

CHAPTER 1

*Physiological Research
Methods in Health Psychology
Applications of the Biopsychosocial Model*

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The emergence of the field of health psychology can be traced to the 1970s, when forward-thinking scientists advanced the notion that health reflects the complex interplay of physiological, psychological, and social factors (Friedman & Adler, 2007). Most notably, in 1977, physician George Engel called for a radical revision of the biomedical paradigm, presenting an alternative framework, subsequently labeled the *biopsychosocial model* (Engel, 1977, 1980; Matarazzo, 1980; Schwartz & Weiss, 1978). In this view, health and illness emerge from multiple influences at the cellular, organismic, interpersonal, and environmental levels. The biopsychosocial model has been adopted as the prevailing paradigm for research, practice, and training within the field of health psychology and related disciplines such as behavioral medicine and psychosomatic medicine (Fava & Sonino, 2000; Lipowski, 1977; Suls & Rothman,

2004). Increasingly, the model has also been influential in the realm of traditional medicine (e.g., Frankel, Quill, & McDaniel, 2003; Institute of Medicine, 2004), although the biomedical approach maintains a dominant role (Suls & Rothman, 2004; Waldstein, Neumann, Drossman, & Novack, 2001).

With the biopsychosocial model as a guiding framework, dramatic advances have been achieved in understanding how physiological, psychological, and social influences interact to affect widely varied health and disease processes (Suls & Rothman, 2004). For example, the etiology and progression of cardiovascular disease is now broadly viewed as stemming from psychosocial influences, such as hostility, depression, stress, and social isolation, as well as genetic, physiological, and behavioral determinants (Everson-Rose & Lewis, 2005; Krantz & McCeney, 2002; Matthews, 2005; Smith & Ruiz, 2002). Similarly, stress and emotions are believed to

play a role in cancer etiology and progression (e.g., Andersen, 2002; Luecken & Compas, 2002), although the evidence is more mixed in this regard. Increasingly, current models of research and treatment have taken biopsychosocial perspectives for many other acute and chronic diseases, including upper respiratory illnesses (Cohen, 2005), diabetes (Gonder-Frederick, Cox, & Ritterband, 2002; Lloyd, Smith, & Weinger, 2005), gastrointestinal disorders (Blanchard & Scharff, 2002; Levenstein, 2002; Levy et al., 2006), asthma (Lehrer et al., 2002; Wright, Rodriguez, & Cohen, 1998), arthritis (Keefe et al., 2002), obesity (Chesney, Thurston, & Thomas, 2001), and chronic pain (Campbell, Clauw, & Keefe, 2003; Gatchel, 2004; Keefe, Abernethy, & Campbell, 2005). In each of these cases, illness or disease is believed to emerge and progress as a function of dynamically intertwined genetic or biological predispositions and influences, psychological states and individual differences, behavior, and social-environmental processes.

Given the widespread influence of the biopsychosocial model and associated theoretical and empirical developments, it is not surprising that major funding bodies, especially the National Institutes of Health (NIH), have issued increasingly frequent calls for integrative, transdisciplinary research efforts. For example, in their report regarding future directions for behavioral and social science researchers, a committee formed by the National Research Council advocated a central focus on “multiple pathways to diverse health outcomes” and research that integrates information from the molecular, cellular, psychosocial, and community levels (Singer & Ryff, 2001). Interdisciplinary research initiatives are also a critical component of the NIH Roadmap (<http://nihroadmap.nih.gov/initiatives.asp>; downloaded September 14, 2006), which outlines pressing health issues and opportunities and how they may be optimally addressed to advance medical science. One

such initiative focuses explicitly on interdisciplinary research to integrate biological with behavioral and social sciences to facilitate progress in confronting the nation’s most prominent and intractable health problems. Clearly, an understanding of physiological pathways and methods is critical for researchers interested in health issues who wish to remain at the forefront of their disciplines.

In combination with changes and discoveries in the field, and associated emphases of funding organizations, technological advances in collecting and analyzing physiological indicators have contributed to heightened interest in including these variables in health psychology research efforts. Recent years have seen the development of relatively accessible, noninvasive, and low-cost methods for measuring key physiological systems and parameters that are relevant to chronic and acute aspects of health and illness. Such technologies have helped elucidate specific biological pathways that link psychosocial factors with health.

For example, sympathetic and parasympathetic aspects of autonomic nervous system functioning (see Thayer & colleagues, this volume); hormonal pathways, including those of the hypothalamic-pituitary-adrenal axis (see Nicolson, this volume) and sympathetic-adrenal medullary system (see Mills & Ziegler, this volume); and alterations in immune and inflammatory processes (see Stoney, Jain & colleagues, and Prather & Marsland, this volume) are fundamental to understanding how variables such as stress, emotions, and social relationships can contribute directly to the emergence of acute and chronic diseases. These pathways are believed to represent a common conduit connecting psychosocial factors with multiple health and disease outcomes, and they are therefore relevant to widely varied research topic areas. Further, their inclusion in research efforts has become a reality, given improvements in measurement and assay methods and advances in understanding the optimal approaches to assessment.

In additional lines of research, scientists have embraced the inclusion of broad indicators of risk to provide a holistic assessment of health, a comprehensive understanding of the roles of psychosocial factors in health, and an evaluation of the utility of psychosocial interventions for improving health. These approaches have ranged from relatively simple, low-cost strategies such as including measures of waist circumference or body mass index to address psychosocial influences on obesity and chronic disease (e.g., see Davis, this volume) to more complex approaches of examining psychological and social processes or characteristics in relation to blood markers of inflammation (for example, see chapters by Jain & colleagues and Stoney, this volume)—a process increasingly viewed as relevant in the etiology and progression of myriad chronic health problems.

Other researchers have begun to explore the neural pathways involved in mind-body connections (see chapters by Ryan & Alexander and Jackson & Jackson, this volume). Advances in neural imaging and examination of electrical potentials in the brain may provide a critical step in our understanding of exactly how stress, emotions, and other psychosocial characteristics and experiences can “get under the skin” to affect health and illness.

Consideration of physiological variables generally requires a level of training that has not traditionally been available in many psychology training programs. Thus, for some researchers, the enthusiasm for including physiological parameters in their work may be tempered by confusion regarding what are the most appropriate indicators and how they should be conceptualized, assessed, and analyzed. The current text represents an introductory bridge for those who wish to newly incorporate physiological pathways into their existing work, or who would like a better understanding of physiological measures they encounter in research reports, whether or not they have an interest in collecting their own

physiological data. Each of the chapters is authored by recognized experts, guided by the latest in research on the optimal methods for assessment, analysis, and interpretation of the relevant physiological measure.

Many excellent recent volumes have summarized and critiqued the literature to date concerning interrelationships among psychological, social, and physiological factors in health (Ader et al., 2006; Baum, Revenson, & Singer, 2001; Christensen, Martin, & Smyth, 2004; Sutton, Baum, & Johnston, 2004). Additional resources address highly technical, specialized information about specific physiological measures (e.g., Cacioppo, Tassinary, & Bernston, 2000). Rather than duplicate the efforts of these texts, the goal of this volume is to provide an overview for the collection, analysis, and interpretation of physiological measures that are commonly used, relatively accessible to a broad array of researchers, and do not require hospitalization of participants, extensive medical training or supervision, or invasive and expensive techniques. The text assumes little or no prior knowledge of physiological systems or assessment of its readers, and therefore can be thought of as a primer, or gateway book, for researchers new to physiological measurement.

In their introductory chapter, Drs. Tim Smith and Bert Uchino review basic principles of measurement and assessment, providing an important context for understanding and critically evaluating the measurement approaches described in the remainder of the volume. Their chapter also describes pressing challenges and future directions associated with the use of physiological measures in health psychology. This thorough overview is followed by a series of chapters that describe assessment approaches across the major physiological systems relevant to the biosychosocial perspective—specifically, the hormonal, cardiovascular, and immune systems.

The first series of chapters in this section provides guidance on assessing hormonal

systems relevant to a variety of health issues and research questions, including suggestions for “best practices” in their collection, storage, assay, statistical analysis, and reporting of results. First, Dr. Nancy Nicolson presents a discussion of cortisol assessment, a primary hormone associated with the hypothalamic-pituitary-adrenal axis. Next, Drs. Paul Mills and Michael Ziegler discuss methods and issues in assessing the sympathetic-adrenal medullary system hormones, epinephrine and norepinephrine. Finally, Dr. Douglas Granger and his colleagues have contributed a chapter concerning a novel method for assessing sympathetic nervous system functioning, via salivary alpha-amylase assay.

The next set of chapters reviews various pathways and parameters intrinsic to the cardiovascular system. Drs. Bill Gerin and Tonya Goyal and their colleagues present an overview of clinic- and home-based assessment of blood pressure and heart rate, and also describe assessment issues in cardiovascular stress reactivity research. Drs. Denise Janicki-Deverts and Thomas Kamarck provide an excellent discussion and overview of ambulatory blood pressure monitoring. Finally, Dr. Julian Thayer and colleagues review the relatively specialized, yet extremely informative techniques of impedance cardiography and heart rate variability assessment.

In the section’s final group of chapters, parameters and methods for assessing immune functioning are described. Shamini Jain and her colleagues address laboratory methods of immune assessment, including methods for evaluating immune responses to acute stress. Widely available and more specialized assessment techniques are reviewed, and their utility, advantages, and disadvantages discussed. Eric Prather and Dr. Anna Marsland then describe methods for assessing immune functioning in the field, reviewing a variety of *in vivo* methods such as examining immune responses to viral infection, responses to immunization, and wound healing.

The third section of the book focuses on broad markers of health and disease risk that are applicable to researchers in health psychology and many other fields. First, Dr. Mary Davis discusses issues in obesity and central adiposity measurement. Cost-effective and easily accessible approaches, such as body mass index and waist circumference, as well as technologically advanced and specialized methods, including dual-energy x-ray absorptiometry of body fat, are described. Dr. Jennifer Etnier then provides a thorough review of various approaches to assessing physical fitness and activity, including self-report, direct, and indirect approaches suitable to a broad range of research questions. Next, Dr. Katri Räikkönen and her colleagues describe issues in conceptualizing and evaluating the metabolic syndrome—a cluster of related risk factors that is becoming increasingly prevalent in the United States and other industrialized nations. In the following chapter, Dr. Catherine Stoney reviews issues in assessing markers of atherosclerosis, with a particular focus on lipids, lipoproteins, and inflammatory factors. Although described in the context of cardiovascular disease, the discussion of inflammatory factors is likely to be of widespread interest, given growing evidence suggesting that inflammatory processes are broadly relevant to health and disease. Finally, Dr. Martica Hall and her colleagues provide an excellent overview of polysomnographic assessment of sleep, reviewing the connection between sleep and health, and discussing both laboratory and ambulatory assessment approaches.

The final chapters in the text address emerging topics in the field of health psychology. The first two chapters review assessments of neural systems that may be of interest to researchers who wish to pursue nuanced questions regarding integration across central and peripheral physiological responses. Drs. Lee Ryan and Gene Alexander provide an overview of major neuroimaging methods,

and Drs. Daren Jackson and Cory Jackson review assessment of electroencephalography and event-related potentials. Both of these chapters describe applications of these state-of-the-art techniques to health psychology researchers. In the final chapter of the text, Dr. Jeanne McCafferey provides a highly interesting and informative discussion of the assessment of genetic factors in health psychology research. Given the developing knowledge base regarding the roles of genetic factors in health and disease, as well as research pointing to the interactive influence of genetic predispositions and social and psychological factors in determining physiological responses, this chapter provides an important perspective for health psychology researchers.

In aggregate, the book offers a comprehensive overview of a diverse set of physiological measures that are becoming increasingly important in the field of health psychology and related research endeavors. It is our hope that the material will inform and inspire future research that incorporates multiple levels of analysis in psychological research by including theoretically meaningful physiological parameters. Optimally, we hope that this information will promote the use of state-of-the-art and methodologically sound techniques for the most reliable measurement, analysis, and interpretation of physiological parameters in continued efforts to understand health and disease through biopsychosocial research.

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