some populations, or the absence of income needed to afford healthy foods. Still others consist of the taken-for-granted conventions about age-related and gender-related participation in paid work, retirement, voluntary associations, caregiving, community activities, etc., that affect the identities, behavior, and well-being of those of certain ages and life stages *as well as* the data and topics scholars pursue. For example, surveys typically sample individuals, but it appears particularly fruitful to sample individuals (or couples) in particular contexts, such as those embedded in certain networks (Smith and Christakis, 2008) or work teams (Kelly et al., 2012).

Finally, the life course itself is more than a developmental trajectory. It is also a gendered social institution, shaped by social norms and structures embedded in systems of education and training; marriage, family, and caregiving; work, retirement, and community; and health behaviors, health care, and social-welfare policies *that are themselves in flux*. This further underscores the value of a dynamic, institutionalized, life course focus on age and aging.

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# 10

## Opportunities and Challenges in the Study of Biosocial Dynamics in Healthy Aging

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### INTRODUCTION

From the womb to the grave, the social world has a profound influence on individual health and well-being. As social animals, human bodies likely evolved to perceive and respond to social stimuli in ways that promote survival and adaptation. Thus, human physiology is attuned to characteristics of our social environment and interactions with others, and social behavior is likewise underpinned by complex biological processes. Social scientists have long been interested in identifying such biosocial dynamics and the roles these processes play in healthy or unhealthy patterns of aging across the life course. The objective of this chapter is to provide a brief overview of the current state of the study of biosocial processes in healthy aging. Research on the biological correlates of social status is reviewed to highlight promising methodological approaches for identifying biosocial connections and for probing biosocial theories of aging. Important methodological and analytical challenges that need to be addressed to significantly advance knowledge of biosocial processes involved in healthy aging are also discussed.

### BIOSOCIAL INVESTIGATIONS: THE PROVINCE OF TWO TRADITIONS

The current state of study of biosocial processes involved in healthy human aging is primarily the confluence of accomplishments in two scientific fields: social epidemiology and social/health psychology. Social

epidemiologists have amassed a large body of evidence documenting social determinants of disease morbidity and mortality, including social inequality, socioeconomic status, social isolation, and a lack of social support and social resources (see, Berkman, 2009; House, Landis, and Umberson, 1988; Seeman and Crimmins, 2001). A particular strength of this research is evidence of prospective prediction of disease onset and mortality following measurement of social conditions, dampening concerns that such connections are primarily the result of selection processes (i.e., that poor health leads to unfavorable social conditions). The documentation of such links in large, nationally representative research cohorts also helps to assuage concerns that associations occur only in subsets of individuals with distinct social characteristics (e.g., those of abject poverty, the extremely isolated). Perhaps the most notable strength of this research is the observation that social risk factors rival or exceed traditional biomedical factors, such as smoking and cholesterol levels, in the power to predict poor health outcomes (Holt-Lunstad, Smith, and Layton, 2010; House et al., 1988). Although these observations have yet to lead to significant attention to social risk factors in clinical health care, social factors are now more centrally positioned in the cross-hairs of those focused on policies and interventions designed to improve public health.

As the evidence highlighting social conditions as key determinants of healthy aging has grown, so too has the motivation to understand how such conditions “get under the skin” to affect functioning and health (Adler and Ostrove, 1999; Seeman et al., 2010; Taylor, Repetti, and Seeman, 1997). In epidemiologic investigations, this motivation has fueled the addition of biological markers, or *biomarkers*, to study assessments in an effort to identify biological processes that might underlie links between social factors and health. This effort has been two-pronged: social studies of aging and health are increasingly incorporating biomarkers into study assessments, and biomedical studies are increasingly instituting more comprehensive measurement of social conditions. Examples of such studies are provided in Table 10-1. The result has been an exponentially increasing number of studies examining biosocial process that play a role in healthy aging.

Occurring contemporaneously with the increasing examination of biosocial connections in epidemiologic investigations, researchers in the fields of social and health psychology have been identifying the biological correlates of social factors in smaller-scale investigations with more fine-grained measures of social and biological processes than is typically possible in large-scale epidemiologic studies. This has included investigations of the biological correlates of psychosocial stressors and other social factors (e.g., quality of social relationships, presence of supportive ties), as well as experimental manipulations that examine the biological sequelae of varying social conditions (e.g., stressor experience in the presence or absence of

**TABLE 10-1** Examples of Longitudinal Studies of Aging and Health Incorporating Social and Biomarker Assessments

Population-Based Surveys	Community-Based or Cohort Surveys
Health and Retirement Study (HRS)	MacArthur Study of Successful Aging
English Longitudinal Study of Ageing (ELSA)	Whitehall Studies
Social Environment and Biomarkers of Aging Study (SEBAS)	Normative Aging Study
National Social Life, Health and Aging Project (NSHAP)	Women's Health and Aging Studies
Study of Midlife in the United States (MIDUS)	Multiethnic Study of Atherosclerosis (MESA)
National Health and Nutrition Examination Surveys (NHANES)	Coronary Artery Risk Development in Young Adults (CARDIA) Study
Cardiovascular Health Study (CHS)	Chicago, Health, Aging and Social Relations Study (CHASRS)
Cardiovascular Risk in Young Finns Study	
British Birth Cohort Studies (e.g., 1958, 1963)	
Costa Rican Longevity and Healthy Aging Study (CRELES)	
Twin Studies (SATSA, OCTO, SALT, GENDER, HARMONY)	

social support). Fueled by technological advances in the measurement of biomarkers in the field, a growing number of studies are also capturing the biological correlates of everyday social experiences as individuals go about their daily lives in their natural social environments.

### Biological Targets of Biosocial Investigations

The social scientist seeking to understand how it is that a given social factor is linked to more or less healthy profiles of aging must first identify the biological pathways in the body that might play a role in differential health trajectories. Then, he or she must identify candidate biomarkers for assessing activity in target pathways and assess the feasibility of measuring such biomarkers. Various perspectives may shape the selection of targeted biological pathways. Disease-focused approaches typically target biomarkers (e.g., lipids, markers of inflammation) that play key roles in the pathophysiology of a given disease (e.g., atherosclerosis). Observation of an association between a social factor of interest and target biomarkers might then point to plausible pathways underlying connections between the social condition and the disease outcome. Biological theories of aging might also provide clues as to the pathways through which social factors

may influence health. A number of biological processes are implicated in theories that posit that the “deterioration and decline” of aging is a byproduct of damage versus repair forces occurring in the course of the physiology of life. These include oxidative damage and antioxidant defense or other repair mechanisms, as well as stochastic DNA damage in somatic cells and the efficacy of DNA repair mechanisms. Neuroendocrine, metabolic, and immune processes are also implicated in programmed aging processes (e.g., the neuroendocrine regulators of the Pacific salmon’s final upstream swim to mate, then die as a notable example), as well as in biological processes that may have been naturally selected for their reproductive and survival benefits in early life, but subsequently have negative consequences for well-being in later life. This concept is known as antagonistic pleiotropy; as an example, immune defense processes promoting survival, especially in the young, may upregulate inflammation burden and disease risk in the old. A discussion of the various biological processes hypothesized to underlie these mechanisms of “aging” are beyond the scope of this chapter, although readers should consult excellent available reviews (Finch and Ruvkun, 2001; Harman, 2003; Kirkwood and Austad, 2000; Martin, 2011; Parsons, 2003; Sohal and Orr, 2012; Sohal, Mockett, and Orr, 2002). The relevant point here is that the occurrence and nature of expression of such biological processes may well be sensitive to social environment input, and they represent mechanisms through which the social world may accelerate or decelerate healthy aging.

Biological targets of study might also be guided by biopsychosocial perspectives that postulate specific patterns of physiological activation through which social stimuli are transduced into electrochemical and biochemical signals in the body to orchestrate downstream physiology and behavior. This includes theoretical perspectives that posit specific biological signatures for specific psychosocial stimuli such as different patterns of autonomic activity in response to threatening versus challenging social situations (e.g., Blascovich et al., 2003) and specific neuroendocrine correlates of social status threats and accompanying cognitive and affective states (e.g., Dickerson, Gruenewald, and Kemeny, 2004; Gruenewald et al., 2004; Henry, 1993), as well as more general organizing frameworks for understanding biosocial connections, such as that found in the conceptualization of primary and secondary physiological regulatory systems (e.g., McEwen and Seeman, 1999). Primary regulators, notably the neuroendocrine and nervous systems, are those that act as communication systems between the brain, where thoughts and emotions regarding the social world are processed, and the downstream physiological systems that carry out behavior and physiology essential for dealing with social demands. These systems initiate changes in secondary regulatory systems, such as the cardiovascular, metabolic, and immune systems, which enable the body to address the demands of a social stimulus.

For example, it is nervous and neuroendocrine regulators, such as the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal (HPA) axis, that orchestrate downstream cardiovascular (e.g., increased heart rate, blood pressure) and metabolic activity (e.g., production of the body's primary fuel, glucose) to enable the body to address the demands of a social stressor (e.g., an argument with one's spouse).

The concept of *allostasis* has been proposed to explain how the activity of these primary and secondary regulators fluctuates to orchestrate physiological functioning to meet demands (McEwen, 1998; McEwen and Seeman, 1999; McEwen and Stellar, 1993; Sterling, 2004; Sterling and Eyer, 1988). As compared to the more tightly regulated setpoints of homeostatic processes (e.g., maintaining the body's pH in a narrow range), allostatic processes are theorized to allow greater accommodation of physiological activity to varying demands (e.g., large increases in blood glucose to meet the energy demands of coping with a severe stressor). While often adaptive for addressing the demand at hand, allostatic activity may render individuals vulnerable to adverse functioning and health states under conditions when allostatic responses *are engaged too often, are prolonged, initiate severe alterations in physiological activity, or are engaged under conditions with little adaptive benefit* (e.g., activation of the HPA or SNS systems in response to worrying about a past social interaction). The wear and tear on body tissues and systems that can result from such allostatic states is referred to as "allostatic load" and represents one model of how social conditions that engage allostatic processes may increase risk of poor health.

### **What Is Learned from Biosocial Investigations?: An Example: Biological Correlates of Social Status**

The allostatic correlates of a wide array of social factors have been explored in both small- and large-scale observational and experimental studies. In this section, the biological correlates of social status are highlighted to provide a flavor of the gains, the promises, and the challenges of biosocial investigations. One reason for this selection is that the connection between social status, most often conceptualized as some form of socioeconomic status (SES), and health has long been a central focus of social epidemiology. A large and relatively consistent body of empirical evidence indicates that those of lower SES experience poorer health, including increased incidence of most diseases, faster disease progression, and greater disease-specific and all-cause mortality risk, resulting in shorter length of life (see, Adler and Ostrove, 1999; Hemingway and Marmot, 1999; Kaplan and Keil, 1993; Marmot, 2006; Matthews and Gallo, 2011). These links have been documented for both prestige (e.g., occupational status) and

resource-based (e.g., income, assets) measures of SES, as well as indicators that tap both dimensions (e.g., education).

The consistently observed SES-health association has led to a hunt for the pathways that underlie the SES gradient in health, and biological pathways have been targets of increasing focus (Miller, Chen, and Cole, 2009; Seeman et al., 2010). A very general conceptualization of the routes through which SES might impact individual biological functioning is provided in Figure 10-1 and includes (1) SES-patterned environmental exposures, including exposure to pollutants, carcinogens, toxins, and adverse neighborhood/community characteristics; (2) SES variations in psychosocial exposures and processes, including psychosocial stress, cognitive-perceptual, and emotional processes, and psychosocial resources (e.g., access to social support, control over environment); and (3) SES-patterned health behavior, including smoking, physical activity, diet, and drug/alcohol use. The overarching hypothesis is that SES profoundly shapes individual thought, feeling, and behavior, as well as exposure to the slings and arrows of life, in turn, affecting allostatic processes and subsequent health-relevant biological wear and tear.

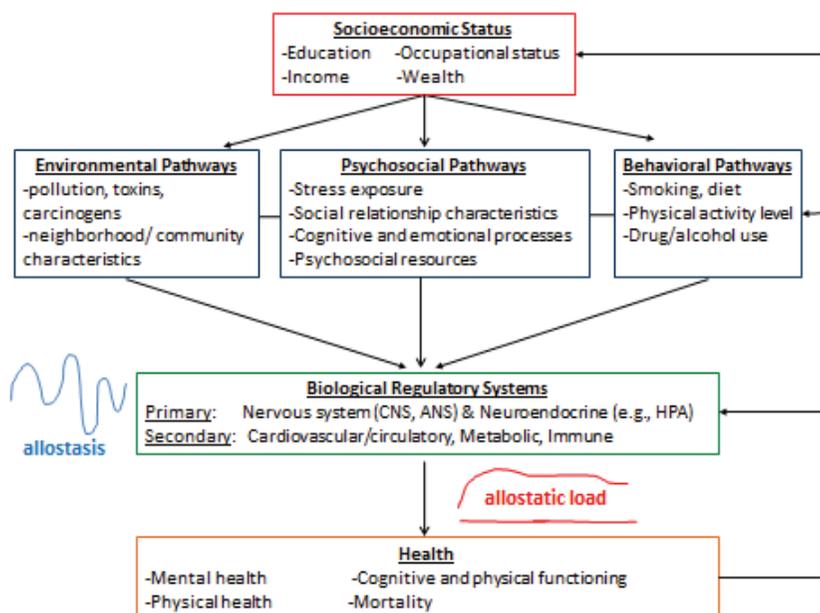


FIGURE 10-1 Conceptual model of potential pathways through which social status is linked to health.

*Biomarker Correlates—Clarity or Confusion?*

At first glance, the picture that emerges from the body of work examining biological correlates of SES is consistent with that examining health correlates: Those of lower SES have poorer biological profiles for most major biological regulatory systems, including nervous, neuroendocrine, cardiovascular, metabolic, and immune systems. For example, those of lower SES have been found to have *higher levels of HPA and SNS hormones* hypothesized to be elevated under conditions of stress (e.g., cortisol and catecholamines; Cohen, Doyle, and Baum, 2006; Janicki-Deverts et al., 2007; Steptoe et al., 2003), *higher biomarker levels indicative of poor metabolic functioning* (e.g., greater body mass index, higher fasting glucose and insulin and glycosylated hemoglobin, poorer lipid profiles; Danese et al., 2009; Loucks et al., 2007a,b; McLaren, 2007; Senese et al., 2009), and other *indicators of cardiovascular disease risk* (e.g., high blood pressure, low heart rate variability, high inflammation burden) (Brunner et al., 1996; Colhoun, Hemingway, and Poulter, 1998; Gruenewald et al., 2009; Hemingway et al., 2003; Koster et al., 2006; Sloan et al., 2005). Upon closer inspection, however, there are nuances in the consistency of findings in this literature that suggest that further attention to methods, measurement, and theory might be fruitful.

One interesting observation is the geographic and demographic variations in associations between SES and some biomarker indicators. For example, a review of 57 studies published over a 30-year period (1966-1996) indicated that a majority of investigations in the United States and Canada observed higher levels of blood pressure in those of lower SES (Colhoun et al., 1998), but associations were less consistent in the United Kingdom, Australasia, Asia, South Africa, and some European countries. Well-documented geographic and demographic (sex) variations have also been observed for associations between SES and body mass index or body weight (McLaren, 2007; Sobal and Stunkard, 1989).

These variations are notable because cross-study consistency in the validity and reliability of measurement of blood pressure and weight is likely considerably higher than is the case for other biomarkers that have to be assessed via saliva, blood, or urine samples and measured with complex assays (e.g., hormone or immune biomarkers). Thus, assuming fairly similar measurement of these biomarkers across samples, focus is shifted to other potential explanations for geographic and demographic variations in SES-biomarker associations, including characteristics of SES measurement, cultural variations in the meaning of SES, and its environmental, psychosocial, and behavioral correlates, and the role of social institutions and more macro social factors (e.g., universal access to health care) in moderating links between individual-level SES and biological functioning. A review of

research that sheds light on each of these possibilities is beyond the scope of this review, *but these observations point to the need for increasing comprehensiveness and sophistication in the measurement and theorization of the social, psychological, and behavioral alongside the biological in biosocial investigations.*

### *Biosocial Investigations—An Opportunity for Life Course Explorations?*

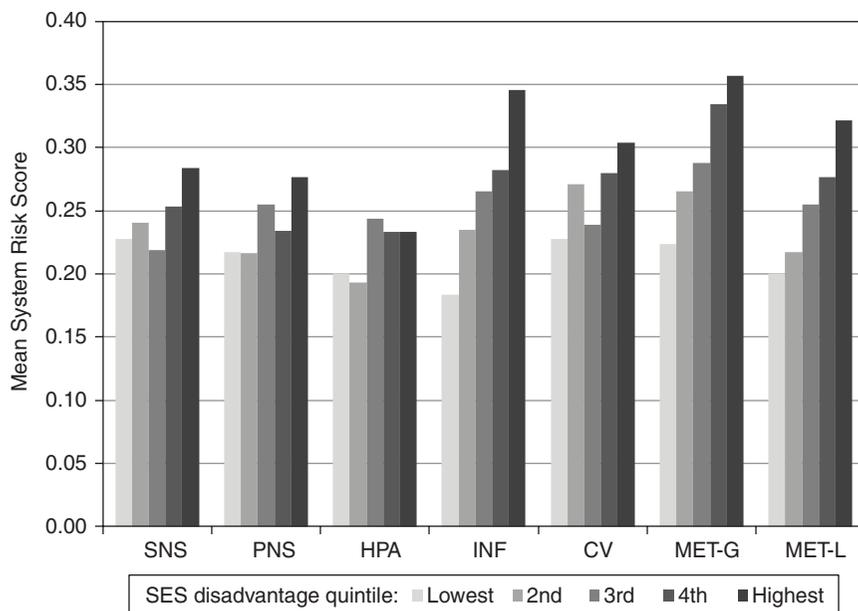
Another aspect of research on SES gradients in biological functioning that is ripe for further attention is a better understanding of when, and how, SES becomes embodied across the life course. A number of life course frameworks have been proposed to explain the role of biosocial processes in healthy aging (Ben-Shlomo and Kuh, 2002; Pollitt, Rose, and Kaufman, 2005), with *sensitive* or *critical* period and *accumulation of risk* models receiving the most attention. The sensitive or critical period model suggests that connections between SES and biological functioning may vary depending on life course phase. Strict critical period models posit that events that occur within specific and narrow windows of development may permanently “tune” bodily systems and subsequent disease risk, which will be unaffected by risk exposures that occur outside the critical window. Sensitive period models posit that risk exposures at certain life course phases (e.g., early childhood) may simply have a stronger negative impact than those that occur in other life phases (e.g., late adulthood).

Growing evidence indicates that SES disadvantage in early life predicts poorer physiological functioning in later life, above and beyond the influence of more contemporary SES characteristics. The negative impact of early life disadvantage has been documented for *cardiovascular and metabolic biomarkers* (e.g., blood pressure, high-density lipoprotein cholesterol, insulin resistance; Blane et al., 1996; Kivimaki et al., 2006b; Poulton et al., 2002) and the *HPA hormone cortisol* (Li et al., 2007). When SES-adversity indicators from different life course phases are pitted against each other as predictors of later-life biological risk, sometimes childhood SES is a stronger predictor (Kivimaki et al., 2006b), while in other cases, more recent SES conditions exhibit greater predictive power (e.g., Blane et al., 1996). A significant limitation of these investigations is the lack of biological information from earlier life periods, rendering it difficult to discern whether SES-adversity experience actually alters biological functioning in earlier life course phases. An analysis where such information was available in the Cardiovascular Risk in Young Finns Study indicated that SES disparities in blood pressure emerged early in childhood and persisted across the life course, with early life alterations accounting for much of the association between childhood SES and adult blood pressure (Kivimaki et al., 2006a,b).

Exciting opportunities are on the horizon for identifying how SES experiences at different phases of the life course get under the skin to affect a wide array of biological processes and how SES disparities in biological functioning might track across the life time. Evidence of SES disparities in childhood of levels of primary neuroendocrine regulators (HPA and SNS hormones), as well as in downstream secondary regulatory systems (e.g., cardiovascular and metabolic biomarkers), is accumulating from cross-sectional and short-term longitudinal investigations (e.g., Evans and English, 2002; Evans and Kim, 2007; Goodman et al., 2005). These biological imprints of social adversity in childhood may provide clues as to the trajectories of healthy or unhealthy aging that lie ahead. *Longitudinal, life course investigations that concurrently measure social and biological factors from childhood to adulthood will be particularly fruitful for understanding when social adversity is embodied for different systems, the permanency of biological imprints, and the genetic, psychosocial, and behavioral modifiers of these links.* Of course, one needs to be mindful of the considerable burden involved in tracking cohorts for long periods of time in advocating for such designs.

Another life course model receiving growing attention in biosocial investigations is the *accumulation of risk* model. As applied to biosocial investigations, this model posits that greater overall exposure to adverse social conditions (e.g., low SES) across the life course accumulates to have a greater toll on biological functioning in later adulthood. The expansive battery of biomarkers recently added to the second wave of the Study of Midlife in the United States (MIDUS), a longitudinal study of health and aging, allowed for an exploration of the range of biological systems that might be sensitive to life course SES adversity experience. Analyzing data from MIDUS, Gruenewald and colleagues (2012b) documented greater dysregulation across seven different biological indices (SNS, parasympathetic nervous system, HPA system, cardiovascular system, glucose metabolism, lipid metabolism, inflammation) in adults with greater experience of SES adversity (assessed with multiple indicators of education, income, and financial strain) across childhood and adulthood. Figure 10-2 demonstrates that greater life course SES adversity left its mark in adulthood on all of the physiological indices examined. Aggregation of individual system risk indices into a multisystem measure of allostatic load (AL) also revealed a steep SES gradient in biological dysregulation. The difference in AL between those in the highest and lowest quintiles of lifetime SES adversity was equivalent to a 17-year age difference in AL, suggesting accelerated “biological aging” in those with greater cumulative adversity experience.

Support for the hypothesis that greater social adversity experience might accelerate the “aging” or “weathering” (Geronimus, 1992) of biological systems is also found in analyses of population-based surveys, such



**FIGURE 10-2** Mean levels of biological system dysregulation by quintiles of cumulative SES adversity (across childhood and adulthood) in the Study of Midlife in the United States (MIDUS).

NOTE: CV = cardiovascular system, HPA = hypothalamic-pituitary-adrenal axis, INF = inflammation, MET-G = glucose metabolism, MET-L = lipid metabolism, PNS = parasympathetic nervous system, SES = socioeconomic status, SNS = sympathetic nervous system.

SOURCE: Gruenewald et al. (2012b). Reprinted with permission.

as the National Health and Nutrition Examination Surveys (NHANES). Geronimus and colleagues (2006) found that poverty, ethnic minority status (“non-Hispanic Black”), and being female were each associated with a greater likelihood of experiencing high AL in NHANES III participants aged 18-64. Moreover, these factors interacted to predict the occurrence of high AL at earlier stages of the life course and disparities widened with age. In an analysis of both NHANES III and IV data, Crimmins, Kim, and Seeman (2009) replicated the finding of widening SES disparities in AL with age up until the 60s. However, they further documented the dramatic consequence of earlier weathering in the socially disadvantaged with analyses suggesting that SES disparities in biological risk disappear at older ages because the poor with high AL die before reaching older adulthood. *These investigations are compelling examples of the value of biomarker data in understanding how life course characteristics of SES adversity may*

*shape disease risk and longevity. These analyses also highlight the complex interactions that may be occurring between SES and other demographic factors (gender, race), as well as other individual and social conditions as yet unexplored.*

### Promising Approaches

#### *Time for a Confluence of Traditions?*

An advantage of adding biomarker measures to large-scale, population-based studies of aging and health is the ability to examine biosocial associations with sufficient power in samples representative of the general population or specific subgroups. Another advantage is the opportunity to track the role of biosocial processes in the development of health conditions over time in longitudinal investigations. A disadvantage is that the design constraints of such investigations tend to allow only a limited “snapshot” measurement of psychosocial, behavioral and biological states at any given assessment. Many psychosocial, behavioral, and biological factors fluctuate considerably over time and context, within and between individuals, and important nuances of such fluctuations are not well captured in large-scale survey investigations.

These nuances have been investigated in smaller-scale observational and experimental studies over the past few decades, primarily carried out in the fields of social and health psychology. The impressive knowledge gained from these biosocial investigations could, and has, filled many volumes, so will not be reviewed in detail here. However, highlights include findings that biological functioning is intricately tied to characteristics of social interactions and social stressor experience (e.g., social conflict, discrimination, social-evaluative threat; Dickerson and Kemeny, 2004; Kiecolt-Glaser et al., 2002; Seeman and McEwen, 1996) and social characteristics that individuals bring with them to social interactions (e.g., background level of social integration and support, social conflict history, cultural norms; Uchino, Cacioppo, and Kiecolt-Glaser, 1996). What is emerging from this body of work is a picture of complex interconnections between our social, psychological, and biological worlds.

Despite the incredible advantage of such investigations in giving us a more detailed understanding of these complex interactions, the design constraints of these smaller-scale investigations typically limit the use of population-based samples, as well as samples of sufficient size to track and predict incident disease. *Given that the relative strengths of the smaller-scale social and health psychology investigations are the weaknesses of the large-scale survey study, and vice-versa, a particularly exciting trend is the effort to combine these two designs within single studies. Although*

*still fairly rare, such efforts are taking the form of the addition of small substudies within larger-scale survey investigations in which more detailed assessments of biosocial processes are collected on subsets of participants.*

### *Exploring Biosocial Connections in the Wild*

One notable form of this substudy approach is the effort to collect data on biosocial processes in individuals' natural social environments, as they navigate the challenges and social interactions of daily life. An example of such an approach comes from the Whitehall II Study of British civil servants, which has been a fruitful source of knowledge regarding the biosocial processes that may underlie social status gradients in health. A substudy of 202 Whitehall II participants examined cardiovascular and neuroendocrine parameters across a workday, with cardiovascular measurements occurring every 20 minutes and 10 saliva samples collected for the assay of the HPA hormone cortisol, at various points from waking to bedtime (Stephens et al., 2003a). This investigation revealed that those of lower occupational status have higher blood pressure and heart rate levels, but only in the morning, while cortisol levels are higher primarily during working hours. This latter finding was reversed for females, with higher status women having higher levels of cortisol across the day. Taken alone, these findings merely add to those of other smaller-scale studies of more select samples, which document SES variations in cardiovascular activity across the workday (e.g., Gallo et al., 2004). However, one advantage of collecting such data within a larger longitudinal study of health and aging is the ability to integrate substudy findings within the larger web of observed biosocial and social-health associations in the parent cohort. Although yet to be done to a great extent, the possibilities of such analyses are numerous.

Despite the methodological challenges, ambulatory substudies of biosocial processes are growing in number. In addition to the Whitehall Study, numerous large-scale studies of health and aging, including MIDUS, the English Longitudinal Study of Ageing (ELSA), the Coronary Artery Risk Development in Young Adults (CARDIA) Study, and the Multi-ethnic Study of Atherosclerosis (MESA), have incorporated diurnal saliva sampling in participants' natural environments. The focus has primarily been the measurement of the HPA hormone, cortisol, but the range of biomarkers that can be measured in saliva continues to expand. Our recent explorations of diurnal salivary cortisol variations in the MIDUS cohort indicate that greater SES adversity is linked to lower cortisol output in the morning but a flatter slope of decline across the day leading to higher evening levels (Gruenewald et al., 2012a). Similar SES variations in diurnal cortisol activity have been observed in other large cohort studies (Cohen et al., 2006; Hajat et al., 2010; Kumari et al., 2010). The changing nature of

SES variations in cortisol activity across the day (lower at some points but higher at others in the more disadvantaged) may render it difficult to discern SES differences with either single snapshot assessments or measures that aggregate information over longer time periods (and thus obscure within period variation). This may explain the less stark SES gradients for the HPA index in Figure 10-2, which included a 12-hour aggregate urinary measure of cortisol activity. The increasing inclusion of ambulatory and clinic-based assessments of biological activity (cortisol, cardiovascular) in large cohort studies will allow for a comparison of physiological measurement methods best able to capture the effect of social conditions on our physiology, as well as enhance our ability to understand the mediators and moderators of such links.

### *Integrating Laboratory-Based and Epidemiological Approaches*

The addition of laboratory-based challenge substudies in large-scale, longitudinal studies of aging (e.g., Whitehall, MIDUS, CARDIA, MESA) is another example of the integration of epidemiological and social/health psychology approaches. Challenge paradigms expose participants to a standardized set of demanding and challenging activities (e.g., difficult cognitive tasks, public speaking) to examine the psychological and physiological consequences of “stressor” exposure. The advantage of such methods is that investigators can compare the psychobiological responses of individuals that vary on social characteristics to the same stimulus, negating concerns about variations in social characteristics “selecting” participants into certain stressors (e.g., conflictual interactions). Investigations of physiological reactivity within the Whitehall cohort have revealed that those of lower SES have delayed recovery of cardiovascular parameters (Steptoe et al., 2002, 2003b) and longer-lasting stress-associated increases in the inflammatory biomarker, interleukin-6 (Brydon et al., 2004). However, no reactivity and recovery differences emerged for other inflammatory (e.g., fibrinogen, tumor necrosis factor alpha) and immune (e.g., natural killer cell number; Owen et al., 2003) biomarkers. Thus, SES variations in stress reactivity are more complex than the simple message of those of lower status exhibiting greater reactivity and less recovery on all biomarker indicators. Lack of stress response differences for many biomarkers does not negate the possibility that stress is a mechanism through which SES variations in health occur, as those of lower SES may simply experience a greater absolute level of stress and its associated physiological correlates.

Another advantage of the laboratory challenge paradigm is the opportunity to more carefully pinpoint the psychological processes that might underlie SES variations in physiological reactivity. Chen and colleagues have documented that low SES children are more likely to interpret ambiguous

social situations as threatening than high SES children (Chen and Matthews, 1999; Chen et al., 2004), which may reflect cognitive interpretation tendencies shaped by an accumulation of less favorable social experiences. This tendency has also been shown to increase with aging (Chen and Matthews, 1999). Furthermore, such threat perception tendencies, and increases in these tendencies over time, partially explain the greater cardiovascular reactivity of low SES adolescents in laboratory challenge paradigms (Chen et al., 2004), as well as greater ambulatory cardiovascular activity during social interactions (Chen, Matthews, and Zhou, 2007) in individuals' normal social environments. Increases in threat perception biases also played a more significant role in predicting future physiological reactivity in lower SES African American adolescents (Chen and Matthews, 2001), suggesting that social stressors (SES, minority status) may interact over time.

### *Moving Upstream*

Another promising area of research is the effort to identify the neural processes that may mediate SES variations in the processing of social stimuli. There has been an explosive growth in the field of social neuroscience in the past decade, which seeks to understand the neural processes that mediate social behavior and social information processing. This has led to an increased understanding of the brain structures involved in these processes, including the prefrontal cortex, the hippocampus, and the amygdala (Gianaros and Manuck, 2010; McEwen and Gianaros, 2010). One of the important roles these social brain structures play is in the modulation of activity of primary regulatory systems (nervous and neuroendocrine systems) in response to the processing of social and emotional stimuli. Thus, a better understanding of SES variations in neural activity may provide clues as to SES variations in the activity of downstream physiological systems.

Although preliminary, data are accumulating indicating SES correlates of neural activity. Gianaros and colleagues (2008) have found that young adults who perceive they came from lower status families exhibit greater amygdala activation in response to viewing angry faces in a functional magnetic resonance imaging (fMRI) investigation, consistent with the threat perceptions biases found in the work of Chen and colleagues. Gianaros and colleagues (2011) also recently reported that prefrontal cortex activity varies in midlife adults as a function of childhood SES, with those from lower SES backgrounds showing a lower cortical response to reward stimuli in fMRI assessments. These findings are intriguing in that they suggest differential patterns of activity in brain structures that modulate downstream stress regulatory systems. However, the links between patterns of functional neural activity in response to various stimuli (e.g., a threatening "social" stimulus in a scanner) and downstream physiology are only beginning to

be mapped out. Another concern is that almost all of this research has been conducted on small and select samples. Neuroscience assessments, including fMRI and EEG measurements, were recently assessed for a small subset of MIDUS participants, allowing linkage to the wide array of biomarkers and psychosocial information collected in the larger MIDUS II cohort. These data are ripe for analyses of how SES and other social factors may influence patterns of neural activity and subsequent downstream disease-relevant physiology.

Another approach through which to assess more “upstream” modulation of physiological functioning is through the study of social regulation of gene expression. Genetic potential is only realized when specific genes are turned on, or “expressed,” via transcription and translation. One of the first studies to show that a social factor could regulate gene expression was conducted by Cole and colleagues (2007) and examined a small subset of participants selected for high and low social loneliness from the Chicago Health Aging and Social Relations Study (CHASRS). Analyses indicated that of humans’ 20,000+ genes, 209 showed significant expression differences in older adults high and low in loneliness. An analysis of the functional activity of differentially expressed genes revealed three primary functional typologies—an upregulation of genes involved in inflammatory activity and a downregulation of genes involved in antibody production and in immune response to viral infection. These gene expression differences are notable because they may affect variations in downstream physiological functioning that explain the significantly greater risk for poor health outcomes in lonely versus nonlonely individuals (see Cacioppo et al., 2011; Hawkey and Cacioppo, 2010) and may represent a pattern of earlier “biological aging” in the lonely.

Gene expression profiles have also been found to vary as a function of SES. Collectively these studies suggest that SES adversity in childhood is associated with gene expression profiles in adolescence and adulthood characterized: (1) as proinflammatory, (2) by diminished glucocorticoid receptor expression and signaling, which may result in less effective control of HPA output and remove the glucocorticoid-mediated brake on inflammation, and (3) by upregulation of catecholamine associated transcription promoter pathways that suggest that the sympathetic nervous system may be playing a role in delivering proinflammatory signals to our genes (Chen et al., 2009; Miller and Chen, 2007; Miller et al., 2009). Miller and colleagues (2007) have labeled this a “defensive” phenotype and suggest that SES-adversity experiences early in life “program” these biological systems during sensitive or critical periods of early childhood, leading to heightened susceptibility in adulthood for the development of the many conditions associated with greater inflammatory and HPA activity. Are such processes a social form of antagonistic pleiotropy, whereby these biopsychosocial

processes confer reproductive or survival benefits in young adulthood but increase risk of ill-being in later adulthood? Or do these social experiences and biopsychosocial responses merely accelerate the forces of damage, and lessen the forces of repair, that shape trajectories of healthy aging across the life course?

A few aspects of these findings bear additional mention. The first is that low SES individuals with the “defensive” gene expression phenotype described above exhibited indicators of greater proinflammatory and HPA activity (Chen et al., 2011; Miller et al., 2009), suggesting that expression profiles bear a connection with more commonly measured “downstream” biomarkers. Second, there is increasing identification of the psychological correlates of expression profiles. For example, Chen and colleagues (2009) found that the threat perception style they had previously identified as more common in low SES children also appeared to underlie much of the association between SES and the defensive phenotype identified in gene expression studies. A third important point is that other social factors may moderate SES variations in gene expression profiles—those of low SES who experienced high levels of maternal warmth in childhood were less likely to show the more “risky” proinflammatory gene expression characteristic of the disadvantaged (Chen et al., 2011).

### *Attending to the Positive*

One final suggestion for understanding SES variations in health comes in the form of turning attention toward understanding the social distribution of the positive goods in life. There has long been recognition that health is more than just the absence of ill-being and that it also encompasses various forms of social and psychological well-being (see Ryff, 1989; Ryff and Keyes, 1995). These include forms of social well-being (e.g., a sense of social connectedness, collective efficacy), hedonic well-being (e.g., feeling happy and satisfied), and eudaimonic well-being (having a sense of purpose in life, feeling engaged, valued, useful, in control), what some have characterized as indicators of *flourishing* or *thriving* (Keyes, 1998, 2002). A growing body of evidence also suggests social patterning of such forms of well-being with those with greater social disadvantage often reporting less of these goods (e.g., Diener et al., 2002; Keyes, Shmotkin, and Ryff, 2002). Beyond the injustice of social variations in these desired ends, social disparities in psychosocial well-being may also explain differential patterns of healthy aging. Lower hedonic and eudaimonic well-being predicts less favorable trajectories of cognitive and physical functioning, greater morbidity and mortality risk, and shorter length of life (Boyle et al., 2009, 2010; Cohen and Pressman, 2006; Gruenewald et al., 2007; Gruenewald, Liao, and Seeman, 2012; Okamoto and Tanaka, 2004; Pitkala et al., 2004;

Step toe and Wardle, 2011). The biological pathways through which these forms of well-being may promote healthier trajectories of aging are just beginning to be elucidated, but accumulating evidence suggests neuroendocrine, cardiovascular, and inflammatory routes (Pressman and Cohen, 2005; Ryff et al., 2006; Ryff, Singer, and Dienberg Love, 2004; Step toe, Dockray, and Wardle, 2009). The promising methodological approaches highlighted above, including identification of upstream physiological modulators and assessing biological correlates of social conditions in the lab and in the wild, may well help us better understand social disparities in flourishing and thriving and the implications for healthy aging.

## SOME CHALLENGES OF BIOSOCIAL INVESTIGATIONS

### Measurement

The potential promises of various methodological approaches in biosocial investigations are tempered by a number of challenges. One is the domain of measurement challenges. On the biological side, numerous challenges abound in collecting biomarker samples, including the relatively invasive nature of measurements (i.e., obtaining samples of blood, urine, or saliva, via physical measurement of the body), the detailed instruction needed for both research staff and participant, and for many biomarkers, sensitivity to the temporal and contextual characteristics of biomarker collection (e.g., time of day, whether to obtain “resting” or “challenge” measures). Biomarkers tend to be relatively expensive to measure (both in collection and processing costs), but costs tend to decrease somewhat with greater adoption in scientific and clinical realms. Technological advances have also led to a significant increase in the biomarkers that can be measured and the mediums (e.g., hair, finger-prick blood spots) and conditions (e.g., return of samples via unrefrigerated, postal mail) for capturing physiological samples. However, much work remains in establishing the reliability and validity of these newly developed methods.

Of course, most of the challenges of biomarker data collection are also the challenges of social factor data collection. Comprehensive measurement of social factors is often invasive (e.g., life experience interview, daily measurements) and requires detailed training and instruction to collect accurately. Social measures are also very sensitive to the temporal and contextual characteristics of data collection. Technological advances have also increased the mediums through which social measures are obtained (e.g., smartphones and other personal communication electronic devices, global positioning system or GPS tracking), and such data collection innovations are also associated with substantial monetary requirements.

Perhaps the biggest challenge is concurrent high-quality measurement of both social and biological characteristics within studies. Early large-scale biosocial investigations tended to add fairly crude measures of one or the other domain depending on the original study framework with the result that failure to observe significant or strong biosocial associations led to aspersions on the whole enterprise (i.e., not seeing the “value” of biomarker or social condition measurement). Fortunately, more focused investigations have continued to document rich biosocial connections, and efforts have been made to better “capture” both social and biological characteristics in larger-scale investigations. However, the considerable participant and investigator burden associated with such efforts continues to plague the field.

### **Capturing and Analyzing the Multilevel and Temporal Complexity**

Another challenge for understanding biosocial processes is the methodological and analytical challenge of capturing and understanding multilevel and temporally complex processes. This overview has presented an incredibly simplistic directional and temporal model of biosocial connections, with the focus primarily at the individual level. Even at the individual level, this overview has neglected a discussion of the complex patterns of development or “aging” within biological, psychological, and social realms, to say nothing of intra-individual cross-level interactions. But most biosocial processes, even those that may be most tightly coupled during narrow windows of development, operate in a bidirectional, iterative process over time, nested within multiple levels of influences from the most micro biological to the most macro social. Biosocial studies of health and aging have particularly neglected measurement of bidirectional flows of influence between individuals and upward to larger units of social organization. Methodological advances, including linked ambulatory monitoring of experiences, activity, and interaction of multiple social actors over time within defined geographic boundaries, including measurement of group-level characteristics, may aid in understanding of such bidirectional flows of influence. However, careful measurement of multilevel characteristics of biosocial processes requires stepping outside one’s disciplinary comfort zone and working in multidisciplinary teams, which academic science has been slow to reward. The temporal and directional challenges also require time-, labor-, and monetary-intensive longitudinal investigations coupled with employment of sophisticated analytic techniques that can appropriately parse units of influence among a complicated web of associations. Nonetheless, the importance of such endeavors is being increasingly acknowledged by public health support systems, such as the National Institutes of Health, which has spurred scientific research initiatives for the study of social network analyses and multilevel systems processes in understanding health and aging.

### Prognostic Significance of Social Variations in Biomarkers

The impetus for many biosocial investigations is to identify links between social factors and biological processes that may explain social gradients in health outcomes. As reviewed, social variations in biomarker levels and activity have been observed in many investigations. These variations in biological functioning can emerge early in life and persist across the lifetime. However, what is needed in this literature is commensurate evidence demonstrating that social disparities in biomarkers underlie social disparities in actual health outcomes. To date, investigations that have attempted to study each link in the chain simultaneously have examined the explanatory power of individual or clusters of biomarkers in explaining SES gradients in cardiovascular health outcomes or mortality. Individual biomarkers of inflammation (e.g., interleukin-6, C-reactive protein, fibrinogen) have been found to account for small to moderate proportions of SES gradients in incident cardiovascular disease/events and mortality, while more traditional cardiovascular risk factors (e.g., blood pressure, metabolic biomarkers) have been shown to play smaller, or no mediating roles (e.g., Loucks et al., 2009; Marmot et al., 2008; Ramsay et al., 2009; Rosvall et al., 2008). Greater explanatory power is observed when examining composites of cardiovascular or cardiovascular/metabolic biomarkers (Marmot et al., 2008), as well as for multisystem indices, such as captured in allostatic load measures (Seeman et al., 2004).

The increasing incorporation of biomarkers into longitudinal studies of aging will allow for these needed mediational analyses in the near future. However, the collection of valid incident disease information is difficult in large-scale survey studies. Mortality occurrence is somewhat easier to assess via links with mortality registries, but investigations must have in place appropriate human subject consent, as well as identifying information (e.g., Social Security number), to allow for identification of deaths through such systems. Nonetheless, the value of establishing the predictive validity of commonly assessed biomarkers is worth tackling these methodological challenges. Important benefits would be greater faith in using biomarkers as intermediate health endpoints, to better evaluate the success of health promotion interventions and policies, and to track the effect of social conditions on physical well-being.

### LOOKING FORWARD

As this overview makes clear, the marriage of social and biological measurements in both large-scale, social epidemiological and smaller-scale, laboratory and observational investigations has been successfully achieved. Much has been learned from this union about the intricate ties between

humans' social, psychological, and biological worlds. However, as in all marriages, there is still much to learn. One important focus for the future is the exploration of life course models of biosocial connections, including a greater understanding of the range of social conditions linked to biological processes, the characteristics of biosocial interactions at different phases of the life course, and how such processes operate across time to influence healthy aging. A second important focus for the future is a better understanding of the interaction of social and demographic factors, at both micro and macro levels, in shaping associations with biological factors. The currently limited understanding of geographic and demographic variations in biosocial associations suggests that additional theoretical and methodological development in this area is needed.

As discussed, there are a number of promising approaches that are poised to considerably advance knowledge of biosocial connections. Efforts to combine the methods and paradigms of social epidemiology and social and healthy psychology may be particularly fruitful. The field seems to be on the eve of incredible advancements in knowledge of the social regulation of "upstream" biological processes, including neural and genetic activity. Efforts in these areas, if appropriately coupled with continuing focus on "downstream" biological processes, will significantly propel our understanding of the biological pathways that underlie social disparities in healthy aging forward. It is necessary to engage these tools to understand not only the biology that underlies ill-being but also that which promotes flourishing and thriving.

As noted, there are also some challenges that may impede easy navigation of this journey. As with many areas of scientific inquiry, measurement challenges are considerable. The methodological and analytical challenges of adequately capturing the multilevel, bidirectional, and temporal characteristics of biosocial processes are also daunting. However, such challenges are not unique to study of biosocial processes and are characteristic of the study of many risk factors of unhealthy aging. For example, such challenges also plague the study of behavioral risk factors like smoking. It is doubtful that any in the health promotion realm would advocate avoiding scientific investigation of smoking because of the multilevel, multivariable, or temporal influences on smoking behavior.

The importance of establishing the prognostic significance of biomarkers and their role in explaining social disparities in health outcomes was also discussed. One should not confuse this with a need to establish the prognostic significance of social factors for healthy aging—decades of research have solidly established such connections. The value of biosocial research will be in the identification of the biological pathways that underlie these links, and in the potential use of biomarkers as surrogate endpoints or indicators that can be used to better understand the impact of adverse social

conditions on biological well-being, to track the efficacy of health-promotion policies and interventions, and to intervene at appropriate points in the life course to place individuals on more healthy trajectories of aging.

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# 11

## The Loyal Opposition: A Commentary on “Opportunities and Challenges in the Study of Biosocial Dynamics in Healthy Aging”

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Exceptions are interesting: They make us ask “why?” Why is this case different? From a scientific perspective—at least in principle—we start with a theory or empirical generalization, and seek to reject it; too often, however, as researchers we seek evidence to confirm our hypotheses. It’s only when we find enough exceptions that we feel compelled to reject the rule or significantly amend it. Kahneman (2011, p. 81), as always, makes the point regarding “a deliberate search for confirming evidence, known as *positive test strategy*,” with elegance and parsimony: “Contrary to the rules of philosophers of science, who advise testing hypotheses by trying to disprove them, people (and scientists, quite often) seek data that are likely to be compatible with the beliefs they currently hold.”

Here we sketch out a case for reconsidering the theoretical motivation for much of the recent biosocial survey efforts. We concentrate on just a few points. First, we present evidence that suggests that health disparities by socioeconomic status (SES) are not without exceptions. Second, we argue that we have only weak evidence showing that biomarkers—at least the ones that are most commonly collected in population-level biosocial studies—mediate the relationship between social status and health. Finally, we focus on the allostatic load paradigm. Allostatic load has been an important guiding framework for much of the biosocial research efforts; correspondingly, it has been widely critiqued. Because the criticisms are well rehearsed—although often ignored in practice—we only briefly discuss some of the vulnerabilities with its application “on the ground.”

These considerations lead us to argue that it is time for our biodemographic investigations to incorporate and test the kinds of theoretical

scaffolding that sociology and evolutionary biology can provide. We suggest a few directions where we believe such theoretical articulation might be productive, but especially in light of our own deficiencies in those areas, we encourage the biodemographic community to be more active in reaching out to the students of those disciplines. Gruenewald's chapter provides a well-organized overview of much of the field, highlighting some of the exciting potential for future work. Our excitement regarding that potential is perhaps more tempered by some of our experience.

### THE SES-HEALTH GRADIENT DOES NOT APPEAR TO BE UNIVERSAL

As noted by Gruenewald, much of the literature documenting links between SES and health (or mortality) suggests that the lower the position in a social hierarchy—typically measured as education, income, or occupational status—the higher the risk of poorer health or earlier death. Much of the evidence for this generalization comes from higher income countries—and even among higher income countries there are inconsistent results—but an increasing body of evidence from middle-income or more recently developed countries appears to show less consistent or weaker patterns (Goldman et al., 2011). Some of these “exceptions” have been documented only recently (Rosero-Bixby and Dow, 2009; Smith and Goldman, 2007), but others, including higher income countries, have been noted for some time. Sweden is such a case. Vagero and Landberg (1989, cited in Wilkinson, 1996, Figure 5.8), for example, compared age-standardized death rates across social classes in Sweden with England and Wales, and Leon et al. (1992; cited in Wilkinson, 1996) did a similar analysis of infant mortality. Both pictures show the expected gradient in England and Wales; the picture in Sweden, however, shows little evidence of an SES gradient. Japanese data for the 1990s (Hirokawa, Tsutsumi, and Kayaba, 2006) show no effect of education (assessed as age at completion of education) or employment status on all-cause mortality for persons aged 60 and older, and no effect of employment status on all-cause mortality of persons aged 59 and younger. Age at completion of education had a discernible effect on mortality for women below age 59 who finished school before age 15.

Age may be one important factor. There is ongoing debate regarding whether the effects of SES on health are likely to increase with age—as the advantages of higher status may accumulate throughout the life cycle—or whether they are expected to decline—as biological frailty dominates social influences and medical care becomes more widely accessible, for example, through Medicare for persons aged 65 and older in the United States (Dannefer, 2003; House et al., 1994). Most empirical work supports the second argument: SES disparities in health generally decline from

middle to older ages (Smith and Goldman, 2007; Zajacova, Goldman, and Rodriguez, 2009). Another age-related effect may also be operating: generally, we would expect the least healthy to die first so one might expect less variability in health as age increases. Either way, surveys restricted to older adults are less likely than those based on a broader and younger age range to identify statistically significant (or meaningful) social disparities in health outcomes.

Another—albeit hotly contested—explanation for these apparent anomalies may be related to the extent of social inequality. In the aggregate, some work has shown that income inequality appears to be (inversely) associated with life expectancy in wealthy countries (de Vogli et al., 2005) and, in the United States, directly related to mortality rates in metropolitan areas (Ash and Robinson, 2009; Lynch et al., 1998). Other analyses, in some instances by the same authors, suggest that the apparent inverse relationship disappears when additional underlying factors are taken into account (Deaton and Lubotsky, 2009; Deaton and Paxson, 2004; Lynch et al., 2000, 2004a,b).

All of this is not to say that SES-associated gradients do not exist. Clearly they do, in some places, at some times, perhaps even in most places—at least in modern times. Any generalization is almost certain to have exceptions, and a very extensive literature would essentially guarantee that we could find at least some support for any claim or counterclaim. Should we focus simply on survival or some measure(s) of health? How—and when—should we measure the outcomes? SES may have a very different relationship with survival (or health) at younger ages from the relationships it has at older ages; some dimensions of health may be more highly associated than others. “When” may also matter not only in terms of age, but also in terms of historical time or situation in the epidemiological transition. For example, historical data for the United States reveal few social class differences in child mortality in the late 19th century (e.g., the children of physicians had death rates close to the national average), but, as health beliefs changed and knowledge of hygienic practices spread during subsequent decades, socioeconomic gradients in mortality widened (Preston and Haines, 1991). And of course, we could always find differences among studies in the ways SES is realized or how health is measured.

Still, we would hope that a “good” generalization would be robust. Len Syme says it well (personal communication, 2012):

We are rightly concerned about defining and measuring variables precisely and perfectly but, to me, the most important variables withstand our imprecision and vagueness. For example, if we used different definitions and different methods in different populations and still always find the same results, I think we have a really important variable. Social class provides a good example of this. We don't really know what social class is and we

measure it in many different ways. But that doesn't seem to matter; Social class turns out to be a very important variable because it is always related to the outcomes we study. Social support provides another example. These variables are so important that they withstand our clumsy attempts at definition and measurement.

We *almost* agree: Our point is that the exceptions to the “always” are interesting because they suggest we may be missing something that should motivate a search for richer more nuanced explanations of those findings. The exceptions remind us that we shouldn't expect to see the same relationships everywhere.

### WEAK EVIDENCE THAT BIOMARKERS MEDIATE THE SES-HEALTH LINK

Here we raise two concerns. First, it is not entirely clear whether an unambiguous relationship between social conditions—broadly construed as position in social hierarchies, social relationships, and networks—and biomarkers has been documented. And second, the extent to which currently obtainable biomarkers mediate the relationship between social conditions and health appears to be an open question. We are not suggesting some magical connection. At some level, we are biological reductionists: We accept that the association must be mediated through physiological pathways, and we caution only that a convincing case has not yet been made. Gruenewald points to the desire to understand how social conditions “get under the skin” as a motivation for the addition of biomarker collection to epidemiological and social and demographic studies. Although she identifies some of the apparent vulnerabilities of these efforts, our overall impression from her commentary is that she is quite optimistic. For a variety of reasons, we have a more guarded view of the landscape. We have concerns about choice of biomarkers, dealing with complex interactions between genetic endowment and environment, the large numbers of pathways for which we would want biomarkers, and finally, we suspect that the physiological influences linking SES to health are comprised of huge numbers of potentially interactive effects, most of which are not observable or measurable. Other measurement issues range from determining how, when—or how often—to measure biomarkers to how to measure environmental influences, especially past environmental influences.

Evidence linking social conditions and biomarkers is not unambiguous. As Gruenewald discusses, even a relatively well-measured marker, such as blood pressure with established ties to disease processes, exhibits markedly different relationships with SES across studies or even within studies depending on sex or measure of SES (Goldman et al., 2011). Other

biomarkers raise even more complex issues of assay comparability and, more fundamentally, the processes that the markers reflect, processes that may differ across time and setting.

Work on the relationship between social factors and markers of immune function or inflammation serves as a good example of such problems. Recent reviews of the literature by Uchino (2006) and Kiecolt-Glaser, Gouin, and Hantsoo (2010) provide insights into factors that make it difficult to generalize about the links. One example is the fact that social interactions typically entail both positive and negative aspects; another is that commonly measured biomarkers of inflammation (IL-6, for example, which can have both pro- and anti-inflammatory influences [Uchino, 2006]) have highly complex mechanisms that could easily be misinterpreted in observational study designs.

One account, proposed by Hillard Kaplan during the course of the workshop, suggests that some of the difficulties could lie in the causal pathways that underlie the inflammatory markers (Kaplan, personal communication, 2011). For example, the history of exposure to infection might influence inflammation throughout the life course. More generally, Kaplan suggested that the causal pathways would be likely to differ not only across environmental conditions, but also with age so that researchers might confound adaptive aspects of aging with potentially correlated, but not necessarily causal, social exposures. Thus, for instance, higher levels of inflammation might be an adaptive response to age-related changes rather than a marker of poor regulation.

Our own recent work in collaboration with Carol Ryff and Yu-Hsuan Lin (Glei et al., 2012a) using U.S. and Taiwanese data provides little encouragement. We examined the relation between two components of social relationships—perceived support and social integration—and six inflammatory markers. Results yielded only weak evidence of a link between the biomarkers and the social relationships. Along the lines of Kaplan's suggestion, one might expect that exposure to infection, especially when today's older adults were children, would be a more important promoter of inflammation in Taiwan than in the United States. If so, that could weaken the potential effect of social relationships in Taiwan. However, even this very plausible suggestion is not supported by the data in this instance: If anything, the association between social relationships and inflammation appeared stronger in Taiwan than in the United States. We recognize that our data cannot support a conclusive test: We do not have direct information on childhood exposure to infectious disease in Taiwan, although, perhaps, a comparison of inflammation in cohorts who were born early versus late in the epidemiological transition might shed some light. We also do not know whether, as discussed earlier, exposure would have pro- or anti-inflammatory effects in adulthood. To move forward, we need to have

hypotheses that direct our attention to the complex interactions and links among social organization, physical conditions, macro-level change in these factors, and individual-level response to exposures. Such hypotheses present heavy—perhaps insupportable—demands on any data collection initiative and will almost certainly require an approach that articulates data across time and place. Such worthwhile efforts at integration, as we discuss later, face their own challenges.

We are also collaborating with colleagues using data from the Survey on Stress, Aging and Health in Russia, a survey of Muscovites aged 55 and older (Glei et al., 2012b; Shkolnikova et al., 2009). Russia might be the “poster child case” for establishing an association between social disparities and mortality: On the one hand, the most greatly disadvantaged Russians (especially men) suffered the greatest declines in life expectancy during the mortality crisis; on the other, highly educated Russians experienced an increase in life expectancy (Murphy et al., 2006; Shkolnikov et al., 2006). If a link between SES and biomarkers corresponding to a link between SES and mortality could be documented anywhere, we expected to find strong evidence in Russia. Indeed, we found substantial educational disparities in physiological dysregulation based on 20 biomarkers. However, more detailed analysis revealed that the size of the differentials varied across systems. Both sexes exhibited a large educational disparity in standard cardiovascular and metabolic factors, but heart rate parameters (based on 24h ECG) and inflammation showed substantial differences only in men. These results are consistent with the excess cardiovascular mortality that is a major contributor to high levels of mortality among Russians, particularly men. Yet, social disparities in neuroendocrine dysregulation were negligible in both sexes. If social disparities in allostatic load and in health outcomes reflect a differential burden of stress, it seems surprising to find so little social variation in these stress hormones, although we recognize the many measurement issues surrounding the collection of these markers.

Whether the current battery of biomarkers actually mediates the relation between social conditions and health is an even more vexed question. Unlike several other studies (see next sentence), the Russia data do show that the biomarkers—accumulated across systems—explain a substantial proportion (albeit only about one-third at best) of the variation in health across SES groups. Other studies that have examined whether biomarkers mediate social disparities in self-assessed health status or physical functioning show that the biomarkers explain only a small proportion of the socioeconomic differentials in Taiwan (Dowd and Goldman, 2006; Goldman et al., 2011; Hu et al., 2007), relatively little of the variation in the United States (Goldman et al., 2011; Koster et al., 2005), and none of the SES gap in Costa Rica (Goldman et al., 2011). As Gruenewald notes in her chapter, “evidence demonstrating that social disparities in biomarkers underlie

social disparities in actual health outcomes” is needed. To date, such evidence is sparse at best, and must be stacked up against a growing body of null or inconsistent findings—at least from population-based studies. The likelihood that null findings are underrepresented because of publication bias simply serves to underscore this point. Overall then, we have not done well at explaining the physiological pathways linking SES to health.

### ALLOSTATIC LOAD—A FEW CONCERNS

Never underestimate the power of a narrative (Kahneman, 2011, p. 81)—and the story behind allostatic load is compelling. A recent review by Juster, McEwen, and Lupien (2010, p. 3) provides a simple summary of the plot: “Allostatic load (AL) represents the ‘wear and tear’ the body experiences when repeated allostatic responses are activated during stressful situations” (McEwen and Steller, 1993). In turn, allostatic response (Juster, McEwen, and Lupien, 2010, p. 2) is the “process whereby an organism maintains physiological stability by changing parameters of its internal milieu by matching them appropriately to environmental demands” (Sterling and Eyer, 1988). The 2010 Juster et al. review summarizes some 58 studies of AL; we estimate that—perhaps—15 of them include measures of stressors or perceived stress. Five of those were based on the Taiwan Social Environment and Biomarkers of Aging Study data and yielded only modest support for links between AL and stress (Gersten, 2008; Gleib et al., 2007; Seeman et al., 2004; Weinstein et al., 2003). Studies in the United States have also yielded some evidence of a modest association (Roepke et al., 2011; von Känel et al., 2003) but others have found mixed results (Gallo et al., 2011; Mair, Cutchin, and Kirsten Peek, 2011) or no association (Seeman et al., 2002). Still other research found a weak relationship in Australia (Clark, Bond, and Hecker, 2007) and Germany (Schnorpfeil et al., 2003), and a modest association in China (Sun et al., 2007) and Sweden (Gustafsson et al., 2011). In short, while there is substantial evidence that multisystem dysregulation—to use that term rather than AL, which implies a link to stressful experience—is related to many health outcomes, its links to stressful experience are not well established.

Concerns with allostatic load are nothing new. The National Institute on Aging (NIA) Exploratory Workshop on Allostatic Load, held under the auspices of the Behavioral and Social Research Program, NIA, was convened November 29-30, 2007, in part to shed some light on the issues. Background materials from the workshop provide a laundry list of such concerns (Nielson, Seeman, and Hahn, 2007). A full discussion of the concerns is not what we would want to accomplish here, but we note that the participants raised issues with (among others): how “stress” is defined (Cacioppo, Crimmins, Epel, Goldman); the choice of biomarkers

that capture dynamics or reflect cumulative dysregulation (Cohen, Coles, Epel, Goldman); and understanding the role of the timing of exposure (Maestripieri)—a question also raised by Gruenewald. One might add assay comparability across time and place, the need for a developmental approach that incorporates exposure and health across the life course, and the various logistical and financial hurdles involved in incorporating well-designed biomarker collection in population surveys.

The definition and measurement of “stress” is a particularly thorny problem (Cohen, Kessler, and Underwood, 1997; Monroe, 2008). A related issue pertains to how “stress” fits into the allostatic load framework. One viewpoint suggests that allostatic load provides a measure of *physiological* stress. This perspective—which tautologically links stress to allostatic load—fails to provide us with testable hypotheses regarding the impact of life challenges or other environmental factors on physiological dysregulation. An alternative framework, which underlies much of the research described in this paper, posits that dysregulation is a result of prolonged or repeated exposure to life stressors. In this case, there is a testable relationship, but one that has not been studied systematically and, to date, has yielded only weak evidence of causal linkages.

### WHERE CAN WE GO FROM HERE?

We are not yet ready to deny more generally the utility of documenting physiological parameters of a population, but we would argue that future forays into biosocial survey data collection need to be grounded in well-formulated theory. No one is advocating throwing the wheat away with the chaff, and we recognize that it may be too early to decide what to keep and what to toss. We see several areas for development. Gruenewald talks about geographic variation and we agree that it is a potentially fruitful area for investigation. “Geographic” encompasses a multitude of possible explanatory factors including variation in environmental conditions, gender roles and relations, epidemiologic history, social structures and institutions, culture, developmental histories, and genetic endowment. We have now amassed an impressive array of biosocial studies across a wide range of geographies, and now the question is how can we best exploit these data.

If we want to move beyond purely descriptive “comparisons” to understand the deeper, possibly causal explanations of variation—and it does seem like a worthy goal—we will need better theory to inform our investigations. It is here that we see a large potential contribution from sociology, from both cultural and biological anthropology, from psychology, and from evolutionary biology. As a field, we are spending too much time talking among ourselves. This commentary has noted or implied a few areas from which to begin: we need help understanding, for example, how

social stratification varies across geographies, how social institutions and structures mutually contribute to and reinforce each other's formation and perpetuation (Sewell, 1992), and the role of priming in relative deprivation (Kahneman, 2011). We have data that will allow us to perform similar analyses in Costa Rica, Russia, Taiwan, and the United States, but how do we explain differences when we find them? As noted by Goldman and her colleagues (2011, p. 313):

Despite a justified appeal for international comparisons of social gradients in health that integrate biological mechanisms, such undertakings are generally unable to establish whether divergent findings reflect true variability in the physiological pathways linking SES to health across countries, regions, and time periods; differences across data sets in measurement error or definitions of biomarkers, SES and health outcomes; differences in analytic strategies; or differences in sample size.

These questions are not only limited to different geographies, but also apply to group differences more generally. How can we explain different relationships among variables when we find them between, for example, men and women? Underlying physiological differences by sex may be only one factor. As Gruenewald says, social factors interact with biology in complex ways: those differences between men and women are almost certain to also have a basis in the social interpretation and expectations for each sex. Similarly, we would look for deeper explanations of black/white differentials.

We have also mentioned the need for both epidemiologic history and evolutionary biology in our discussion of inflammation, but one could easily imagine that those questions factor in to just about any physiological–social link that we would want to examine. Overall, we would advocate for comparative studies that bring together diverse explanations for the links between physiology and social conditions. Are there ways to test (i.e., reject) the theories? If—as seems likely—additional data collection initiatives continue to be funded, we would advocate for carefully targeted, theoretically driven studies.

So, is the glass half empty or is it half full? As always, the answer is “both.” We remain both skeptical and cautiously optimistic.

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## 12

# Social Genomics and the Life Course: Opportunities and Challenges for Multilevel Population Research

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The past decade has brought remarkable advances in the integration of social and biological models of health across the life course (see also Gruenewald, this volume). Research is beginning to specify multilevel connections between diverse social experiences—reflecting status, isolation, support, and stressors—and biological pathways, including neuroendocrine processes and intracellular mechanisms involving the genome (Miller, Chen, and Cole, 2009). Moreover, these multilevel complexities are now being studied with reference to life course models (principally, sensitive period, accumulation, and pathway; Shanahan and Hofer, 2011).

This chapter focuses on one promising subfield of this larger literature, social genomic studies of genetic transcription, and the opportunities and challenges that it presents for demographers and social epidemiologists who study aging and health. Social genomics was chosen as the focus for this chapter because this subfield attempts to interrelate social settings with gene expression by way of chains of mediating factors, and thus illustrates the promise and challenges of multilevel research in sharp relief.

The field of social genomics focuses on the mechanisms by which social experiences regulate genetic activity (Cole, 2009). Transcription regulation refers to processes that govern the rate at which DNA is transcribed into messenger RNA (mRNA), which in turn eventuates in proteins. Thus, social genomic studies of transcription focus on how social experiences influence mechanisms by which the information contained in the DNA is transcribed (or written out) into mRNA. This focus on transcription is important because mRNAs serve as the molecular building blocks for proteins, which are integral to virtually every biological process in the cell.

Social factors likely influence genetic activity by way of complex mediating chains involving many levels of analysis, possibly extending, for example, from political economies to people's reactions to their immediate circumstance to intracellular mechanisms. By establishing these mediational links between social experiences and transcriptional activity, scientists can begin to understand how social experiences, like those associated with socioeconomic status (SES), affect physical and mental health.

The possibility that social genomics can articulate such mechanisms is highly significant, because most population research relies on nonexperimental survey data that make causal inference provisional. Human studies of transcription often suffer from the same limitations; however, these human studies can then inform nonhuman animal studies that use experimental designs, and even human experimental designs. When these diverse types of studies converge on a mechanistic model that links social experiences with expression profiles, causal inferences about social context and health are indeed strengthened. Thus, a major payoff of social genomics for demography and social epidemiology is the strengthening of causal claims by specifying the mechanisms that link social experience with behavior and health.

Viewed broadly, social genomic research to date suggests a "two-stage" historiography: (1) earlier research, conducted by social and behavioral scientists, identified putative social risk factors and (2) investigations, conducted largely by health and biological psychologists, then focused on how such risk factors "get under the skin," eventuating in altered gene expression. As a result of this two-stage exchange, increasingly sophisticated models are emerging that aspire to mechanistically connect social risk factors, psychological and neuroendocrine mediators, and molecular processes that, in turn, explain the emergence and progression of diseases. These advances raise new questions for a "Stage Three," the integration of population-based studies of social risks with gene expression mechanisms in the study of health and aging.

Drawing on early research in this area, which examined several acute and chronic stressors, the chapter begins by explaining the concept of transcription and, in general terms, research strategies that are used to study social factors and transcription. The chapter then reviews advances in social genomics with particular attention to studies of socioeconomic status, which are of central interest to population researchers. (The chapter could also have focused on social isolation as an illustrative example, and interested readers are directed to Cacioppo et al., 2011.) Finally, the chapter identifies a series of opportunities and challenges for Stage Three, population studies of health and aging that are informed by transcription studies. These opportunities and challenges include (1) the collection of multilevel data, including expression data, relevant biomarkers associated with stress

response, and neuroimaging data; (2) extensively longitudinal designs that can adjudicate among several life course models; (3) the refinement of measures of social context; (4) the use of large, diverse, population-based samples; and (5) the strategic use of diverse designs to strengthen causal claims and to examine the effects of socioeconomic status on gene expression in different policy settings, political economies, in societies characterized by different demographic compositions, and among migrants. In turn, such challenges and opportunities call for the innovative organization of interdisciplinary teams of scientists.

The overarching point of this chapter, then, is that population-based research originally inspired social genomic (transcription) studies, and the results of these investigations now suggest future directions for population-based studies of social location, health, and aging. Ideally, such studies will be designed to study multilevel, meditational processes as they extend over many decades of life.

## SOCIOECONOMIC STATUS, GENE TRANSCRIPTION, AND INFLAMMATORY PROCESSES: STAGES ONE AND TWO

### The Emergence of Transcription Studies of Social Experiences

Transcription depends on RNA polymerase (RNAP), an enzyme that attaches to the promoter region near a gene and that then synthesizes mRNA from the DNA template strand. In turn, the mRNA shuttles to the ribosomes, where encoded proteins are synthesized and then perform two broadly defined functions. First, the synthesized proteins maintain and regulate the basic metabolic processes necessary for life. The ENCODE Project—which draws on high-throughput sequencing to examine the functional elements of the human genome—reveals that transcription processes are quite complex, that the genome contains much more information than is expressed at any given time, and that cells are highly selective in which genes are expressed (ENCODE Project Consortium, 2011; Weinstock, 2007, and accompanying articles). This last point is evident when one considers that the diverse cells that make up the human body all develop and are regulated with instructions from identical copies of the individual's DNA. Because each person's DNA contains a massive amount of information, it must be selectively expressed to orchestrate coherent development.

Second, transcription is also an important (although not exclusive) mechanism of adaptation, allowing the cell to respond to changing circumstances. The process of adaptation depends on the regulation of RNAP and its attachment to the promoter region of a gene. The promoter region includes response elements, short sequences of DNA that can bind molecular flags known as transcription factors. Once a transcription factor attaches

to a target response element, it can promote or block the recruitment of RNAP. When the transcription factor attaches to the response element and recruits RNAP, the gene is said to be up-regulated, meaning that its rate of expression increases. Blocking (or repression) of RNAP leads to down-regulation. Roughly 200 transcription factors operate in the mammalian genome, and each binds to a specific stretch of DNA (i.e., a response element), which is typically 10-20 but possibly up to 40 nucleotides in length. Research has identified the nucleotide sequence for many major transcription factors, and researchers can combine that information with data from the Human Genome Project to make inferences about patterns of transcription factor activity.

Transcription factors themselves are the product of intracellular signaling cascades and signals (or stimuli) originating from the environment. Heat shock factor was perhaps the first transcription factor identified that is responsive to environmental stimuli, discovered in 1974 in *drosophila melongaster*. This transcription factor is, not surprisingly, highly conserved across species and indeed observed in humans. However, that transcription was downstream from *social* experiences—that is, responsive to social circumstances by way of mediating chains—was only recently documented, beginning with studies of psychosocial factors and HIV-1 progression (Cole, 2008b).

Several streams of evidence (involving humans and nonhuman primate experiments) pointed to the activation of the sympathetic nervous system (SNS; typically associated with the body's "flight or fight" response to stressors) in increasing the HIV's transcription and replication and, hence, the progression of the disease. That is, psychosocial stressors and reactivity to stressors eventuate in faster progression of HIV-1 because of increased viral replication. Because the SNS is downstream from social stressors, however, this research suggested a broader possibility: that, beyond the specific example of HIV-1, social experiences could influence gene expression because of their effects on the nervous system.

Cole and his colleagues (2007) were among the first to examine this possibility, focusing on social isolation and the transcriptional profiles of white blood cells (leukocytes). Consistent with the two-stage historiography suggested earlier, this study began with social epidemiological and sociological research identifying social isolation as a risk factor for diverse forms of distress (e.g., Seeman, 1996), including physical diseases. In fact, Cole and his colleagues had earlier shown (1994) that social isolation was associated with increased activity in threat-related pathways of the SNS (for a recent review, see Irwin and Cole, 2011).

The study's focus on white blood cells was highly strategic. Gene expression is likely tissue-specific, making the study of many of the body's organs a highly invasive process. Peripheral blood cells, in contrast, may

be collected with minimal inconvenience to participants. Also, white blood cells are integral to host resistance to infection and inflammatory processes, which are implicated in cardiovascular disease, neurodegenerative disease, and likely depression. Thus, this study of social isolation joined two very different research traditions: a considerable body of population-based research on risk factors, and biological models of leukocytes, which offer a noninvasive window into the immune system and inflammatory processes associated with many common diseases of aging.

The basic issue, then, was whether genes were expressed differentially among socially isolated versus socially integrated adults. In turn, the answer to this question was examined in terms of three questions. First, are transcripts differentially expressed between socially isolated and integrated people? Fourteen healthy adults from the Chicago Health, Aging, and Social Relations Study were selected based on their relatively high or low scores on a standard measure of subjective loneliness, the University of California, Los Angeles, Loneliness Scale. Differential expression of mRNA was then examined using global gene expression profiling and was observed in 209 transcripts (of roughly 22,000 examined transcripts) correcting for a false discovery rate. Thus, the social isolates differed in their gene expression profiles from the socially integrated adults.

Second, what were the functions of these differentially expressed genes? The functions of these transcripts were then identified using the Gene Ontology (GO) catalog, a directory that lists the functions of gene products (see <http://www.geneontology.org>). The issue was whether the over- and underexpressed transcripts had biological functions that would indicate how social isolation could affect health. In fact, the GO categories indicated that lonely adults were, generally, showing greater activation of innate immune cells (e.g., pro-inflammatory signaling). And third, among the differentially expressed genes, could specific transcriptional pathways be identified that would help explain immune activation? This question was examined using TELiS, bioinformatics software that analyzes the prevalence of specific transcription factor binding motifs (TFBMs) in differentially expressed genes.

Several pathways were identified, but one—involving the glucocorticoid receptor (GR)—is particularly significant because of its replication by other studies, its biological plausibility, and its possible applicability beyond the specific case of social isolation. Glucocorticoids (Gs) are a class of steroid hormones that are integral to the immune system; when bound to a glucocorticoid receptor, the resulting complex migrates to the nucleus where it up-regulates genes that code for anti-inflammatory proteins and slows the expression of pro-inflammatory proteins by preventing other transcription factors from entering the nucleus. Thus, Gs and GRs are central players in inflammatory responses.

Cole and his colleagues found significantly less expression of GR-target genes in the leukocytes of socially isolated adults when compared to socially integrated ones. This pattern is consistent with the “glucocorticoid insensitivity hypothesis”: Chronically stressed individuals become insensitive to the anti-inflammatory actions of Gs (such as cortisol), reflecting the down-regulation of GR transcription factors. That is, chronic stress lessens the ability of G-GR complex to work as a transcription factor that ultimately reduces inflammation (for experimental support, see Cole, Mendoza, and Capitanio, 2009; for evidence suggesting that even low levels of isolation could trigger G insensitivity, see Cole, 2008a).

Additional support for G resistance is found in Miller and his colleagues’ (2008) study of links between chronic stress and transcription, a genome-wide expression study (using microarray technology) of family care-givers of brain cancer patients and matched controls. They hypothesized that chronic stress elevates cortisol, which in turn leads to (1) an eventual, compensatory down-regulation of GRs in monocytes (a type of white blood cell that is integral to immune response) and (2) a consequent enhancement of pro-inflammatory signaling. Miller et al. (2009) examined the TFBMs in the promoter regions of differentially expressed genes. As expected, TFBMs occurred about 23 percent less frequently in genes associated with glucocorticoid receptors, and they occurred more frequently in genes associated with pro-inflammation in caregivers, compared to controls. Overall, the results suggested that social stress has a “transcriptional fingerprint” involving resistance to glucocorticoids and mild systemic inflammation (for an additional example focused on interpersonal stress, see Miller et al., 2009).

### Transcriptional Studies of SES

In addition to studies of acute and chronic stressors, research has also examined SES, of central interest to demography and social epidemiology in the study of health disparities. Miller and his colleagues (2009) examined why children’s SES is associated with health (such as indicators of cardiovascular disease) decades later, in adulthood. Once again, and consistent with the two-stage historiography, this study began with epidemiological observations suggesting that low SES in childhood predicts coronary heart disease throughout adulthood even among people who attain high levels of SES later in life (Kittelson et al., 2006). They suggest that early adversity increases the likelihood of a “defensive phenotype,” the hallmark of which is exaggerated biological response (e.g., inflammation) to stressors. As stressors accumulate in the life course, people with this defensive phenotype will be increasingly prone to inflammatory diseases, including, for example, some types of cardiovascular and respiratory.

Consistent with this model, the authors observed that, controlling present SES, low SES during childhood (as indicated by parents' occupations during the child's first five years of life) was associated with several transcriptional patterns that imply a defensive phenotype at about age 34. These findings suggest that early socioeconomic experiences result in durable programming of the stress response system. As Shanahan and Hofer (2011, p. 143) observe, "although the use of occupational prestige to indicate 'adversity' deserves further consideration, the empirical findings raise the possibility that early experiences are capable of enduring biological programming (by way of transcription) in response to social circumstances." The potential importance of early SES was likewise suggested by research showing that SES at age two was associated with the expression of GR mRNA during adolescence, a relationship that was not moderated by current SES (Miller and Chen, 2007). The authors conclude that "low SES operates most potently during this period [of early childhood] of immune-system priming . . . in a way that favors the emergence of a pro-inflammatory phenotype" (p. 408).

Two additional studies support the hypothesis that low SES early in life is associated with genetic transcription patterns consistent with G insensitivity and add nuance to this basic pattern. Chen et al. (2011) examined gene expression profiles among adults who grew up in low-SES households but experienced either high or low maternal warmth. The results suggested that low-SES children with warm mothers showed reduced bioinformatic indications of pro-inflammatory transcription factor activity and immune activating transcription factor activity compared to those who were low in SES early in life but experienced low maternal warmth. In other words, high maternal warmth served as a protective factor for children from low SES households with respect to transcription patterns related to immune response and inflammation. Consistent with Miller and Chen (2007), they also reported that current SES did not alter this pattern of findings.

Second, Chen et al. (2011) examined genome-wide transcription profiles for T lymphocytes of asthmatic children from low- or high-SES households. Low-SES children showed overexpression of genes regulating inflammatory and catecholamine processes, including some involved in chemokine activity, stress responses, and wound responses. Some of the observed differences, however, appeared to be mediated by perceived threat. That is, children from low-SES households were more likely to perceive threat in ambiguous situations, and this tendency appeared to activate neuroendocrine processes that eventuated in changes in inflammatory signaling pathways.

### Summary

Social genomic studies of transcription are relatively new but have nevertheless led to a cohesive body of research that point to biological mechanisms by which social experiences can affect health. To date, evidence suggests that low SES in childhood and diverse contemporaneous social stressors alter genetic expression by adolescence and also in mid-adulthood. These alterations are consistent with a G resistance model such that prolonged exposure to stressors is thought to lead to insensitivity to Gs, which would otherwise up-regulate anti-inflammatory and down-regulate pro-inflammatory proteins. This resistance could, in turn, be associated with diverse inflammatory illnesses, including asthma, cardiovascular disease, and depression. Some evidence suggests that a sense of threat or heightened vigilance may serve as a critical social psychological mediator that links social stressors with transcription profiles.

At the same time, many of the discussed studies rely on small, possibly unrepresentative samples, and nonexperimental designs. Although efforts are made to statistically control alternative explanations (e.g., by accounting for correlations among social stressors), such studies likely can address these threats to causal inference in a limited fashion. However, experimental designs that examine these links constitute Stage Two research (e.g., Cole, Mendoza, and Capitanio, 2009) and, as these designs are increasingly used in conjunction with nonexperimental designs, causal inferences will be strengthened. Thus, Stage Three researchers should pay close attention to the extent to which nonexperimental results have replicated in experimental settings.

### STAGE THREE: POPULATION-BASED MULTILEVEL STUDIES

This chapter has proposed a two-stage historiography according to which population-based research identified putative social risk factors (Stage One) and, drawing on this research, social genomic studies identified possible biological mechanisms by which these risk factors could eventuate in diminished health (Stage Two). Yet what are the implications of these studies for population research (Stage Three)? The Stage Two studies that have been reviewed raise a number of distinct opportunities and challenges, including (1) the collection of multilevel data, (2) the examination of diverse life course models, which require extensive longitudinal data, (3) the refinements of measures based on diverse measurement strategies (including observation and tasks, for example), (4) the specification of cause and effect, and (5) the use of comparative designs.

### Collection of Multilevel Data

Mechanistic models of health and aging call for extensive information about the context, people's psychological states and behaviors, and biological processes. In the context of the transcription studies discussed, for example, population-based studies should begin assessing gene expression profiles for cells associated with immune processes in peripheral blood. The initial body of research was based, quite understandably, on relatively small samples drawn nonprobabilistically from communities, which renders inference and the study of diversity difficult. However, gene expression patterns may provide critical evidence of linking mechanisms that connect social experiences with health. The collection of gene expression data in the context of demographic and epidemiological research may be possible in the near future, although there are presently practical barriers (e.g., peripheral blood draws require nontrivial processing in a timely manner) that make large-scale collection from a geographically dispersed population challenging and expensive. Until those barriers are addressed, however, several collection strategies may be strategic.

First, the collection and processing of peripheral blood from subjects participating in well-defined and characterized community samples is logistically plausible. Many community-based samples have been studied for decades, resulting in rich descriptions of the participants' social experiences. Particularly when such studies begin before or shortly after the birth of the subjects and include valid, reliable measures of social, psychological, and medical assessments, the collection of expression data could be highly informative. Second, smaller purposive samples are also logistically feasible, which allow for the study of strategically defined groups. For example, as noted, Cole and his colleagues (2008a) studied expression profiles among adults who were pre-screened for social isolation, resulting in matched groups differing, apparently, only on this characteristic. These strategies could involve embedding, the selection of a subset of respondents from a larger, ongoing study, ideally with thorough matching on possible confounds. Researchers interested in health disparities might examine, for example, groups that are apparently resilient despite exposures to a risk factor (poverty, discrimination, etc.).

Whatever the research design and sampling, the resulting data will ideally include multiple assessments to address a series of life course problems. Such a proposal is not new in itself, with many studies attempting to collect multilevel data (e.g., famously, the National Health and Nutrition Examination Surveys, or NHANES).

### Life Course Models

That health and well-being reflect life course processes has long been appreciated, although research is now accumulating that suggests the relevance of prenatal (and intergenerational) experiences to health throughout adulthood, realities that call for data covering at least the entirety of people's lives, from conception to death.

At first glance, the results of gene transcription studies of SES appear largely consistent with a sensitive or perhaps critical period model. However, extant evidence is not decisive and indeed conceptual considerations suggest a hybrid model involving a sensitive or critical period followed by a "chain of insults," with perhaps accumulating disadvantage. Extensively longitudinal data, ideally extending across generations, will be needed to resolve these issues.

A sensitive period model posits that a specific biological system is highly plastic (i.e., subject to change, also referred to as *programming*) at specific points in development; that the resulting biological change takes place in response to the environment; and that the biological change is durable, potentially creating stable biological and/or behavioral tendencies. The critical period model differs in that the period of plasticity is the only time during development in which the biological system is open to change. That is, in contrast, the sensitive period model suggests a time span during which the system has heightened sensitivity to programming, but it may change during other periods as well.

Adjudicating between these two models requires extensive longitudinal data that describe the biological system and the social factors that are thought capable of changing it. Such data would allow for the study of the purported sensitive or critical period but also "before" and "after" periods. Indeed, only data collection spanning "before-during-after" could inform whether a period is sensitive or critical; whether observed changes endure and, if so, for how long; and whether any enduring changes are in fact associated with biological and behavioral tendencies in later life. Presently, research suggests that socioeconomic experiences before age 5 are associated with gene transcription patterns perhaps as early as age 9 (Chen, Martin, and Mathews, 2006; Miller and Chen, 2007) and as late as age 40 (Miller et al., 2009). Indeed, one study raises the intriguing possibility that the one-to-two-year-old span is a sensitive period for GR, and the two-to-three-year-old span is a sensitive period for toll-like receptor 4, which are proteins of the innate immune system that recognize conserved features of potentially invasive microbes (Miller and Chen, 2007). That is, different age periods may be sensitive with respect to different aspects of the immune system.

At the same time, several opportunities are suggested by the complexities of the sensitive period model and the extant data. First, although socioeconomic status before the age of five is thought to be decisive, less is known about the “before” and “after” periods. The reviewed studies rely largely on retrospective measures of SES in childhood and control present SES. However, the role of SES patterns before birth and after age 5 have not been studied prospectively. With respect to the “before” period, a large body of evidence points to the possibly powerful roles of maternal experiences on fetal development (for an overview, see Godfrey, Gluckman, and Hanson, 2010) and of intergenerational transmission of gene expression patterns in response to social experiences of grandparents (for a review, see Morgan and Whitelaw, 2008). To the extent that these prenatal experiences are correlated with SES during infancy and toddlerhood, it is conceivable that they could play causal roles in shaping transcription patterns.

With respect to trajectories of SES after age 5, there are likely a limited number of life course trajectories of SES (Hallqvist et al., 2004; Rosvall et al., 2006), raising the possibility that, for example, few people with chronically low SES before age 5 experience high SES over the next five years. Thus, statistical control of present SES may not be entirely effective in simulating group comparisons between high and low SES toddlers, controlling subsequent SES trajectories. In any event, it may take very large samples to adequately study people with diverse longitudinal patterns of SES.

Second, although socioeconomic status in early childhood is hypothesized to be the causal contextual agent, it is unclear when altered transcription patterns emerge. The lag between the environmental exposure and these changes, or the induction period, is unknown. One possibility is that transcription patterns change very soon after, or during, the sensitive period, a possibility for which there is presently no evidence. An additional possibility is that the sensitive period model is characterized by a longer induction period, meaning that there is an appreciable interval of time between the environmental exposure and altered transcription. Extant data are presently consistent with an induction period extending somewhere between exposure at ages 1 to 3 and altered transcription perhaps as early as age 9. However, more data are needed.

Third, the “chains of risk model” posits that risks (such as low SES) increase the likelihood of subsequent disadvantages, creating a chain reaction of challenges, but very little extant data shed light on this possibility. Miller and his colleagues (2011) propose such a model, the “defensive phenotype model,” arguing that early chronic stressors such as low SES are associated with pro-inflammatory tendencies (as discussed above), but also vigilance and mistrust of others, diminished self-regulation, and a proclivity for risky behaviors. That is, GR insensitivity is integral to the defensive phenotype, but the latter is broader and includes psychosocial processes.

According to this perspective, early chronic stressors are also associated with heightened biological responses to other stressors, which accentuates the pro-inflammatory tendencies.

Thus, children growing up in low-SES households (i.e., subjected to chronic stressors) are characterized by a constellation of biological, psychological, and social challenges that, in turn, create yet more stressors, diminish their capacity to cope with stressors, and make them more responsive to the negative effects of stressors. The resulting chronic inflammation is then thought to lead, over many years, to inflammatory disease states, although pre-disease indications may be observable by late childhood (Koenig et al., 2011; Lupien et al., 2009). However, the types of social, psychological, and biological experiences that would connect early SES and later inflammatory gene expression patterns are not well studied. Indeed, very little is known about how children in low-SES settings may, through their behaviors, create stressors and impede effective coping and social supports. These considerations suggest a critical or sensitive period that, in turn, is accompanied by a chain of social, psychological, and biological risks with considerable positive feedback among the types of risk and over time.

Fourth, while life course epidemiology and demography recognize the chain of risk model (e.g., Hayward and Gorman, 2004; Kuh et al., 2003), life course sociology has proposed an additional, complementary form of risk accumulation. O'Rand (2006) proposes a cumulative disadvantage model, according to which early disadvantages (like those associated with low SES) initiate strongly path-dependent exposure to risks, a "chain of insults" that extends across the phases of life. In contrast, people with advantageous early circumstances encounter a strongly path-dependent sequence of enriched environments marked by high levels of social capital, interpersonal relationships that facilitate the attainment of goals and positive development. In keeping with a large empirical literature, O'Rand emphasizes the importance of the SES of the family-of-origin, which is highly influential with respect to lifelong patterns of social capital and social risks. The distinguishing feature of this model, however, is that differences attributable to initial disadvantage are magnified over time (analogous to compound interest) (DiPrete and Eirich, 2006). Some evidence suggests that this insight may be important in understanding health disparities in late adulthood (e.g., Dupre, 2007; Willson, Shuey, and Elder, 2007). That is, the "chains of risk" model refers to the accumulation of a risk factor or factors, and O'Rand's model refers to how the effect of early risk is accentuated over time.

All of these considerations suggest a highly nuanced life course model: a sensitive or critical period, with a possibly short induction period followed by chains of social, psychological, and biological risks with extensive positive feedback among them; the child's behaviors reflecting social

disadvantages but also creating stressors and undermining coping and social supports; predisease symptoms observable by late childhood; and disease states emerging in adulthood, perhaps according to a power function. Clearly, such possibilities call for multilevel data, extensively longitudinal data.

### Refining Measures of Social Risk Factors

As noted, Stage Two can inform Stage Three by suggesting refinements in measures. There is impressive evidence linking SES with “flexible resources” (e.g., knowledge about health) by which people avoid risky behaviors and other threats to health, engage in health-promoting behaviors, and attempt to address symptoms and disease states (e.g., Phelan, Link, and Tehranifar, 2010). The multilevel research on gene expression, however, suggests two additional mechanisms by which SES could influence health, and these mechanisms suggest new avenues for the measurement of social context.

First, as noted, early pronounced, chronic stressors may lead people to view ambiguous situations as threatening, which in turn activates neuroendocrine processes that eventuate in changes in inflammatory signaling pathways (Irwin and Cole, 2011). The evidence for this link, between stressors and sense of threat and vigilance, is complex but hinges on changes in the corticolimbic circuitry, which is associated with memory and emotion (Miller, Chen, and Parker, 2011). In any event, a possible link between SES and the activation of the corticolimbic circuitry suggests the refinement of measures of the social environment to more directly assess contextual features that would foster a sense of threat, vigilance, and mistrust. Irwin and Cole’s (2011) review of connections between the SNS and threat suggests the importance of violence, hostility, aggression, interpersonal loss, trauma, and physical exhaustion. Thus, research could directly assess how specific aspects of SES and features that are strongly associated with SES induce threat, vigilance, and mistrust; SNS mechanisms; and gene expression.

Presently, some evidence supports this focus. Harsh, insensitive, and cold parenting likely fosters such reactions in children and indeed mediates links between SES and, for example, internalizing and externalizing symptoms (e.g., Conger and Donnellan, 2007). Many indicators of neighborhood disorganization and the built environment—crime, violence, safety, racism, sense of community, abandoned buildings, and dilapidated and disrepaired structures—likely breed vigilance and mistrust (Sampson, Morenoff, and Gannon-Rowley, 2002). However, extant studies apparently do not assess sense of threat, vigilance, and mistrust. Indeed, the assessment of threat in population-based studies may be difficult. One extant measure, CAUSE, developed and used by Chen and her colleagues, uses videos of

ambiguous situations (e.g., a clerk watching a customer in a store from a distance) to elicit interpretative remarks from the subject (e.g., “the clerk thinks the customer is going to steal something” or “the clerk wonders if the customer needs help”). Such a measure might be administered to large groups of people with the use of computers or personal digital assistants. In any event, it is unclear whether sense of threat or vigilance could be assessed by survey instruments, suggesting the need for behaviorally based assessments.

Less well-studied are aspects of daycares, preschools, schools, and racial discrimination that might aggravate these feelings in children. Also, social capital typically refers to ties between people that are characterized by trust and reciprocity. However, associations between networks (structural features and dynamics) and mistrust and vigilance have not been studied. Thus, a key unresolved issue is how SES is associated with specific features of families, neighborhoods, schools, and social networks that breed a sense of threat, mistrust, and vigilance. And, in turn, little is known about how sense of threat then creates more stressors for the person, contributing to the chain of risk model.

Second, early chronic stressors are thought to influence the corticostriatal circuitry, which is central to the processing of reward-related information and self-regulation (including, for example, impulse control and goal-directed behaviors) (e.g., Miller et al., 2011). Very little is known about the specific features of social context that can account for this association, and whether such features reflect aspects of SES. Gianaros and his colleagues (2011) suggest that some of this relationship, once again, reflects turbulent family relationships that are traceable to socioeconomic need. However, they also propose and report evidence consistent with a cultural argument, according to which SES is associated with a “cultural-intellectual orientation” that stimulates social and intellectual skills. According to this perspective, such family-based activities as engaging in intellectual discussions and attending cultural events positively influences brain development, which in turn facilitates cognitive abilities and capacities for self-regulation. There are presently no standard measures of the features of communities, neighborhoods, families, schools, and social networks that would provide these experiences, however. And once again, it will be difficult to link such measures to behaviors associated with the corticostriatal activity (prime examples being impulsive behavior or discounting of future rewards), which typically are based on behavioral tasks (e.g., Eisenberg et al., 2007). Thus, a major pathway by which SES may affect inflammatory processes involves diminished reward-related information processing and self-regulation, but the specific features of social context that would link SES with these behaviors are not known.

Both of the discussed mechanisms suggest the development of new measures that focus on features of social context that are graded by SES and that heighten a sense of vigilance, mistrust, and threat and that diminish self-regulatory capacities. Further, it may be that behavioral measures will be needed to assess these reactions to settings. In addition to measures of context and these behaviors, research could also incorporate imaging technology to directly assess corticolimbic and striatal activity (e.g., Gianaros and Manucj, 2010). Given logistical considerations, such an effort would likely be embedded in a larger study, but would provide crucial evidence bearing on whether connections between social context and, for example, sense of threat did indeed reflect differences in the corticolimbic system.

### Specificity of Causes and Effects

As more detailed data from different levels of analyses are collected, issues of causal specificity will be more readily addressable. The extant evidence presently suggests that chronic, pronounced stressors in early childhood are associated with GR resistance and other pro-inflammatory mechanisms. Indeed, the replication of the GR resistance model across multiple studies that examine different types of stressors is impressive and noteworthy in genetic research as an apparently robust pattern of replication. At the same time, these findings raise the issue of specificity in two respects. First, does a given inflammatory condition reflect one specific social risk factor, or even one specific “signature set” of risk factors (i.e., specificity of contextual cause; Shanahan et al., 2008)? It may be that a wide range of early, chronic stressors—stressors associated with SES—are functionally equivalent, meaning that they are substitutable contextual experiences that trigger the same biological pathways. Presently, the mediating role of the corticostriatal and limbic systems appear to be crucial, suggesting that any social experiences that could affect these systems could initiate causal chains that lead to pro-inflammatory patterns.

Viewed from the perspective of necessity and sufficiency, several possibilities cannot be ruled out. Because several different stressors appear to trigger GR resistance, it is unlikely that any one stressor is necessary and sufficient. Social isolation, parental stress due to a child’s severe illness, low SES, and child maltreatment have all been associated with the up-regulation of pro-inflammatory and down-regulation of anti-inflammatory transcriptional pathways. Miller and his colleagues (2011) note that both low SES and child maltreatment share many common social, psychological, and biological consequences, perhaps because both are associated with the corticolimbic and corticostriatal processes discussed above.

At the same time, SES is not a stressor but rather many stressors are SES-graded. Indeed, childhood maltreatment is substantially correlated with

a wide range of SES-graded stressors, including poverty, family conflict, neighborhood disorganization, parental substance abuse, sibling hostility, geographic mobility, income instability, and parental psychopathology. This network of correlations among stressors is of particular concern, raising the issue of whether any one stressor is necessary and sufficient, unnecessary but sufficient, necessary but insufficient, or unnecessary and insufficient. The issue can only be resolved with large, diverse samples that assess a wide range of stressors. Moreover, the study of these possibilities may be facilitated by diverse statistical models, including methods well suited to the study of conjunctive and disjunctive patterns among possible predictors (e.g., Eliason and Stryker, 2009; Hastie, 2009).

Once environmental specificity with respect to transcriptional patterns associated with inflammatory pathways is addressed, a second type of specificity remains to be considered: whether a social risk factor or signature set of such factors predict only one or multiple outcomes (i.e., specificity of outcome). Research suggests that GR resistance and other pro-inflammatory pathways are associated with a range of diseases, possibly including cardiovascular disease, depression, asthma symptoms, and, in principle, other conditions (e.g., arthritis, allergies, and several cancers). Do risk factors that trigger GR resistance explain all of these disease states, or are there specific patterns of risk factors associated with specific inflammatory diseases? Answering this question will depend on data collection efforts that include a wide range of inflammatory symptoms and disease states. It may be that stressor-inflammatory symptom associations are characterized by multifinality (the same causal agents leading to different outcomes), equifinality (diverse causal agents leading to the same outcome), or both—types of complexity that are often not considered in empirical research.

### **Diverse, Mutually Informing Research Designs**

The use of diverse, mutually informing research designs has been discussed as a way to study the full complexity of phenomena while allowing for strong causal inference whenever possible. From a demographic perspective, comparative designs also broaden the scope of inquiry by focusing attention to distinct social settings. In the case of social genomics, for example, how do distinct macro-social contexts trigger pro-inflammatory transcription patterns? A central issue is the extent to which low-SES children are exposed to settings that heighten a sense of threat and vigilance, and these comparative strategies may shed light on this problem. First, what policies protect low-SES children from these experiences and thus prevent or retard the emergence of vigilance, difference in gene expression, and inflammatory conditions? Comparisons of low-SES households in different regimes of transfer payments, political economies, and societies could

address this question. With respect to support for families and children, salient policy differences might include transfer payments to low-SES households, the provision of daycare and adequate health insurance, investments in schools and training opportunities, and the provision of safe, affordable housing. Indeed, gene expression profiles and related biological substrates (particularly biomarkers of the immune system) could be assessed in evaluation studies of specific policies, which could be especially informative when the policies have been applied to randomized groups.

With respect to political economies, for example, Esping-Andersen (1990) influentially distinguished among liberal (e.g., the United States), corporatist-statist (e.g., Germany), and social democratic (e.g., Sweden) regimes. Such distinctions produce variation in life course patterns of school, work, and family, and perhaps they also bear on the stress load created by low SES. The corporatist and social democratic regimes provide substantially more support to low-income households when compared to liberal regimes, but the social democratic society socializes costs associated with family life, and includes thorough welfare provisions for workers and the unemployed. With respect to other societal differences, not necessarily reflecting political economic policies, it may be that the distribution of SES conditions its effects on families. A very large body of research suggests that health is less favorable in societies where income differences are greater (Wilkinson and Pickett, 2006). To the extent that minority status is associated with discrimination (a potentially potent chronic stressor), societal distributions of race and ethnic groups may also bear on how much stress is suffered by low-SES children and their families.

Differences in policy settings, political economics, and demographic features of societies can also be studied by comparing migrants to a new setting and people who remained at the origin. Such a strategy has been used to study dietary changes and health, for example, and has the advantage of controlling, in the aggregate, for genetic factors that might otherwise distinguish, for example, low-SES children from two different countries. This strategy could be used to compare and contrast low-SES origin and destination groups and how their social location is associated with threat and self-regulation, and transcription patterns. Ideally, such a design would involve nonvoluntary migrants to control for selection to migration.

In any event, these comparative strategies could be used to study how the stress load created by low SES differs by social systems.

## CONCLUSIONS

A large and complex body of research suggests that social experiences of early childhood may have lifelong implications for the immune system and the emergence of inflammatory diseases. This body of research began

with studies of social risk factors and health (Stage One) and then progressed to the study of how such risk factors could conceivably “get under the skin” (Stage Two). Broadly, early chronic stressors are associated with pro-inflammatory tendencies (e.g., due to GR resistance), but also vigilance and mistrust of others, diminished self-regulation, and a proclivity for risky behaviors. Children growing up in low-SES households (i.e., subjected to chronic stressors) are thus characterized by a constellation of biological, psychological, and social challenges that, in turn, create yet more stressors, diminish their capacity to cope with stressors, and make them more responsive to the negative effects of stressors. In this way, society may “get under the skin,” but behavior then creates a feedback to one’s social circumstances, creating yet more stressors (i.e., bidirectionality). The resulting chronic inflammation is then thought to lead, over many years, to inflammatory disease states, although pre-disease indications may be observable by late childhood.

This emerging model, in turn, suggests a symbiotic relationship between Stage Two and population-based studies of aging and health (Stage Three). On the one hand, Stage Two research provides evidence of linking mechanisms that may connect social experiences and health, mechanisms that are necessary for any convincing causal account of social risk factors and health. On the other hand, Stage Three studies can validate and extend Stage Two research. To date, logistic considerations have prohibited the application of genome-wide expression studies to large, representative samples. However, just such samples are needed to validate Stage Two studies and to study diverse patterns of social experiences and trajectories of symptoms and disease states.

Moreover, the results from Stage Two studies suggest unique challenges and opportunities for Stage Three research. Given that social experiences may be biologically embedded before age five, given the central role that chains of risk and processes of accumulation play in creating stress, and given the emergence of diseases over many decades, extensively longitudinal data are imperative. And, further, given that none of these relationships is determinative, extensively longitudinal research is also needed to study life course patterns that are associated with resilience and varying patterns of vulnerability. As noted, the basic model emphasizes the importance of very early experiences. At the same time, several studies reported GR resistance profiles among adults (e.g., Cole, 2008a; Miller et al., 2008), based on their contemporaneous experiences. The connections between these two sets of findings are unclear, but perhaps there are windows of vulnerability throughout life.

The Stage Two research also suggests new themes with respect to measurement and modeling. Given mechanisms suggested by Stage Two research, future studies could profitably focus on specific aspects of the

social context that heighten a sense of threat, vigilance, and mistrust, and that undermine self-regulatory capacities. Such refinements may be challenging because these behaviors are likely best assessed with behavioral measures and, ideally, would be accompanied by neuro-imaging studies. The reviewed studies also suggest very high levels of contingency among social experiences and the psychological and biological cascades that they initiate. That is, it may be that many different stressors are essentially substitutable, equally capable of instilling threat and increasing the likelihood of pro-inflammatory transcription patterns (i.e., equifinality). This challenge of contingency is compounded by the possibility that the same social experiences could produce different inflammatory symptoms and disease states (i.e., multifinality). Thus, methods that are sensitive to high levels of contingency—e.g., fuzzy set analysis, machine-learning techniques—will be appropriate, although their application may depend on further methodological developments that strengthen their inferential basis.

Most directly appealing to the traditional domain of demography, gene expression profiles can be studied in diverse comparative frameworks to understand how much stress a given social system generates. Such comparisons could involve different policies as they bear on the lives of low-SES households and different political economies, comparisons that may be especially informative when involving origin and destination groups of nonvoluntary migration. Finally, considerable attention has been devoted to risk behaviors (smoking, drinking, inactivity, poor diet, etc.) as crucial explanations for socioeconomic differences in health. Stage Two research appears to complement this focus, suggesting that stressors associated with low SES led to diminished self-regulation, which in turn may well be associated with a wide range of risk behaviors.

Population-based studies of health have traditionally had an admirably interdisciplinary quality. As the models that describe connections between social, psychological, and biological levels of analysis become increasingly complex, greater attention should be paid to how such teams are organized and encouraged. The payoff for such efforts will be increasingly thorough explanations of SES gradients in health and thus the scientific basis for effective prevention and intervention.

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13

The Challenge of Social Genomics:  
A Commentary on  
“Social Genomics and the Life Course:  
Opportunities and Challenges for  
Multilevel Population Research”

*Jason Schmittker*

The preceding chapter by Michael J. Shanahan provides an excellent review of social genomics as it relates to health. In my comments, I would like to entertain the challenges embedded in the perspective. The chapter is comprehensive and forward-looking, but the implications of social genomics for research on socioeconomic status (SES) and health are mixed. On the one hand, the chapter is, in many respects, aspirational, with Shanahan outlining three stages for moving the debate forward from where the field is now. The positive tone is entirely appropriate given the very high upside of social genomics: In principle, social genomics will circumvent the silos created by disciplines, encourage a robust multilevel approach, and allow population scientists to explain health-related phenomena rather than merely describe them. No less important is the possibility of new discoveries, which the framework has, in my opinion, already delivered on (including in Shanahan’s excellent empirical work). On the other hand, despite expanding on several fronts simultaneously, social genomics as Shanahan articulates it does not put the influences it catalogues on the same conceptual plane. The chapter is more detailed, specific, and directive with respect to the *genomic* aspects of social genomics than with the *social* aspects. Furthermore, as a matter of emphasis, some influences are elevated above others. Some of the topics Shanahan encourages more research on can (and should) be explored fruitfully without considering genetic transcription, inflammatory processes, or other aspects of social genomics. It is worth thinking seriously about what direction aging research will move should it fully embrace a social genomic agenda.

In Shanahan's chapter, the appeal of social genomics is cast in terms of identifying mechanisms and strengthening causal effects, which, early in his chapter, Shanahan describes as the "major payoff" for population research. He emphasizes the potential evolution of the literature in noting that after transcriptional activity is established, scientists can begin to understand how social experiences affect health. These ideas have a great deal of resonance as long as social scientists are unable to identify how social factors get under the skin, as the argument goes. Strong claims regarding causality cannot be made, especially in the context of nonexperimental data (Taylor, Repetti, and Seeman, 1997). Causality is also crucial for prevention and intervention, as Shanahan notes in the conclusion of his chapter.

There is a distinction between identifying effects and providing explanations. There can be a strong sense of the former without the latter, regardless of the level of a putative effect. Effective intervention can occur before an understanding of what connects an actionable "lever" with an outcome. There are many examples of such levers, and they are arrayed across multiple levels of analysis. Doctors used aspirin, for example, long before they understood how it worked, and, of course, the effects of aspirin were no less real when they were poorly conceptualized. (Digitalis provides another example.) The same logic applies to causes further upstream. Social scientists recognize that SES, the focus of Shanahan's chapter, has causal effects on health even without being able to explain all of those effects in their entirety. To be sure, the absence of a chained mechanistic explanation might be unsatisfying from some perspectives. Furthermore, the fact that intervention can take place with incomplete knowledge does not mean researchers should not try to find mechanisms—they can and should seek mechanisms. Yet there are risks to demanding a full account that proceeds from the macro to the micro or to thinking that social effects are weak or superficial in absence of a complete biological explanation.

For one, the provisionality Shanahan identifies with respect to causal inference in the social sciences applies as much to biological processes as social ones, resulting in uncertainty at all levels. Shanahan points to the widespread use of nonexperimental survey data in population research, but nonexperimental data are used in social genomics as well and there, too, this usage has serious implications. The observational methods employed for studying gene-environment interactions, for example, are often contaminated by gene-gene interactions, undermining confidence regarding the main effects of genes (Conley and Rauscher, 2010). Furthermore, at least in the social sciences, methods suitable for disambiguating correlation and causation (e.g., the use of compulsory education laws to identify the effects of education on mortality) are often ill suited for illuminating mechanisms. More generally, the goals of social scientific explanation can diverge in meaningful ways from those of biological explanation. Along these lines,

Shanahan notes that social genomic research demonstrates the relevance of SES for gene transcription, but a full explanation of the relationship between SES and health requires rigorous explanation both up and down the line. As Shanahan notes, this research reveals little regarding what it is about SES that matters, often relying on single indicators. The same is true at other junctures in the chain of connections between SES and health. Chronic stress and the activation of the sympathetic nervous system provides one potential mechanism linking SES to transcription processes and ultimately to health (as established in the case of HIV-1). However, appealing to stress merely invites further speculation regarding why and how SES is related to chronic stress. This issue is further complicated by the apparent resilience of those of low SES. Shanahan notes this, but scholars understand very little about the topic and, on its own, it is worthy of focused attention. Some of these gaps and complications likely explain why interactions between genes and features of SES otherwise united in their relationship to “resources” are occasionally inconsistent even in their direction (e.g., Pescosolido et al., 2008). In short, there is much to be done simply in terms of characterizing the environment.

Shanahan is sensitive to these issues and concludes his chapter by discussing several topics for future research, including how possibly to refine measures of social risk factors, the specificity of causes and effects, and the value of comparative studies. It is notable, however, that these discussions become increasingly speculative, and Shanahan has fewer empirical examples the further he moves away from influences that lie beneath the skin. The point is not that these influences are less relevant. As Shanahan argues, research *should* explore, for example, the effects of the welfare state, the network of correlations among stressors, and self-regulation processes. Yet studying how these influences are related to health does not require the collection of gene expression data, biomarkers, or neuroimaging, and it is not necessary to wait until such data are produced to investigate them further. These influences also probably implicate far more than stress or other biological processes that inform much of the transcription research. Understanding the role of the political economy in health, for example, will require more than an understanding of transcription.

Indeed, insisting on collecting transcription-relevant data as a matter of emphasis may, in some instances, lead investigations astray. One risk in demanding a biological mechanism lies in prematurely foreclosing on a generative sense of uncertainty, especially when mediating pathways are dynamic. Shanahan provides some illustrative specific examples of mediation. For instance, he reviews how SES may be linked to HIV-1 progression through activation of the sympathetic nervous system and, in turn, HIV's transcription and replication. Yet, in general, SES is linked to health through a variety of proximate mechanisms that change over time and,

therefore, the link will involve different biological pathways at different times. The relationship between SES and cholesterol, for instance, switched direction with the introduction of statins (Chang and Lauderdale, 2009). In this case, the identification of a mediating mechanism does not settle the debate regarding causality any more than the use of statins ensures the elimination of the association between SES and heart disease. Provisionality, in this sense, is part of the effect itself, not a reflection of scientific naiveté.

A related complication concerns the *scope* of social genomics as it applies to the literature on SES and health. The perspective Shanahan articulates is capacious, implicating multilevel processes in an integrated life course framework. But when it comes to the specific results of the studies he reviews, much of it is quite focused. For example, Shanahan focuses much of his attention on gene-environment *interactions*—how do social factors affect gene transcription—which he identifies as the core agenda of social genomics. This work has immediate appeal to social scientists (e.g., Caspi et al., 2003). Among other things, studies of this sort move the literature away from simply gene *or* environment questions to gene *and* environment questions. Yet focusing on interactions can constrain the scientific imagination nearly as much as focusing on main effects. It also leaves scientists ill prepared to take the null hypothesis (no interaction) seriously, which is increasingly required given the state of the gene-environment literature. The literature also suffers from well-known replication problems, with interactions significant in one study often insignificant in another (e.g., Risch et al., 2009).

Shanahan ultimately emphasizes the relatively robust patterns found in research on transcription processes and, in turn, inflammatory processes. But if this is the area with the most scientific confidence, then the relevance of social genomics for SES and health is suddenly smaller than it once seemed. The set of disease outcomes related to SES exceeds the set related to the inflammatory response. If stress has a prominent transcriptional fingerprint, as Shanahan notes, SES has an enormous mortality footprint. Lest researchers disregard genes or environments altogether, motivating interaction effects should perhaps take a back-seat to motivating main effects. Surely genes are worth exploring even if social processes have little bearing on how they are expressed, just as social processes are worth exploring even if they sometimes operate independently of genetic transcription or inflammation.

Beyond these concerns are some risks to organizing a debate according to the concept of *levels*, at least as the idea is usually articulated. In any multilevel investigation, some levels emerge as more important than others, even if the goal is to shed light on many different influences. Furthermore, the idea of a level implies a *boundary*, and, despite the ecumenical nature of social genomics, some of these boundaries are becoming sharper, not softer.

It is possible to be sensitive to all the relevant influences, without attempting to reduce an outcome to a narrow set of risk factors. A notable feature of the current multilevel approach, for example, is a split between those moving toward higher levels of analysis, such as those interested in different policy settings and political economies, and those moving toward more micro-level processing, such as biomarkers, neurons, and genes. Shanahan encourages movement in both directions and effectively reviews both arms of the literature. Yet it is important to be mindful of the vast meso-level in between. This may be where much of the action is, and, indeed, much of the research Shanahan reviews would seem to push in a meso direction. Shanahan highlights, for example, the role of a sense of threat or heightened vigilance in mediating the link between social stress and transcription profiles. He further highlights, by way of review, the role of changes in corticolimbic circuitry in linking stress to vigilance. In this way, he links SES to stress to neurons to cognition to health, consistent with his mediational focus. Psychological influences provide a crucial link in this chain, but it is useful to pause with every link and, thus, to dwell on the independent relevance of psychological influences, apart from any role they may play in explaining the relationship between SES and health.

For one, heightened vigilance is not entirely a reflection of SES. Furthermore, important psychological influences can be measured in survey instruments without also collecting biological samples. (In Shanahan's framework, the primary purpose of Stage Three is to collect biological and genetic data in more representative samples in order to confirm results from earlier stages.) It is important, for example, to study the relationship between social context and sense of threat whether or not the relationship reflects the corticolimbic system. A counterargument, articulated by Shanahan, is that social genomic research illuminates the importance of psychology and, therefore, that the study of genes is a useful tool for the discovery and refinement of social mechanisms. But if social genomics is fundamentally about illuminating mediational pathways, it would do just as well to remind social scientists that the *mind* is important as to remind them that *genes* are important, and the former can be considered without the latter. Indeed, the literature risks misplaced specificity by focusing on genetic transcription, and, in the process of further reduction over consecutive stages, risks overlooking other important influences. Regardless of the route that leads researchers to psychological influences, it is important to give them their full conceptual due, and a tight focus on transcription processes might prevent this.

In the formidable sweep of Shanahan's chapter, an emphasis on psychological factors might appear modest. It might even appear regressive. There is no mistaking the cutting-edge allure of genetic transcription and the inflammatory response. It is also impressive how many social scientists,

like Shanahan, have developed expertise in fields other than their own. Yet an appreciation of human psychology alone addresses many of the themes discussed in Shanahan's chapter, including scientific integration, causality, contingency, and multilevel integration. Psychology is concerned with how the environment is internalized, and, in this sense, psychological factors are no less "under the skin" than genes. The scope of psychological influences is also appropriate to the task of explaining socioeconomic differences in health insofar as they are related to multiple health outcomes through many different pathways.

Furthermore, the reluctance of some disciplines to integrate genomics is very closely related to the reluctance of the same disciplines to integrate psychology: In both cases, social scientists fear explaining behavior in terms of individual attributes rather than social structures, or in terms of dispositions rather than constraints. Yet the empirical foundation of psychology is strong, long-standing, and sophisticated in ways that are not dissimilar to the foundation of social genomics. Decades of research reveal that psychological factors are crucial to behavior and intersect with the environment in interesting ways (Ross and Nisbett, 1991). Psychological factors motivate behavior and therefore can link environments to action. They are also central to how the social environment is created, construed, and remembered, and therefore can speak to person-environment interactions. The high degree of contingency within social genomics—an especially appealing aspect of the field—is echoed throughout contemporary personality psychology (Mischel, 2004). If population research wishes to traverse levels while progressing "inward" in some fashion, psychology provides an excellent avenue. And if the challenge of integration rests as much with psychology as genes, the challenge is no less great.

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# 14

## Interventions to Promote Health and Prevent Disease: Perspectives on Clinical Trials Past, Present, and Future

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As a 2000 report by the Institute of Medicine (IOM) observed, health interventions based on social and behavioral research have great potential to improve health and prevent disease. Unfortunately, to date, such intervention efforts have had a mixed record of success, with some interventions making significant improvements in the health of the target group and others having little or no effect. In this chapter, we discuss some of the major challenges facing such interventions, describe some of the progress that has been made in the 13 years since the IOM report was released and offer a number of suggestions for how researchers might improve their chances of success in future interventions.

### THE 2000 IOM REPORT

In 1998, one of us (Syme) was asked to chair a committee at the Institute of Medicine to evaluate the success of interventions aimed at improving health. The IOM committee was asked to focus specifically on interventions that were based on findings from social and behavioral research. The 10-person committee spent two years evaluating intervention accomplishments. Members reviewed the literature and interviewed dozens of experts. The committee also commissioned 12 groups of scholars to prepare detailed papers that summarized intervention work in their area of expertise, and, toward the end of the committee's work, 33 distinguished researchers and practitioners were invited to assess these 12 papers in the presence of a large audience in Atlanta, Georgia. Finally, the committee published a 508-page

report presenting the papers and discussing the committee's findings and recommendations (Institute of Medicine, 2000).

The report concluded that there was a great deal of evidence indicating that social and behavioral interventions could lead to significant improvements in health, stating that "Behavioral and social science research has provided many new advancements in the effort to improve population health, and offers promise for the development of new interventions with even greater utility and efficiency in the years to come" (Institute of Medicine, 2000, p. 33). In addition to making a general argument that social and behavioral interventions are promising ways to improve health, the report made a number of specific recommendations concerning promising intervention strategies. It suggested, for example, that interventions should be carried out to address the health of potential mothers before they get pregnant and that efforts should be made to increase the social capital of communities and neighborhoods in order to improve the effectiveness of behavioral change interventions. The report also made a number of research recommendations for studies that could support and strengthen intervention trials. These recommendations included carrying out studies aimed at identifying the pathways through which social contexts affect disease pathogenesis and outcomes and performing cost-effectiveness analyses that could identify those interventions with the greatest potential to improve health at the least expense.

The general tenor of the report was very positive, because it emphasized the potential of intervention trials based on behavioral and social research and called for continuing work in the area. Less emphasis was placed on the fact that, up to that point in time, most interventions of this sort had either failed or were of only modest significance. There had been a few exceptions, such as the success in smoking cessation and in the use of seat belts and safety helmets, with these achievements attained by a combination of efforts on the individual, organizational, and legislative levels. Overall, however, the results had been disappointing.

The bottom line is that, as promising as intervention trials based on social and behavioral research may be, a number of challenges face anyone who would carry out such trials. In the rest of this chapter, we discuss these challenges, look at progress that has been made since the 2000 report in dealing with these challenges, and make some suggestions for future directions in dealing with such challenges.

### CHALLENGES TO INTERVENTION TRIALS

During the committee's work in preparing the 2000 report, it became clear that researchers who seek to carry out health intervention trials based

on social and behavioral research face a number of difficult challenges. In this section, we discuss some of the most commonly encountered ones.

### Challenges to Randomized Controlled Trials

We begin by describing the difficulties associated with one of the most expensive and ambitious randomized and controlled clinical trials ever conducted: the Multiple Risk Factor Intervention Trial, or MRFIT (Multiple Risk Factor Intervention Trial Research Group, 1982). The challenges experienced by the researchers running this trial were similar to those experienced in many other clinical trials and thus serve as a case study in helping scientists think about the best approaches to conducting intervention trials in the public health field.

The trial was initiated in the 1970s at a time when it had been clearly established that the three most important risk factors for coronary heart disease were high levels of serum cholesterol, high blood pressure, and cigarette smoking. People who had all three of these risk factors had a six-fold increased risk of developing heart disease. Additionally, all three of these risk factors were clearly amenable to intervention.

The study team decided to focus on men who met two primary criteria: First, they had risk levels that were in the top 10 percent in the nation and, second, they were free of coronary heart disease at the time they enrolled in the study. Study power calculations indicated that 12,000 such men would need to be enrolled in the trial, half to the experimental intervention delivered in the MRFIT clinic and half to work with their own physicians as part of their usual care (i.e., the control arm). The decision was made to enroll only men in the study because including women would have approximately doubled the sample size.

To find these 12,000 men, almost a half million men were screened in 22 cities across the country. Following the initial study screening process, those still eligible were asked to attend two additional intensive screenings before they could be formally enrolled in the trial. Along the way, it was made clear to them that they should not participate if they had any reservations about the trial. They were told that if they were eligible they would be randomly assigned to work with an intervention team in the clinic or with their own physicians. They were warned that if they worked with the intervention team in the clinic, they would have to come to the clinic frequently at the beginning, sometimes with their family, and would be asked to change their diet, take medication to control their blood pressure, and stop smoking. They were also told that the trial would go on for six years. There was a behavioral team in every clinic to eliminate men thought likely to be poor participants over the long haul.

The study was carried out with great care and attention to detail. The clinics had large, well-trained staffs. Study participants were invited to come to the clinics with their families to observe demonstrations of low-fat cooking. The staff went to markets with them to show them how to read labels and visited them in their homes to show them how to use the foods that were already there. But after six years, when members of the study team were invited to Bethesda to learn the results of their work, they were told that there was no statistically significant difference between the “special care” and “usual care” groups.

The apparent reason became clear later when it was learned that a number of the men sent back to their own physicians became energized by being assigned to the usual-care arm. In interviews carried out after the study, a number of the men said, in essence, “First, I go through an exhaustive series of screening tests. Then you tell me I am in the top 10 percent risk group in the nation for developing coronary heart disease. Then you tell me to go back to my own doctor, which I could have done on my own, without having to go through all of those difficult screening exams. I’ll do it myself!” Others said that they had been invigorated by the substantial attention linked with the large amount of screening and assessment that they received throughout the course of the trial. In fact, subsequent trials have documented the positive effects that usual- or standard-care controls involving brief physician advice in combination with extensive screening and assessment activities can exert on health behaviors and study outcomes (Writing Group for Activity Counseling Trial Research Group, 2001).

To be sure, the MRFIT trial, despite the ambiguous nature of its original results, contributed decades’ worth of important scientific information that has advanced the understanding of cardiovascular risk factors and treatments. This classic study also helped to set the stage for improvements in randomized controlled trial (RCT) methods and design that have culminated in highly successful multisite trials such as the Diabetes Prevention Program. In that trial, lifestyle intervention aimed primarily at weight loss and increases in regular physical activity in a large study sample at high risk for diabetes led to a 58 percent lower diabetes incidence in this group relative to controls and a 39 percent lower diabetes incidence in the lifestyle group relative to the group taking metformin (Knowler et al., 2002).

But MRFIT also serves as a cautionary tale about the potential limitations of RCTs for advancing knowledge in the areas of treatment and prevention. One of the lessons from the MRFIT story is that the randomized controlled trial, while traditionally serving as the gold standard for answering a number of scientific questions related to intervention efficacy, may not be the best method for answering all intervention-relevant scientific questions, particularly as they pertain to intervention effectiveness in real-world conditions. Thus, while the RCT offers clear advantages in helping to

reduce confounding and other threats to internal validity, it also has specific limitations that need to be carefully considered.

One such limitation, for instance, is the problem of subject selection biases (e.g., the fact that samples typically are restricted to generally motivated individuals who are often healthier than other community members). While selecting a reasonably homogeneous group of research subjects can reduce the complexity of a trial, it also constrains study generalizability. For example, consider a trial aimed at evaluating the health consequences of an intervention to improve social support networks. The complexity of the intervention can be reduced by including only a specific segment of individuals who could potentially benefit from such an intervention, as opposed to broader representation from the larger community. Similarly, the often long list of eligibility criteria accompanying many RCTs often reduces sample heterogeneity, and, with it, external validity. The resulting study sample is often no longer representative of the populations targeted.

Furthermore, once a decision is made regarding the kinds of people who are to be invited to a trial, only some people will agree to join, further limiting representativeness. In addition, not all who agree to participate in the study remain in it to the end, and not all follow the study's intervention advice.

There are other problems with the RCT as well. The nature of the intervention is usually specified with the hope that those who received the intervention can be compared with those who did not. Notably, however, the effects of an intervention can extend beyond what the investigators originally conceptualized or intended. In the Multiple Risk Factor Intervention Trial, the focus was on blood pressure, fat in the diet, and cigarette smoking. It turned out, however, that those who attempted to change their risk engaged in many other behaviors as well. Some became more physically active, some took yoga lessons, some went to church more often, some spent more time with their children, and so on. While scientists may focus on a defined range of "risk factors" being targeted by an intervention, study participants often focus on broader "life factors."

### General Challenges to Intervention Trials

In addition to the challenges specific to RCTs, there are a variety of challenges that face intervention trials in general, including both RCTs and other types of trials.

#### *Choice of Outcomes*

Many failures to successfully intervene may be due to the fact that the intervention is aimed at the wrong outcomes. This problem is illustrated

by a study that one of us (Syme) conducted with San Francisco bus drivers (Ragland et al., 1987). This study was initiated in response to the observation that this sample of bus drivers had a very high rate of hypertension. By the time drivers were 60 years old, the prevalence of hypertension among them was 90 percent. A research grant from the National Heart, Lung, and Blood Institute allowed us to conduct an epidemiologic study of hypertension risk factors that led to the development of an intervention project to reduce the rate of hypertension among the drivers.

Toward the end of the project, it was noticed that the drivers also had a very high rate of low back pain. We subsequently received a grant to study that problem as well and began to develop an intervention strategy to address it. We then learned that the drivers had high rates of respiratory difficulties, gastrointestinal problems, and alcohol issues, which led us, finally, to begin to rethink our project. While the research team was focusing on those issues that had come to our clinical attention, the real problem was the job itself. The job was creating a constellation of health problems and, thus, the attributes and parameters of the job itself should have been our focus. Without attending to this fundamental determining force, our interventions would have remained focused on treating individual clinical outcomes for this workforce without getting to the root cause of the many health issues associated with that occupation. Thus, it is important in intervention development to consider not only the type of risk factors being targeted but also the outcomes.

### *Selection of Risk Factors*

Another challenge is the selection of risk factors that affect susceptibility. Although we, as experts, are good at selecting factors that we think are significant, it is important to realize that these priorities do not always coincide with the priorities of the people who we intend to help. This problem is illustrated by the experience of one of us (Syme) in a study of smoking cessation. In this study, the purpose was to reduce smoking rates in a community with a very high prevalence of smoking. In particular, the objective was to change the climate of opinion about smoking in the community, including challenging the social acceptability of smoking. In Richmond, California, the rate of smoking was more than 50 percent when the project started. It was a well-designed project that was later used as the basis for a nationwide series of smoking cessation interventions in 20 cities across the country (COMMIT Research Group, 1995).

After five years of rigorous work, however, the project failed to show any differences in smoking rates between Richmond and the two comparison communities, Oakland and San Francisco. The COMMIT study resulted in generally disappointing outcomes as well. Without going into

all the details of the Richmond failure, it is clear that the research team came to this community with the attitude that a 50 percent prevalence of smoking was unacceptably high. But Richmond is a very poor city with very high rates of crime, unemployment, high school dropouts, and drug use, as well as having few health services and few food markets. It later became clear that the smoking rate in Richmond was not high on the priority list of citizens of this community. The research team had never checked with residents about this, however, and in interviews with Richmond residents after the failure of the smoking cessation project, it became clear that residents were more concerned with crime, drugs, schooling, jobs, money, and safety than smoking. These and other examples have made clear that it is critical to take account of the social circumstances in which people live. An exclusive focus on risk factors alone may be inappropriate.

### **Choosing the Right Time Frame: Recognition of Life Course Events**

Another issue that can compromise the ability to intervene successfully involves the recognition of life course effects. Berkman (2009) described two clinical trials that evaluated interventions directed at social support and depression among older adults. Both of the trials were well designed and carefully implemented, but neither showed significant results relative to controls.

One of these trials was the Enhancing Recovery in Coronary Heart Disease Patients (ENRICH) trial (Berkman et al., 2003). It was designed to evaluate whether enhancing social support would lower the rate of depression among post-myocardial patients. The hope was that a lower rate of depression would reduce re-infarction and all-cause mortality among 2,481 cardiac patients. This ambitious trial involved 80 hospitals and 8 clinical centers.

The second clinical trial was called FIRST, for the Families in Recovery from Stroke Trial (Glass et al., 2004). It was designed to improve social networks with the hope that these networks would in turn increase the functional independence of stroke patients following their strokes. The study involved 291 patients recruited from 8 hospitals.

Neither study produced the desired results. Berkman has suggested that such intervention studies may need to be more mindful of the importance of life course issues and trajectories when targeting populations on which to intervene. If one intervenes on a problem such as depression or a way of coping that originated and stabilized early in life, or if the problem is the result of a cumulative exposure over the life course, it may make less sense to intervene on that problem much later in life. Berkman suggests being more mindful of these issues in planning interventions (Berkman, 2009).

*Study Reproducibility*

A final problem to be considered concerns study reproducibility. All interventions rely on information that has been derived from prior research, and if that information is flawed, then it can affect subsequent investigations. Scientific inquiry has long emphasized the importance of determining the reproducibility of methods and results. In research, scientists are urged to use standard questions that have been used by others and to publish their methods so that others can repeat the work. We suggest, however, that this emphasis may have certain limitations. The goal of complete reproducibility may be achievable in basic laboratory research, but it is often unattainable in human research. Repeating a research project in an identical sample of people is virtually never possible. For instance, using a standardized questionnaire in two different groups of people drawn from the same population ignores the subtle differences of context that can make reproducibility difficult.

An alternative to strict reproducibility may be preferable. This alternative could involve maximizing differences to better test the generalizability of an intervention across different populations and circumstances. Continuing to observe the same patterns in all of this work indicates a finding of real importance, as seen in studies of social class and health. Social class has been measured in many different ways in different population groups, but the same result emerges in virtually all of these studies—those from reduced social circumstances have higher rates of virtually all diseases. The same result is found in studies of social support. A recent meta-analysis of 148 social support studies involving 308,000 people showed that people with better social support networks—defined and measured in many different ways—had better health related to a wide range of different diseases over a seven-year follow-up period (Holt-Lundstad, Smith, and Layton, 2010). As was noted earlier, this was true even after accounting for age, gender, and health at baseline. These social class and social support results are robust and transcend differences in research methods and populations. For that reason, they may be considered all the more important and useful.

**WHAT HAS BEEN LEARNED SINCE THE 2000 IOM REPORT**

Since the publication of the 2000 IOM report, basic understanding of interventions to change health behaviors has greatly improved. This growing knowledge, along with advances in intervention methods and design and an increasing understanding of the importance of contextual and environmental factors in influencing daily health decisions, has opened the way to more potent and sustainable interventions. Below we describe a few of

the areas in which significant improvements have been made in methods or understanding that should lead to improvements in intervention trials.

### **Appreciation of the Heterogeneity of Health Targets as Well as Populations**

While a great deal of scientific attention has been focused on the demographic heterogeneity of the sample being enrolled in an RCT, disease and health targets themselves are often treated as reasonably uniform. This is often not the case, however. For example, health targets such as obesity typically represent a constellation of conditions with varying etiological, biobehavioral, and contextual features that need to be addressed when developing an intervention.

A growing appreciation of this fact has led some researchers to call for a targeted intervention approach aimed at meeting the needs of a particular population segment with common health features and circumstances (e.g., King et al., 2008). This targeting approach contrasts with the “one-size-fits-all” approach that has been pervasive in much of the intervention literature. The growing use of the targeted intervention approach has been accompanied by the development of statistical methods aimed at better understanding which subgroups of participants may have fared better or worse with a particular intervention (Kraemer et al., 2002). For example, as part of the ENRICH trial described above, Schneiderman et al. (2004) found that while intervening in depression and low perceived social support within 28 days after myocardial infarction did not increase event-free survival rate, it seemed that white men—although not other subgroups—may have benefited from the ENRICH intervention. Such exploratory findings are informative and suggest additional discovery work to further refine and improve interventions for additional population groups.

### **Advances in RCT Research Methodology**

As researchers have come to understand the limitations of traditional RCT methods, particularly in the areas of external validity and translational efficiency, it has resulted in the development of various ways to increase the real-world applicability of RCT research. One such approach—the practical clinical trial—aims to extend design parameters to real-world contexts and to promote greater generalizability in the areas of intervention development, implementation, evaluation, and translation (e.g., through contextually relevant interventions, diverse populations and settings, and a broad range of outcomes). By using a structured framework to evaluate the impacts of the intervention in areas related directly to external validity

(e.g., the RE-AIM model), it is possible to achieve an improved translation of research into practice (Dzewaltowski et al., 2004).

Other innovative methods for enhancing the flexibility and real-world relevance of clinical trials research include adaptive designs that use a stepped-care approach to intervention delivery based on participant response and adaptive interventions that use prespecified decision rules based on tailoring variables to adjust intervention dose and related parameters (Collins et al., 2005). There have also been efforts to determine the most relevant control groups to use in clinical trials research depending upon a study's aims, objectives, and resources (Mohr et al., 2009). Finally, given that changes are often required in multiple risk factors and behaviors that together influence disease endpoints, behavioral scientists and other researchers have begun to investigate the best methods for making multiple behavior changes (Prochaska, Spring, and Nigg, 2008). These efforts stand in contrast to the majority of the clinical trials that can be found in the literature, in which risk factor interventions have been combined in various ways with little regard to theory or evidence.

### Employing “Stealth” Interventions That Harness People’s Intrinsic Life Values

Health represents only one area in people’s busy lives, and, in many cases, it may not be the most important or salient issue on a day-to-day basis. Therefore, it is important to explore other ways to engage people’s passions and motives, where health may not play an explicit role but may be benefited indirectly. Such motives can include family, faith, culture, recreation, leaving a reduced carbon footprint, or other pursuits. By identifying which values or motives might resonate most strongly with a population of interest, promoting health through harnessing these other motives becomes an attractive option. Published examples of such “stealth interventions” have included utilizing interests in social movements (e.g., environmental sustainability) to indirectly motivate dietary improvements (Hekler, Gardner, and Robinson, 2010) and providing meaningful public school volunteer opportunities for older adults that have been shown to improve their own physical health and cognitive and social engagement in addition to benefiting the school children (Fried et al., 2004).

### SUGGESTIONS FOR FUTURE IMPROVEMENTS

Although various advances have been made since the release of the 2000 IOM report in the understanding of the importance of contextual and environmental factors as well as in intervention methods and design, much

remains to be done. In this section we offer a variety of suggestions for how intervention trials might be improved in the coming years.

### **Importance of Aiming for the Underlying Drivers of Health**

One key fact about intervention trials is that they rarely attempt to intervene in the fundamental driving forces in society—both social and environmental—that are responsible for many of the health problems in the first place. These upstream social and environmental factors that influence health and disease include such factors as poverty, lack of education, and neighborhood incivilities that can negatively affect daily health-related decisions and behaviors regardless of how committed an individual or community may be to living a healthier life. Interventions aimed at making a discernible difference in promoting health and preventing or controlling disease need to reflect these multiple, interconnected levels of influence, including biological, behavioral, sociocultural, environmental, and institutional and policy levels (Institute of Medicine, 2002). Such ecological frameworks typically require more complex interventions than have often been evaluated in the RCT literature. However, given the importance of the “web of causation” described in ecological models for determining health outcomes, multilevel interventions aimed at these differing impacts deserve substantially greater attention.

### **Using a Two-Step Model Framework**

Consider two puzzling facts rarely addressed. One is that the risk factors that are intended to explain the occurrence of specific diseases actually explain a relatively small proportion of the diseases they are intended to explain. The second is that many of the psychosocial risk factors of interest are related to a wide range of disease outcomes. For example, people in lower social class positions have higher rates of not just one or two diseases, but of virtually every disease studied. The same phenomenon exists for social support: In many studies, people with poor social connections have higher mortality rates than people with better social connections, and these observations hold after controlling for age, gender, and health status. This generalized disease finding is true for a number of other psychosocial risk factors as well.

Thus, on the one hand, a set of disease-specific risk factors do not fully explain the diseases they are intended to explain, and, on the other hand, a set of psychosocial risk factors are inexplicably related to virtually all diseases. Perhaps this puzzle can be explained by looking at disease causation in a different way, using a two-step model framework. The argument would be that psychosocial risk factors are related to host susceptibility.

The effect of harmful psychosocial risk factors would be to compromise the body's immune system and increase individual vulnerability to disease, but they would not predict which diseases we get: These psychosocial risk factors would not necessarily increase the risk of any one disease but would make us vulnerable to disease more generally. The specific disease that one would contract would be attributable to the particular disease agents that one was exposed to—viruses, bacteria, tobacco smoke, high fat diets, air pollution, stress, and so on.

Colleagues at the University of California, San Francisco, recently presented some remarkable early data that are supportive of this way of thinking. In their two separate studies of 113 and 96 people of varying racial and ethnic backgrounds and from several social class groups, it was found that several important psychosocial variables were related to immune functioning in a very significant way (John-Henderson et al., 2011). Specifically, it was found that interleukin-6 responses varied in exactly the ways that would be expected with selected psychosocial factors. Interleukin-6 plays an important role in the immune functioning of the body and is related to a number of diseases, including coronary heart disease, depression, diabetes, prostate cancer, and rheumatoid arthritis. These and related results can further the understanding of such two-step models of disease etiology.

Those who study the epidemiology of infectious diseases have for many years approached their research in this way. These scholars know that disease agents must be considered in relation to both host susceptibility and environmental circumstances. Many researchers interested in psychosocial factors have not taken this into account in a satisfactory way. The implication of this work is the need to think about an additional set of risk factors—risk factors that affect people's vulnerability and susceptibility to disease in general.

### **Better Defining the Needs of Different Population Groups Through Community-Based Participatory Research Methods**

In recent years, there has been an increasing appreciation among public health researchers of the critical perspectives that community members can bring to the intervention research endeavor (Minkler and Wallerstein, 2008). Community-based participatory (CBPR) methods represent one such approach for doing so (Horowitz, Robinson, and Seifer, 2009). CBPR activities consider community stakeholders as active partners throughout the research decision-making and implementation process, and researchers who use a CBPR approach employ such techniques as team building, mutual exchanges of ideas, the sharing of resources, and joint decision making involving both community members and researchers. The approach requires that the interests of the researchers and the use of rigorous designs and

methods be balanced against the needs of the community and the larger aim of developing contextually valid and sustainable interventions (Horowitz, Robinson, and Seifer, 2009). Although such an approach may involve a greater upfront effort than more traditional approaches, by involving communities in the intervention development process from the beginning it is possible to avoid some of the problems discussed above (e.g., in the COMMIT study) and to improve the chances that the intervention will have positive effects on health.

### **Intervening Where People Live, Work, and Play**

With the current explosion of electronic communication channels and devices, it has become easier to reach diverse groups of people in ways that can be personalized to meet their individual needs, preferences, and contexts. For example, eHealth advances provide previously unimagined opportunities to positively affect daily health behaviors and choices that can broadly influence the health of the population (King and Guralnik, 2010). They also offer innovative ways of capturing contextually rich information throughout an individual's day that can help inform intervention development as well as evaluation. Systematic investigations of the efficacy of some of these technologies have demonstrated that they offer a viable alternative to human advisors for promoting sustained behavior change in health areas such as physical activity (King et al., 2007).

Concerns have also been expressed, however, about the potential impact of such technologies in increasing already significant health disparities in the United States by expanding the "digital divide." This concern is fueled in part by socioeconomic and cultural differences related to computer access and literacy as well as to more general health literacy. Greater attention in the eHealth and mobile health fields needs to be paid to the types of communication technologies that can be tailored to a broad range of language, reading, and related user abilities and access issues. An example of one such technology is the embodied conversational agent, which requires minimal levels of reading and computer proficiency and health literacy to use (Bickmore et al., 2010) and could potentially be placed in community settings that residents frequently visit.

### **Putting the Public in the Driver's Seat in Areas of Data Collection to Create Meaningful Community Change Related to Health**

Some of the technology-based innovations noted above provide a unique opportunity to "deputize" community members to collect and share the types of local barriers to and enablers of a healthy lifestyle that are potentially amenable to change on an organizational or policy level. This

type of crowd-sourcing activity is currently being used in rudimentary ways by various municipalities and universities across the country to highlight neighborhood problems, such as litter or unsafe streets, that can be addressed by local decision makers. Such activities could also be aimed specifically at neighborhood barriers to healthy living and eating. For example, a recent pilot study found that a simple neighborhood audit tool, residing on an electronic tablet and adapted to the lower literacy skills and physical limitations of an older population, could be effectively used to gather photo, audio, and location data relating to the walkability of the local neighborhood environment that could, in turn, be shared with municipal decision makers (Buman et al., in press). Such applications can potentially empower legions of community residents to become actively engaged in contributing to the evidence base in ways that could directly impact program and policy decisions relevant to health in their communities.

### SUMMARY

Although there is great promise in health intervention trials based on social and behavioral research, researchers who seek to carry out such trials face a number of challenges, including choosing the most appropriate risk factors and outcomes and determining how to deal with a lower level of reproducibility than many researchers are accustomed to. Progress has been and is being made in the area, but much remains to be done. Researchers carrying out such intervention trials in the future should keep in mind the importance of aiming for the underlying drivers of health, of using community-based participatory research methods, of applying new digital communications technologies, and of including the public in data-gathering efforts. Researchers should also consider using a two-step model framework that interprets psychosocial risk factors as increasing a general susceptibility to poor health and disease.

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