NORTHWESTERN UNIVERSITY

Exploring the Early Development of Health Inequality: Culture, Stress, and Health among African American Adolescents

A DISSERTATION

SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

for the degree

DOCTOR OF PHILOSOPHY

Field of Anthropology

BY

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EVANSTON, ILLINOIS

June 2008

Abstract

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Racial disparities in cardiovascular health constitute one of the most pressing current public health problems in the United States. This dissertation examines how individual's cultural experiences of stress become embodied and contribute to these racial health inequalities. Anthropologists have traditionally approached culture through narrative ethnographic methods that are difficult to incorporate into quantitative epidemiological models. I address this challenge by using an innovative anthropological technique, called the Cultural Consensus/Consonance approach. This method combines qualitative ethnography with statistical factor analysis to allow dimensions of culture to be quantitatively operationalized, while preserving the richness of their ethnographic contexts. Using this approach, I develop models of culturally contextualized, everyday experiences of stress and social position for African American teens on the west side of Chicago. I then examine how individual adolescent's experiences fit with these cultural models. I employ two biomarkers of stress – blood pressure and diurnal cortisol rhythms – to show how individual exposures to these stressors become embodied and influence adolescent health risk. My results show that culturally salient measures of stress and social status are better predictors of adolescents' biological health indicators than more conventional subjective psychological measures (depression, anxiety, and perceived stress). With this study, I challenge bio-deterministic and racial genetic theories of health disparities by demonstrating how the social and cultural experience of race can affect the early development of health risk. I also demonstrate the significance of biocultural anthropological approaches that allow the social experience of adolescent stress and the emergence of health risk and inequality to be understood in new ways.

Acknowledgements

Research supported by the National Science Foundation, Dissertation Improvement Grant #0514731

Thanks to Thom McDade, Bill Leonard, Chris Kuzawa, and Lance Gravlee for their advice and mentorship with this project.

And thanks to the youth of Maywood who participated in this study, the Maywood Fine Arts Association and *Get Off the Street and On Your Feet* program, Proviso East and Proviso West High Schools, Maywood Parks and Recreation Department, Proviso Lleyden Council for Community Action, and to Dr. Amy Luke and Dr. Richard Cooper at Loyola Stritch School of Medicine, Dept. of Epidemiology and Preventive Medicine for their help with this study.

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Chapter 1

Introduction: Health Disparities and the Anthropology of Race

Racial disparities in health constitute one of the most pressing current public health problems in the United States. The statistic that an African American man in Harlem is less likely than a man in Bangladesh to survive to the age of 65 is now well known (McCord and Freeman 1990). Nationally, African Americans have an all-cause mortality rate that is 1.5 times that of whites (Keppel, et al. 2002). Cardiovascular diseases (CVD) and their precursor conditions, such as hypertension, diabetes, and obesity, contribute heavily to this disparity. The risk of dying from heart disease is 1.3 times higher in African Americans compared to US whites (Mensah, et al. 2005), and African Americans are 1.8 times as likely to develop diabetes (CDC 2005). Hypertension rates are roughly 1.5-2 times higher in African Americans compared to whites (Mensah, et al. 2005). In total, nearly half of all African Americans have some form of cardiovascular disease (AHA 2007).

Medical, public health, and popular media attention to these racial health inequalities has recently been described as a "storm" (Krieger 2005). Research attempting to explain the origins of these disparities has proliferated during the past two decades, due in part to massive funding and priority initiatives from the National Institutes of Health (1993 Revitalization Act) and the Food and Drug Administration (Food and Drug Modernization Act of 1997) aimed at paying greater attention to minority health (Ossorio and Duster 2005). The pharmaceutical industry is also getting involved. In 2005 the first racially-specific drug therapy, BiDil, was approved by the FDA for the exclusive treatment of heart failure in African Americans (Kahn 2006; Kahn and

Sankar 2006). In the popular press physicians and journalists are discussing what racial disparities in health, and drugs such as BiDil, mean for the practice of medicine (Satel 2002a; Satel 2002b; Wade 2002).

This widespread attention to racial health inequalities has made the race concept one of the more popular topics in contemporary scientific discourse (Bamshad and Olson 2003; Burchard, et al. 2003; Cooper, et al. 2003; Krieger 2005; Wade 2002), and has spurred intense debate over the meaning of human biological variation. In particular, health disparities scholars and commentators are sharply divided over whether racial differences in disease prevalence are due to social circumstances or genetic predisposition. Those who argue that social forces drive racial disparities in health point to the importance of factors such as economic disadvantage, psychosocial stress, and institutional and interpersonal discrimination as causes of ill health (Brondolo, et al. 2003; Davidson, et al. 2000; Harrell, et al. 2003; Jonas and Mussolino 2000; Troxel, et al. 2003; Williams 1999; Williams and Jackson 2005; Williams, et al. 2003; Williams and Collins 1995; Wyatt, et al. 2003). Such cultural and structural challenges can promote unhealthy lifestyles, limit access to quality medical care, and chronically strain physiological stress systems that are linked to disease (Dressler and Bindon 2000; Krieger 2005; LaVeist 2005; McEwen 2001). Those who advocate a genetic model of health inequality (Burchard, et al. 2003; Hirsch, et al. 2006; Risch, et al. 2002; Sarich and Miele 2004; Saunders 1995) hold as central assumptions that human genetic variation can be differentiated into conventional 'racial' clusters (Allocco, et al. 2007; Calafell 2003; Hinds, et al. 2005; Lao, et al. 2006; Redon, et al. 2006; Rosenberg, et al. 2002; Tang, et al. 2005), and that disease-causing alleles are likely to be among those variants that segregate between these 'racial' groups (Burchard, et al. 2003; Risch, et al. 2002).

This current debate over the epidemiology of health disparities reflects long-standing disagreement around the meaning of the race concept in science. Throughout much of its history anthropology was at the forefront of this discourse, playing pivotal roles in both the construction and challenge of the scientific "race" concept (Brace 2005). While the discipline of anthropology largely abandoned race as a suitable topic of scientific research in the mid-20th century (Harrison 1995; Harrison 1998; Shanklin 1994; Shanklin 1998), the contemporary health disparities "storm" is reprising the need for a critical anthropological perspective on the topic of race. As experts on what "race" does and does not represent, anthropologists are in a position to make significant contributions to understanding how the social consequences of race may articulate with biology and health.

The Anthropology of Race

The history of anthropology is, in many ways, embodied in the history of the race concept. From its inception, the discipline of anthropology, particularly physical anthropology, has had the study of human races as a defining characteristic. The earliest practitioners of anthropological study, especially in the United States, were concerned primarily with categorizing the range of human biological diversity into clearly demarcated racial groups (Brace 2005; Caspari 2003; Jackson 2000). Trained largely in medicine, these scholars sought to catalogue and describe in detail the physical and behavioral traits that they believed defined members of these racial categories (these practices and their scientific history are described in more detail in Chapter 2). In most instances, these categorizations involved judgments about the relative physical, mental, and cultural inferiority of non-white races, and hierarchical representations of racial value, with African-origin populations typically occupying the lowest-

ranked position. As a result, much of the early history of anthropology is viewed by contemporary scholars as a highly problematic and racist legacy; one which has had a profound impact on the subsequent development of the field.

Franz Boas, widely considered the father of contemporary American anthropology, was the first scholar within the discipline to offer a significant challenge to the scientific legitimacy of racial categorization. In the early 1900s Boas conducted a landmark study of the bodily forms of European immigrants to America (Boas 1912). By comparing immigrants and their children born both within and outside of the United States, Boas was able to demonstrate that supposedly fixed characteristics of racial groups were highly variable depending on the physical, social, and nutritional environments in which individuals were raised. This study thus offered empirical contradiction to the idea that human races were definable based on biological or physical traits. Boas instead emphasized the equality of human racial groups and the importance of cultural diversity across populations.

Several of Boas's students, including Margaret Mead and Ashley Montagu, would continue throughout their careers to challenge the scientific race concept and promote the study of cultural anthropology within the academy. In 1950 Montagu helped to pen the UNESCO Statement on Race, which famously stated that race "is not so much a biological phenomenon as a social myth" (quoted in Shanklin 1994 pg. 92). This perspective would be echoed in official position papers by the discipline during the 1990s. In 1996 the American Association of Physical Anthropologists issued a statement on race, reinforcing the opinion that a genetic or biological basis for racial differentiation is unfounded (AAPA 1996). Similarly, the American Anthropological Association Statement on "Race" in 1998 defined race as an invented "social mechanism" (AAA 1998).

The scientific basis for the anthropological perspective that race is not biologically meaningful was strengthened during the 1960s, with the help of emerging technological advances in the study of human genetics. Anthropologists such as Frank Livingstone and C Loring Brace popularized the idea of clines as an alternative way of understanding human biological variation (Brace 2005; Livingstone 1962). They demonstrated that many 'racial' traits show continuous variation across geographical space rather than the distinct and isolated clustering that a biological theory of race assumes. In 1972, geneticist Richard Lewontin provided further support for this view by demonstrating that global variation in human blood group polymorphisms did not conform to conventional racial groupings. Rather, Lewontin showed that the vast bulk (85%) of human genetic variation in these markers was found within all populations examined, and regional differences accounted for only ~15% of the total variance (Lewontin 1972).

With this accumulated evidence that a definition of race based on biological or genetic grounds was untenable, many anthropological scholars began to adopt the Boasian view that the race concept and its corresponding categories are social constructions. As the AAA position paper (AAA 1998) illustrates, this perspective has come to be a dominant, but by no means universally accepted, understanding of race within the discipline. The social constructionist view of race emphasizes the culturally bounded understanding of global human variation within the United States. The early immigrant population of the United States consisted predominantly of representatives from global geographical extremes, namely Southeast Asia, Northern and Western Europe, and Sub-Saharan Africa (Marks 1996). It is thus no coincidence that the primary categories recognized under the Western scientific race construct correspond to these

populations, and do not readily accommodate groups from more geographically intermediate areas such as the Middle East and India (Marks 1996; Serre and Paabo 2004).

Anthropologists who view race as a social construction also emphasize the political and economic incentives underlying the creation of ranked racial categories. Several scholars have observed that the modern race concept did not exist prior to demands for economic expansion and dominance that accompanied the colonial era. Ideas about racial biological and intellectual inferiority became particularly necessary in the context of emerging pre-capitalist resource exploitation and the need for large-scale forced labor (Martinot 2003). It is thus no surprise that race science became particularly popular and widespread in the United States, where biological definitions of race were used to justify and control a highly productive system of institutionalized slavery.

The early adoption of the race concept in colonial American society provides an excellent illustration of its broader social, cultural, and political economic construction. In the earliest years of colonial presence in North America, historical records show use of religious (Christian vs. heathen) or cultural (civilized vs. savage), rather than explicitly racial, terms to differentiate between populations (Martinot 2003). The use of race terms such as Negro, black, and white became dominant in popular and legal rhetoric somewhat later, as the need to define and control racial boundaries became more instrumental to the colonial enterprise. In particular, scholars have suggested that the creation of "whiteness" as both a socially and legally recognized category of purity was essential to the racialization process in the United States. Anti-miscegenation laws, first passed in Virginia in 1662, played key roles in this process. Through the control of women's sexuality, these laws simultaneously banned racial 'mixing' and assigned all racially mixed children the servitude status of their mother (Martinot 2003). Anti-

miscegenation laws thus sought to protect the economic status of the white elite class and laid groundwork for the subsequent "one drop rule" of racial categorization, by which an individual with any amount of African ancestry was legally considered "black".

This historical construction of race in the United States illustrates the inseparability of the concept from issues of gender and class, and this remains true today. Anthropologists who study race in contemporary scholarship emphasize the continued interconnections between political economy and "race" in US society (Winant 2000), including the ways in which race structures formal and informal policies of residential segregation (Massey and Denton 1993), disparities in educational, career, and economic opportunities (Williams and Collins 2001; Williams and Jackson 2005), and inequalities in wealth accumulation (Shapiro 2004). Anthropologists have been highly critical of "culture of poverty" (Wilson 1987) explanations for racial inequality. Popular in sociology and economics, this perspective attributes African Americans' lower socioeconomic position to their own negative and unproductive cultural attitudes (di Leonardo 1998). This "black underclass" perspective problematically engages in victim blaming while ignoring the active construction and maintenance of racial inequalities through economic and social policy that favors and protects the interests of the white upper class (di Leonardo 1998; Harrison 1995).

Culture of poverty and related theories often frame their construction of black culture in highly gendered terms, and anthropologists have been critical of these trends as well. Page (1997) for instance, has described the overwhelmingly negative use of black male imagery in the popular and news media, portraying African American men as criminally deviant, hyper-sexual, and lazy; "incompetents of a violent nature" (Page 1997 pg. 100). Similarly, Williams (1994) has chronicled the inherent pathologization of black female sexuality in underclass theory, as young,

unmarried, black mothers are seen to lack the values and self-control to make responsible reproductive decisions. In this way, teen mothers are branded as the primary perpetuators of a self-destructive black underclass. Geronimus (Geronimus, et al. 1991), however, has documented the ways in which young motherhood often represents the best option – economically, socially, and biologically – for African American women in poor and marginalized social positions. Geronimus (Geronimus 1992; Geronimus, et al. 1991) and others (di Leonardo 1998; Harrison 1995; Williams 1994) have criticized the gendered stereotypes that dominate portrayals of black urban poverty and point to their prevalence as illustrative of racism's persistence in contemporary social and political economic discourse.

While cultural anthropologists have been increasingly engaged in scholarship that highlights the persistent social and economic meaning of racial constructions (Harrison 1998), biological and medical anthropologists have been more silent on the race issue since the 1960s (Gravlee and Sweet In Press). Following the dismantling of the genetic race concept, many in the field abandoned race altogether as a suitable topic of anthropological study. As a result, anthropology is now largely absent from the contemporary debate over racial health disparities and the resurgence of race science occurring throughout public health and medical fields. Scholars both within and outside of the discipline have called for anthropologists to be more engaged in the contemporary race discussion and to help construct a more holistic understanding of how the social experience of race can contribute to health inequality.

Recent work in biocultural anthropology is beginning to address this call. Dressler's work on both status incongruity (Dressler 1988; Dressler 1991a; Dressler 1991b; Dressler 1996b) and cultural consonance (Dressler, et al. 1998a; Dressler, et al. 2005; Dressler, et al. 1998b; Dressler and Bindon 2000) has offered insight into the role of culturally mediated stress in the health risk

of African American adults. Status incongruity represents a conflict among the multiple dimensions of and individual's social position (such as having high educational status but low income) and is thought to be a significant source of psychosocial stress. Dressler has shown that inconsistencies between skin color, as a marker of social position, and material lifestyle (Dressler 1991a), as well as incongruities between socioeconomic status and material lifestyle (Dressler 1990a; Dressler 1991b), are important predictors of higher arterial blood pressure among African Americans. Similarly, Dressler (Dressler and Bindon 2000) has shown that conforming to cultural norms of material status, particularly in interaction with access to social support, is associated with lower blood pressure for African American adults. This work suggests the multiple avenues through which the social and economic realities of racial inequality can have real consequences for health and biology.

Gravlee's examination of skin color and blood pressure in Puerto Rico (Gravlee and Dressler 2005; Gravlee, et al. 2005) offers another example of biocultural approaches to the contemporary social experience of race and its relationship to health. It has long been recognized that darker skin color is associated with higher blood pressure among African Americans and other African-origin populations. Gravlee (Gravlee, et al. 2005) has demonstrated that, in Puerto Rico, local cultural constructions of skin color (*color*) which incorporate consideration of several social variables in addition to physical appearance, are associated with blood pressure, while skin pigmentation is not. This work demonstrates the culturally bounded nature, rather than innate biological basis, of racial classification and its significance for biology and health.

The Dissertation

In this dissertation I build on these anthropological approaches to health disparities, as well as other biocultural work in the anthropology of stress and race, to examine how the social and cultural experience of race can influence African American health and the development of health inequality. I explore mechanisms of psychosocial stress, including both psychological and physiological components of the body's stress response, as processes through which social experiences can become embodied in health risk. I focus, in particular, on the embodiment of culturally salient stress for African American adolescents, taking into consideration the influence of early life exposures on adult health and the critical ways in which cultural beliefs shape everyday experiences of stress. Specifically, this dissertation project has the following research objectives:

1) To construct a holistic understanding of the everyday cultural experiences of stress and coping for urban African American youth, focusing on three dimensions of stress experience: sources of stress, sources of social status, and social support.
2) To examine the ways in which these everyday cultural experiences of stress are associated with emotional and biological health risk indicators.
3) To explore the extent to which emotional, or psychological, measures mediate relationships between stress experiences and biological markers.

I pursue these research objectives in the community of Maywood, Illinois – a predominantly African American, lower-income neighborhood on the west side of Chicago. The Chicago area is a particularly salient location in which to examine racial health disparities as, contrary to national trends in which black-white gaps in health status have persisted but narrowed, health disparities between blacks and whites in Chicago have widened in recent years (Margellos, et al. 2004).

Through this dissertation project, I will contribute to a better understanding of the emergence of African Americans' disproportionate health burden as well as the social and biological processes that underlie racial health inequalities. An organizational plan and chapter summaries for the dissertation follow.

Organization of the Dissertation

Chapter 2 of the dissertation, "Debating the Essentialist Racial Paradigm: Race and Heredity in Historical and Contemporary Context," traces the historical development and contemporary manifestations of the race concept in science and biomedicine. Stemming largely from the confluence of colonial exploration with new practices of categorizing the natural world, the modern scientific race concept first arose during the 18th century and quickly became a popular topic of study among naturalists and biologists. Understandings of race at this time reflected broader scientific discussions of the origin and reproduction of life, with debates over evolution, development, and divine creation playing pivotal roles in shaping how the scientific race construct was formed. This historical construction of "race" allowed for the later alignment of racial theories with the genetic paradigm of the Modern Synthesis and set the stage for anthropological debates over the meaning of race in the 20th century. During the past two decades, essentialist genetic theories of race have found a new home in the arena of health disparities. *Chapter 2* will conclude by discussing how this contemporary mode of race science reflects the historical development of the race construct and will highlight its significance for anthropology, public health, and science generally.

Chapter 3 of the dissertation, "Chronic Psychosocial Stress: A Pathway to Disease for African Americans," reviews current evidence for the role of stress in chronic disease

development and describes the ways in which stress may be particularly salient for African American health. Activation of the body's stress response system, whether through physical or psychosocial stressors, results in several downstream biological consequences. There is now substantial evidence that chronic activation of these physiological responses, including release of both glucocorticoids and catecholamines into the body, can result over time in increased risk for cardiovascular and other diseases. Current social constructionist theories of health disparities suggest that the social and economic consequences of racial inequality in the United States may influence African American health through these psychosocial stress pathways. Epidemiological evidence supports these theories, suggesting that several psychosocial factors are linked with poorer health outcomes for African Americans. The extent to which social environmental factors explain racial health differences and the precise mechanisms through which they operate, however, are still unclear. This is due to three primary limitations in health disparities research: 1) Most studies do not examine the complete pathway through which psychosocial stress may impact health, including stressors (exposures to stress or sources of stress), emotional experience of stress, physiological response to stress, and long-term health consequences of chronic stress activation, 2) The specific elements of racial inequality in US society that may be sources of stress for African Americans, and the local social and cultural contexts within which those stressors are experienced, have not been adequately explored in health disparities research, and 3) Until recently, studies have tended to focus solely on adult exposures to psychosocial stressors, leaving open the question of how experiences earlier in life and throughout the lifecourse may impact health through stress pathways. *Chapter 3* concludes by discussing how this dissertation project addresses these limitations of health disparities research and helps to fill in gaps in current knowledge of African American stress and health.

Chapter 4 describes in detail the research methods employed in this dissertation project; in particular, the use of innovative biocultural methods that allow cultural and individual levels of analysis to be linked in quantitative models. As mentioned, adequately measuring aspects of cultural and psychosocial environments in epidemiological research has proven challenging. The rich, often narrative, ethnographic data elicited with qualitative research methods are difficult to quantitatively operationalize – a necessary step if aspects of the social and cultural environment are to be examined in relation to biology and health outcomes. The cultural consensus (Romney, et al. 1986) and consonance (Dressler 1996a) methods combine qualitative and quantitative data collection and analysis in a way that allows ethnographic data to be measured in epidemiological research. Employing a unique application of statistical factor analysis to ethnographic interview data, the cultural consensus method determines the extent to which individual attitudes and beliefs are shared, and thus constitute cultural information. This analytic method can be used to create a cultural model of community beliefs around a particular topic. In this study, cultural models of the most important sources of stress, social status, and social support for youth in the Maywood community are determined. Individual conformity with these models, or cultural consonance, is then measured in relation to several biomarkers of health risk. In particular, adolescent blood pressure, a cardiovascular risk factor that tracks fairly consistently into adulthood, and diurnal salivary cortisol, a hormone indicating patterns of activation of the body's physiological stress response, are employed as markers of emerging health risk. By linking aspects of the cultural environment with biological indicators of health risk, the methods used in this study help to better elucidate the role of social experience in the development of health inequality.

Chapter 5 of the dissertation, "Ethnographic and Consensus Results: Cultural Models of Stressors, Social Status, and Social Support," presents results from the ethnographic and cultural consensus phases of the study. Cultural consensus analysis indicated remarkably high agreement among participants regarding the most important sources of stress and social status for youth in this community. Analyses revealed that, for youth in Maywood, the sources of stress that are most prominent in their everyday social worlds are far more varied and complex than conventional models of urban adolescent stress indicate. In addition to the aspects of violence and neighborhood safety that are assumed to comprise the bulk of black adolescents' stress exposure, Maywood youth reported that several academic, home, and peer pressures were of equal or greater salience for them. Similarly, participants described pressures around social acceptance and popularity and the complex avenues through which social status is attained within their local youth culture. In particular, the experiences of Maywood youth suggest the challenge of conforming to adolescent material status ideals in a community of low economic resources. While consensus levels were not as high among participants for sources of social support, youth did indicate several family and friend relationships that were particularly important when they needed help. In general, the cultural models developed in this study provide a rich understanding of the social lives of adolescents in the Maywood community and allow for more meaningful measurement of the types of experiences that may influence their health.

In *Chapter 6*, "Adolescent Stress and Health: Sample Characteristics, Cultural Consonance, and Blood Pressure," the associations of adolescent blood pressure with individual measures of cultural consonance, controlling for covariates, are described. For youth in Maywood, several aspects of cultural consonance are associated with higher blood pressure. Individuals carrying a high burden of culturally-salient home-related stressors, for instance, have

higher average blood pressure than those with lower exposure to stressors. Additionally, attaining high material status, particularly when parental economic resources are low, is associated with higher blood pressure for youth in this community. These results indicate the health significance of stressful social environments for the development of health risk among youth, and suggest the health impact of maintaining high material status in an economically poor environment.

Chapter 7, "Adolescent Stress and Health: Psychological Factors, Cultural Consonance and Health," describes associations of cultural consonance with adolescent emotional health and salivary cortisol levels. Several aspects of cultural consonance, including a higher burden of culturally-salient stressors and lower levels of social support, were found to be strongly associated with higher perceived stress, depression, and anxiety in this adolescent sample. These results indicate that the social and cultural environment is strongly linked with adolescent negative emotional states – important measures of youth well-being in their own right, as well as indicators of potential cardiovascular risk. Additionally, adolescents with higher burdens of culturally-salient stressors had higher average diurnal cortisol curves, indicating greater overall activation of physiological stress response systems. These youth thus may be at greater risk for having dysregulated stress responses as adults and developing chronic cardiovascular conditions. The fact that perceived stress levels are *not* associated with cortisol profiles indicates that the pathway through which stress influences biology is not via its subjective perception. For these youth, being exposed to stressors in their community and everyday lives is predictive of emergent health risk, whether they perceive themselves as being 'stressed out' or not. These findings thus highlight the utility of ethnographically derived measures of social environmental exposures for understanding health.

Chapter 8 will conclude the dissertation by discussing the significance of biocultural anthropological approaches for understanding contemporary racial health disparities. Linking cultural, individual, and biological levels of analysis is necessary for understanding how the social and economic inequalities associated with race influence health. Perspectives and methods in biocultural anthropology, such as the cultural consensus and consonance methods used in this study, offer a more holistic understanding of how social environments become differentially embodied in health risk. By elucidating the experiences that are salient in particular local contexts, biocultural methods help to highlight the social determinants of health that are meaningful for individuals; what Kaplan and Lynch (1997) have described as an "epidemiology of everyday life". This dissertation shows that adolescents' everyday cultural experiences of stress are important determinants of health risk, suggesting pathways through which racial health inequality develops. In the process, this study advances the contemporary anthropological discussion of race; challenging reprised strains of genetic essentialism in scientific racial discourse by helping to illustrate how the social construction of race, and its individual and cultural experience, can be reflected in biology and health.

Chapter 2

Debating the Essentialist Racial Paradigm: Race and Heredity in Historical and Contemporary Context

The contemporary discourse of racial health disparities, which spans medical, public health, and social science disciplines, has recently been described as a "storm" (Krieger 2005). It is characterized by intense debate and polarization over the existence of genetic or social/environmental bases for African Americans' disproportionate disease burden. Gene-based theories suggest that blacks carry an innate genetic predisposition to certain pathologies, particularly cardiovascular diseases, while social constructivist theories suggest that material disadvantage and entrenched social inequalities result in health disparities. At the heart of this polarization is a broader debate over what 'race' means at a biological, or 'innate,' level and what racial categories represent.

The debate over race – whether human types and human traits are fixed or plastic, whether races are more similar or more different - has had a long history in science and in anthropology. From the 18th century through the middle of the 20th century, race was an issue of central importance to biological and anthropological fields. However, the race debate has had a more secondary position since the 1960s, when the social sciences largely rejected the race concept as a valid marker of meaningful biological difference, and turned their attention to more proximate issues of class, ethnicity, and culture (Harrison 1995). The biomedical sciences, by contrast, largely retained a biological/genetic view of race. However, without the means to explicitly examine the genetics of race, this view was left as merely an assumption through much of the 20th century.

During the past 15 years, an increased focus on race via health inequalities and the development of new genome sequencing technologies that allow the question of genetically-based race to be explicitly tested, have forced debate over race back into the spotlight. In this contemporary discussion, 19th century debates over the unity or divergence of the human species are being replayed in the context of genome analysis. With new evidence and new technology, the discourse still rests on alternative interpretations of human races as either fundamentally the same or different – the same alternative positions that have characterized most of the history of the debate. The durability of opposing arguments in the race debate, and the resurgence of this debate in contemporary health literature, point to the continuing significance of research that addresses race and the need for novel approaches for understanding health disparities.

History of Race in Science

Typologies and Human Variation

The race concept originated in the 18th and 19th centuries, and coincided with emerging scientific understandings of the world as a 'Natural System' and of humans as occupying a place within it. Prior to this time, the natural world was perceived as somewhat chaotic: sudden individual metamorphoses and species transmutations were believed to be possible, and organizing the relative instability of nature into a functional, ontological system was considered largely impossible (Amundson 2005). The common representation of the natural world up to this time had been the *scala natura*, or Great Chain of Being, which organized life forms as a linear continuity, arranged as a hierarchy according to graded physical resemblances (Voegelin 1998). This arrangement, however, represented only a logical organization of the known world in

relation to God. The categories in the hierarchy were not thought to reflect real, natural entities, and no biological relationships between them were illustrated.

By the late 17th and early 18th centuries naturalists began trying to understand species in the natural world as real, biologically distinct types. John Ray's botanical classifications and Francis Willughby's classification of birds were among the first attempts to create species typologies based on observations of the form and relationship of organisms in natural settings (Bowler 2003). Rather than using an arbitrary system of classification based only on relative resemblance, Ray and Willughby categorized types according to complexes of traits that they thought defined each natural species as a real, biological type. This method of categorization thus introduced the modern concept of essentialism to biology – complexes of physical traits were thought to index the stable essence of a natural type, constituting the vital force that makes each type truly distinct (Voegelin 1998).

In 1735 Linnaeus produced the first classification of the entirety of the known natural world in *Systema Naturae.* Its organization was also based on the defining, essential characteristics of each species, and included humans as a part of this real-ontological Natural System (Brace 2005; Voegelin 1998). This inclusion of humans as a species-type in natural classification posed complex issues for naturalists, since concomitantly the documentation of physical human differences across populations was growing with European exploration, and later, colonialism. Colonial travelogues described cultural and physical variation in human groups across the globe, and naturalists struggled to incorporate the variety of human skin color and other highly visible traits into their natural classification systems (Voegelin 1998). While most naturalists of the time acknowledged that human physical variations existed, they disagreed over what these variations represented.

Many late 18th and early 19th century naturalists favored environmental explanations of human variation, or 'racial' difference. Buffon, Blumenbach, and Kant, whose typological classification systems all included human color varieties or races, considered these differences in skin color, and other distinguishing traits, to be the transient result of local climatic influence rather than expressions of different underlying essences (Voegelin 1998). Advocates of this environmentalist notion of race incorporated notions of monogenetic origins, and considered human varieties to be deviations from a single original type, with each race responding in physical form to their particular climatic circumstances. The monogenist position maintained a strict biblical interpretation of the creation of humans, and assumed that all racial types emerged over time from a single divine creation event (Brace 2005). The environmental race theory and monogenism, focused on superficial biological responses to local climatic conditions, and as a result, tended to emphasize the deeper unity of the human species over its variety. As Marcel de Serres said in 1845, "When we compare at once, and without any intermediate series, the skin of the white man with that of the black or the red man, we are tempted to assign a distinct origin to each of these races; but if we pass from the white to the black or the red, through all the intermediate varieties, it is no longer the difference, but the analogy, which strikes us," (de Serres 1996:201).

Others believed that climatic influences could not explain human racial varieties and that their differences were more essential in nature. For instance, Linnaeus, whose 10th edition of *Systema Naturae* described five racial subspecies of humans, and Camper, who developed the facial angle method of racial measurement and classification, both believed that races were permanent types - fixed creations of God (Brace 2005). Fixed-type race theorists argued that known physical responses to climate, such as tanning, do not persist after the exposure is no

longer present. Since racial skin color variation persists under different climatic conditions, they argued that these racial traits are fixed, and that human races must be different from each other in essence. This perspective was often accompanied by the polygenist position that races represent different species, and are the result of different creation events. As Joseph-Julien Virey stated in 1823, "All the facts which have been collected, concur to prove how constant and indelible are the natural and moral characteristics of Negroes in every climate, notwithstanding a diversity of circumstances. In natural history, it is then impossible to deny that they form not only a race, but truly a species, distinct from all other races of men known on the globe," (Virey 1996: 163).

Heredity: the broader issue of trait origin in biology

Informing these theories of environmentally-induced and fixed-type human races was a broader debate that had been unfolding in biology over the nature of heredity and degree to which individual and group characteristics are predetermined. Robert Knox, who was a strong supporter of the fixed race theory, summed up the race debate in 1846 as follows: "That the minds and bodies of men are influenced, to a certain extent, by external circumstances, I see no reason to deny. But this is not the real question: The question is, to what extent?" (Knox 1996: 250). One answer to this question was that external circumstances had very little influence on the human form and that adult traits were, for the most part, predetermined. The theory of preformationism was a long-held belief that organisms are already fully constructed at the time of conception, and that the ultimate form of the adult is determined before it is born. During the 17th and 18th centuries, the extreme spermist and ovist theories of preformation suggested that miniature, fully formed organisms inhabited male sperm and female egg cells. These tiny adults were thought to contain their own preformed sperm and egg inhabitants, creating a "Russian

Doll" effect in which all life forms could be traced, uninterrupted, to an original divine generation (Van Speybroeck, et al. 2002).

The alternative viewpoint was based on the Aristotelian notion of epigenesis, or the gradual development of organisms from undifferentiated embryonic material. Epigenesists argued that adult traits and the differentiation of organismal components were produced through a dynamic developmental process. While epigenesist theories often imagined development as a teleological process, with form unfolding to produce a purposive end result, they largely rejected divine creation as an explanation for the generation of organisms (Voegelin 1998). Particularly following Wolff's concept of 'active nature' and Blumenbach's ideas of an 'active force' in the late 18th century, epigenesists argued that development was the result of natural materials and processes and could be profoundly influenced by external circumstances and environments (Van Speybroeck, et al. 2002).

By the later 18th and 19th centuries, the idea that organisms develop, rather than having all of their mature complexity at the outset, was generally accepted, and the heredity debate refocused around the degree of stability or predetermination that constrained the fate of the developmental process (Van Speybroeck, et al. 2002). Preformationists at this time, as with the naturalists who were beginning to catalogue the natural system, adopted the idea of a vital essence: not just as the defining and distinguishing quality of species, but as a fixed embodiment of individuals. Each organism was thought to inherit this species-defining essence which would remain stable despite small variations in development, fixing species and the individuals within them as unchanging types (Voegelin 1998). Thus the fixed-type and polygenist race theorists of this time conformed to the preformationists' notions of heredity and predetermined, essential form. They rejected the idea that external circumstances could significantly alter the

development of human racial traits; rather they saw these traits as predetermined by fixed, essential differences between the races.

The epigenesist notion of environmentally influenced development gave support to monogenist race theories that emphasized the underlying essential unity of human races and the external, climatic source of physical variation. Epigenesist ideas in the 19th century formed a basis for emerging theories of environmental adaptation, evolution, and species transmutation – theories which posed significant challenges to ideas of fixed, essential types. Lamarck's *Zoological Philosophy*, published in 1809, was the first major work to challenge the idea of fixed types through a theory of gradual evolutionary change (Bowler 2003; Gottlieb 2002). Lamarck asserted that behavioral interactions with the environment could result in adaptive morphological changes, and that cumulative intergenerational inheritance of these changes could result in species transmutation and differentiation (Gottlieb 2002). The issue of whether physical responses to the environment could be inherited was a key point of disagreement in the race debate, and fixed-type race theorists argued strongly against this evolutionary idea. As Lawrence asserted in 1819, the environmental effect on skin color "goes off if the cause be removed: it terminates in the individual, and is never transmitted to the offspring," (Lawrence 1996: 104). Similarly, Desmoulins argued the inverse position in 1826 that "the offspring of the negro, in the most temperate regions of the United States, is as ebony as if it were produced under the African equator," (Anonymous 1996: 136). Thus, the fixed-type argument was that since skin color's known environmental response was not inherited, and racial skin color was inherited, even in diverse environments, it must be predetermined and essential.

Darwin's theory of evolution, published in *On the Origin of Species* in 1859, offered new challenges to the idea of fixed types by suggesting additional mechanisms through which

external circumstances could affect species change. Darwin's emphasis on the common evolutionary descent of all species and the role of environmental adaptation in producing species change through the mechanism of natural selection were in line with the epigenesist doctrine that physical/biological form is the product of dynamic process. As such, his theory was embraced by evolutionary morphologists in the latter half of the 19th century, who sought to understand evolutionary histories and phylogenetic relationships through the comparison of structural and physical forms (Amundson 2005).

Evolution and Racial Typology in Historical Context

Darwin's and Lamarck's evolutionary ideas and developmental emphases were strongly opposed by those who subscribed to the preformationist belief that species and individuals are defined by stable essences and that natural types are biologically fixed. This opposition was in part a reflection of social pressures and contexts that accompanied processes of industrialization and class formation in Europe and the United States. While ownership classes favored hierarchical worldviews in which social placement was predetermined and fixed, the growing middle and working classes sought paradigms in which categories were more fluid and opportunities for change and advancement were possible (Bowler 2003). The developmental/ evolutionary paradigm of the late 19th century was seen by some to represent a dangerous anti-Creationist materialism and liberal opposition to the dominant social order. Evolutionary thinking suggested that social, racial, and biological hierarchies were dynamic and unstable, and granted substantial agency to environmental conditions and reproduction in forming and transforming life. As a result, Darwin's ideas of continuous and gradual change were met with

much criticism and challenge from the preformationist and prederminist scientists of the late 19th century.

In the United States in particular, where the institution of African slavery had tied racial theory to the political and economic development of the nation, the challenge to fixed types was perceived as especially threatening. Early American anthropologists and naturalists had made careers out of racial typologizing and measuring the physical attributes that they thought formed the essence of the black race (Haller 1971). Samuel George Morton, who played a particularly prominent and pioneering role in the study of race and the development of physical anthropology in the United States, published the monumental and influential *Crania Americana* in 1839 in which he detailed measurements in cranial form for five major human races. Morton's view of human races was solidly essentialist, and he believed that the cranial variation he documented among races was a reflection of the fixed and predetermined differences of these groups (Brace 2005). Josiah Clark Nott and George R. Gliddon were also influential in early American anthropology and race theory and both supported a polygenist view of race. In the *Types of Mankind,* published in 1854, Nott and Gliddon argued that the fixity of inferior racial types provided a scientific justification for the institution of American slavery (Brace 2005). When Darwin's theory was published in 1859, Louis Agassiz, another strong supporter of polygenism and essential racial difference, devoted much of his work at Harvard University to combating the threat that evolutionary environmentalism posed to the predeterminist racial paradigm (Brace 2005).

Hard Heredity and the Development of Gene Theory

One significant problem with Darwin's evolutionary theory of natural selection, which provided fuel for his critics and prevented his epigenesis-related theory from gaining wide acceptance by scientists during his lifetime, was the absence of a known hereditary mechanism that would allow it to function (Amundson 2005). Natural selection required both variation within a species and a durable medium of inheritance that would allow adaptively successful variants to be retained by the next generation. At that time, theories of inheritance, including Darwin's and Lamarck's, were "blending theories" in which hereditary material from both parents was assumed to be mixed at conception. Critics noted that natural selection could not operate with such a mechanism, because any adaptive traits favored for their survival or reproductive value would be progressively diluted through the mixing of parental germinal material at each generation (Amundson 2005; Gottlieb 2002). These theories of "soft inheritance" also allowed for the environmental exposures and responses of the parental generation to influence the development of offspring – an idea that was very much at odds with preformationist views. These supposed flaws of Darwin's evolutionism gave support to those who rejected his theory and encouraged increased attention in the last part of the 19th century to understanding how heredity functioned.

Francis Galton, Darwin's cousin and strong opponent of evolution, developed one of the first theories of "hard heredity" in the 1870s. Stemming largely from his belief in the innate inferiority of non-white race, Galton postulated that family ancestral lines were continuous and fixed; unable to be altered by the exposures of any individual parental generation (Bowler 1989). In this framework variation existed among ancestral lines, but inheritance functioned only to preserve the innate essence within each line. This theory allowed Galton to assert the innate

inferiority of African ancestral lines and to promote a social agenda of group reproductive regulation and selective breeding.

However, not all theories of hard heredity were based on an underlying racist and anti-evolutionary agenda. In the 1880s August Weismann developed a theory of heredity that would provide a mechanism through which natural selection could function and allow Darwin's evolutionary theory to be compatible with the preformationist view of inheritance. Weismann's theory of the germ plasm postulated that chromosomal bodies in the cell nucleus contained the heritable material of an organism, and that this material was stable across generations (Bowler 2003). In Weismann's theory, the somatoplasm, or body, was completely separate from the germ plasm. While the soma could adapt and change in response to the environment during the course of growth and development, the germ plasm was thought to be sequestered and immutable in the face of internal or external stimuli (Gilbert 2002). Under this theory of inheritance, the population variation on which natural selection could operate was contained only in the germ line, and was not influenced by the adaptations or reactions of the body to the environment.

Thus Weismann's theory of hard heredity and stable germ plasm provided a new basis for preformationism. As a strong supporter of Darwin's natural selection theory, Weismann sought to discredit the Lamarckian notion that environmental adaptations could be transmitted across generations. In 1893 Weismann and Herbert Spencer, a supporter of Lamarck's evolution theory, engaged in a passionate debate in the *Contemporary Review* over the exclusive ability of natural selection to account for species change (Gould 2002). The titles of their respective papers – Spencer's "The Inadequacy of 'Natural Selection,'" and Weismann's "The All-Sufficiency of Natural Selection" – tell much of the story. While Spencer thought natural selection was an important mechanism of evolution, he did not believe it deserved the position of primacy and

exclusivity in evolutionary theory granted to it by Weismann and his school (Gould 2002). Weismann, however, argued strongly that selection of traits inherited through the sequestered germ line was the only mode through which species change could take place.

Weismann's view of heredity and evolution would have wide influence among biologists and within the emerging study of genetics at the beginning of the 20th century. In 1900 Gregor Mendel's laws of inheritance, developed in the 1860s, were rediscovered and interpreted as support for a particulate, chromosomal theory of heredity – in-line with the Weismannian germ line view (Bowler 1989; Gilbert 1998). William Bateson was among the most enthusiastic early supporters of Mendelian genetics and was an outspoken advocate for its ability to provide the mechanism of inheritance that allowed evolution to function (Gilbert 1998). Thomas Hunt Morgan, one of the first experimental geneticists in the United States, was also instrumental in developing gene theory and the field of genetic study. Morgan promoted a synthesis of Mendel's principles of heredity with Weismann's concept of the continuity and isolation of the germ plasm. In contrast to epigenesists and embryologists who maintained that the locus of heredity was the cytoplasm, Morgan, along with Oscar Hertwig, Wilhelm Roux, and Theodor Boveri, asserted that only the nuclear chromosomes contained inherited and form-constructing elements (Gilbert 1998; Gottlieb 2002; Keller 1995). In his highly influential *The Mechanism of Mendelian Heredity* in 1915, Morgan declared genes to be the ultimate causative sources of adult phenotypic traits, making the role of embryonic development in the production and inheritance of form insignificant (Amundson 2005). Under this synthetic theory, the gene served as the new locus for the preformationist essence of life; no longer imagined as a tiny man in the head of a sperm cell, the continuity of predetermined organisms was now seen to be contained within stable genetic sequences.

The development of gene theory and its synthesis with Darwinian evolutionary theory – the Modern Evolutionary Synthesis – developed rapidly during first few decades of the 20th century and grew to have widespread influence within biology. R.A. Fisher, Sewall Wright, and J.B.S. Haldane were particularly instrumental in the development of the synthesis, proposing mechanisms through which genes could result in both discrete and continuous phenotypic variation (Gottlieb 2002; Gould 2002). In 1937 Dobzhansky's *Genetics and the Origin of Species* solidified the basic tenet of the modern synthesis perspective – that while the environment can affect phenotypic variation to an extent, genes are the only source of inherited traits and provide the 'blueprint' for determining the adult form (Gottlieb 2002; Gould 2002). With the acceptance of the modern synthesis genetic paradigm across biological fields, the nuclear gene was widely considered to be the sole locus of heredity, and determinant of growth and development (Jablonka and Lamb 2005). The discovery of the double helix structure of DNA in the 1950s identified the specific mechanisms through which genes function as heritable units, and completed the solidification of the modern synthesis perspective in biology (Keller 2000).

Race and Evolution

As neo-Darwinian evolutionary theory, which strongly prioritized adaptation and natural selection over other mechanisms, began to be scientifically accepted in the early 20th century, it provided a new framework for the scientific study of race. For some scientists, including many American physical anthropologists, the new evolutionary discourse and concept of hard heredity allowed earlier fixed racial typologies to be re-cast in genetic terms. Some used the new evolutionary ideas as justifications for hierarchical and unequal naturalizations of human races. Francis Galton's eugenics movement played a key role in these developments. While Galton's

views on heredity were expressly anti-evolutionary, he did recognize the significance of key components of the natural selection theory - reproductive success and survival of the fittest. The eugenics program developed by Galton combined these tenets with his view of hard ancestral heredity to suggest that racially, economically, and mentally unfit people should be bred out of the population. Eugenics programs in Europe and the United States sought to inhibit the reproductive success of what were seen to be inferior races, and in some cases instituted forced sterilization to accomplish that goal (Brace 2005). While some founding contributors to the modern evolutionary synthesis, such as R.A. Fisher, advocated somewhat more limited and subtle versions of eugenical thinking, T.H. Morgan and other geneticists were outspoken critics of what they saw to be unwarranted abuse of new genetic theories.

Eugenics-influenced thinking also had some influence in the bourgeoning field of physical anthropology in the United States. Earnest Hooton, who was among the first American professional physical anthropologists, had more complex and nuanced views on race than that of a solid Eugenicist, but Hooton was influenced by Galton's writings and advocated an evolutionary view of race that mirrored polygenism. He was an essentialist and believed that human races had evolved separately and discretely from ancestral forms (Caspari 2003). However, Hooton was also active in promoting anti-racism within the field of anthropology. While he believed in essential racial types, Hooton largely rejected biological determinism and argued that scientific evidence did not support racial evolutionary inferiority. However, Hooton's legacy in anthropology is more representative of his essentialist and eugenic leanings. Hooton's students would go on to found almost every academic physical anthropology program in the country. Many of these students, including, notably, Carleton Coon (Coon 1962; Coon, et al.

1950), would be active in perpetuating ideas of evolutionary polygenism in anthropology, making tree diagrams of human racial evolution common in the field (Caspari 2003).

Franz Boas, one of Hooton's colleagues in the anti-racist campaign and highly influential figure in the development of American anthropology, took a different approach to incorporating evolutionary ideas into the study of race. Boas was a strong proponent of developmental evolutionary ideas of plasticity and environmental influence, and did not adopt the ultra-selectionist, gene-based paradigm of Neo-Darwinism and the modern synthesis. He opposed biological determinism and essentialism and pioneered statistical applications to the study of human variation in order to demonstrate the invalidity of fixed human types. In the early 20th century, Boas initiated a landmark study in which he collected and compared craniometric data from over 17,000 immigrant children and parents. Boas's study revealed a remarkable level of plasticity in cranial form between generations, and demonstrated the significant influence of environmental contexts in affecting the development of a supposedly fixed racial trait (Boas 1912). Boas's work would have lasting influence in anthropology and the study of race, as would the work of many of his students. One of Boas's students, Ashley Montagu, became an outspoken critic of the race concept in anthropology, and wrote the 1950 UNESCO statement that defined race as "not so much a biological phenomenon as a social myth," (Montagu 1997).

Race and Anthropology in the Age of Classical Genetics

By the mid-20th century, after the modern synthesis and gene theory were fully established across biological disciplines, the race debate had refocused around the question of whether the underlying genetic constitutions of races were fundamentally different. Beginning in the 1950s, Sherwood Washburn advocated for a new physical anthropology that adopted the

modern genetic evolutionary paradigm and focused on population studies and non-categorical distributions of human biological variation (Washburn 1951). This new physical anthropology inspired a genetic approach to the study of race that emphasized continuous variation over fixed types (Caspari 2003). C. Loring Brace and Frank Livingstone were instrumental in using genetic data, particularly protein markers for ABO blood groups, to demonstrate the clinal, continuous, geographic distribution of traits. In a 1962 article, Livingstone coined the famous phrase, "there are no races, only clines," emphasizing the new anthropological focus on individual trait distributions rather than races (Brace 2005). Brace argued that, since most traits are influenced by natural selection independently and thus have different distributions, no human group could have a genetically distinct constitution; there would be no clear boundary to draw around varying distributions of traits.

In 1972 Richard C. Lewontin examined allele frequencies for 15 genetic protein markers among populations, and demonstrated that only 6% of the allele variation occurred between continental groups. A full 85% of genetic variation was found to occur within populations, suggesting that human populations and races are far more genetically similar to each other than they are different. With advances in molecular biology and availability of new genetic markers for research, such as microsatellite DNA and RFLPs, Lewontin's study of global genetic apportionment was replicated several times over the following three decades. Regardless of which marker was used, all human genetic apportionment studies have confirmed, and in some cases strengthened, Lewontin's general findings that continental race groupings account for relatively little human genetic variation (Relethford 2002).

Lewontin's findings were interpreted by many cultural anthropologists and social scientists as proof that the biological race concept was untenable. After the 1960s, many in these

fields rejected the typological, determinist, and essentialist study of race, and adopted alternative areas of study around ethnicity, culture, and populations (Harrison 1995). By the 1990s, both the American Anthropological Association and the American Association of Physical Anthropologists issued official statements denying a biological/genetic basis for race, drawing on and updating Montagu's earlier UNESCO position statement. While debate over the meaning and significance of race continued among anthropologists, these official positions and much research in the field reflected an understanding of race as a social construct.

Racial Health Disparities

Race in Medicine

While there was a general elision of race from much anthropological and social science research after the 1960s, biomedical fields retained a biological/genetic view of the race concept throughout the 20th century (Williams 1997). Racial differences in health status had long been documented in the United States - higher rates of many infectious diseases among African Americans, including tuberculosis and syphilis, were documented during the 19th century (Krieger 1987), and higher prevalence of essential hypertension among black Americans compared to whites was first noted in the early 20th century (Adams 1932; Donnison 1929). The new gene-centered and preformationist worldview of the modern evolutionary synthesis provided a useful framework for understanding differential disease prevalence among races. Gene theory suggested that all adult traits, including health and disease, were the result of predetermined genetic sources. Therefore genetic differences in disease susceptibility between the races became the favored explanation for health disparities in biomedicine.

The most widely elaborated genetic theory of a health disparity is the Slavery Hypothesis (Wilson and Grim 1991); a theory originating in the 1960s to explain African Americans' higher rates of hypertension. This theory proposed that populations in West Africa from which slaves were drawn carry a salt-conserving allele that provided a survival advantage during the harsh conditions experienced during the Middle Passage. As a result, this hypothetical gene would have been common among the subset of slaves who survived to populate American plantations, leading to more common hypertension in their descendents faced with the high sodium intake of the modern American diet (Wilson and Grim 1991). In fact, there is no evidence for such a salt-conserving gene in African Americans (Cooper and Rotimi 1994), and the hypothesis has been widely challenged on the basis of both historical accuracy (Curtin 1992) and evolutionary plausibility (Jackson 1991). Kaufman has written extensively on the hypothesis, and has noted that it continues to be widely cited as an explanation for race disparities in hypertension in the medical and popular literature, despite the general lack of supporting evidence (Kaufman and Hall 2003).

Other explicit genetic theories of racial health disparities grew out of literature on skin pigmentation and health. A relationship between skin pigmentation and blood pressure among African Americans was first documented in the 1970s (Boyle 1970), and confirmed in additional studies in the United States (Dressler 1991a; Harburg, et al. 1978; Klag, et al. 1991) and other African-diaspora populations (Sorlie, et al. 1988). Skin pigmentation was assumed by some researchers to index the proportion of African genetic constitution retained by individual black Americans in the US context of historical white admixture. In the first documentation of the skin color gradient in blood pressure, pigmentation was measured explicitly as a "genetic marker,…to elucidate the etiologic role of hereditary factors in the high prevalence of hypertension found in

Charleston Negroes" (Boyle 1970). Others suggested a direct physiological pathway between genetically controlled skin pigmentation and hormonal effects on blood pressure (Harburg, et al. 1978). Some research suggested that the relationship between blood pressure and skin color was at least in part due to confounding effects of socioeconomic and environmental factors (Keil, et al. 1981; Keil, et al. 1977; Klag, et al. 1991). However, the idea that skin color is an index of genetic constitution remains in biomedical literature.

Other assertions of genetic bases of health disparities have been more vague. In 1995 Saunders reviewed the "pathophysiologic characteristics of hypertension in blacks," and concluded that "they seem to form a basis for suggesting there may be some underlying genetic cause" for the black-white disparity in hypertension (Saunders 1995). Similarly, in 2006 Hirsch and colleagues suggested that "race serves as a marker for the differential clustering of genetic polymorphisms" that lead to frailty and age-related risk for chronic disease morbidity and mortality (Hirsch, et al. 2006). In neither case was explicit genetic evidence provided to support the stated conclusions. Rather, these authors rely on the assumption, widely accepted in biomedical literature and cited in biomedical texts (Williams 1997), that races are genetically different and that that difference is the logical explanation for health disparities.

Race and the Genomic Revolution: A Polarized Discourse

An explosion of interest in health disparities at the end of the 20th century renewed the debate over what 'race' means at a biological level, and forced many who had rejected the race concept to become more vocal in their opposition to biomedical assumptions of genetic races. The dramatic increase in health disparities attention resulted primarily from two major policy endeavors: the *Healthy People 2000* initiative, launched in 1990, which included reducing health

inequalities as one of three major public health goals for that decade, and the 1993 NIH Revitalization Act, which mandated minority inclusion in all federally funded clinical trials. With these explicit funding priorities, biomedical research around race and health skyrocketed, with 76.7% of all articles published in the *American Journal of Public Health* and the *American Journal of Epidemiology* between 1996 and 1999 referencing race or ethnicity (Comstock, et al. 2004). With this level of research and funding attention directed towards health inequalities, scholars from the social and biomedical sciences have resurrected debates over what the biological nature of race is. The result is a highly polarized contemporary discourse around race and health.

In the midst of this polarization, the arrival of the "genomic era" and a revolution in molecular genetic technologies at the beginning of the 21st century has offered a new medium with which to explore racial-genetic theories of health. Throughout much of the 20th century, the study of human genetic variation had relied on examining classical protein markers, such as blood group polymorphisms. Discoveries of protein markers increased dramatically after the introduction of electrophoresis technology in 1949, and genetic research flourished in the latter half of the 20th century. However, the ability to sequence entire genomes did not occur until the 1990s and allowed for a depth and resolution in the study of human genetic variation that was previously unknown (Cavalli-Sforza and Feldman 2003). With the completion of the Human Genome Project's sequencing of the human genome on April 14, 2003 and the new research tools it made available, came the possibility that a genetic basis for race and its role in health disparities could now be empirically tested (Cooper 2003).

However, the new era of genomic research has only elicited more debate. In 2002 Rosenberg and colleagues used data from the Human Genome Diversity Cell Line to examine

variation at 377 microsatellite loci among over 1000 individuals from 52 populations. The goal of the research was to determine if, after stripping the genotype data of its population origin information, individuals could be segregated into distinct ancestral subgroups on the basis of patterns of allele frequencies. The computer program used for the analysis required the number of subgroups generated to be predetermined, leading to significantly different results depending on how many subgroups were specified. When five groups were programmed, the allele frequency clusters corresponded to major geographical regions – Africa, Eurasia, East Asia, Oceania, and America. However, when a sixth subgroup was added to the analysis, the cluster consisted primarily of individuals from a northwest Pakistani population rather than a major continental region. It was also found that individuals from many populations could not be definitively segregated into a genetic cluster, as they had similar probabilities of membership in multiple subgroups (Rosenberg, et al. 2002). The disparate findings of Rosenberg and colleagues have spawned different interpretations and conclusions from researchers, and have made the issues brought to light in the 2002 paper quite significant in the current health disparities discourse.

In March 2003 the *New England Journal of Medicine* featured two high-profile editorials debating the issue of race in medicine, and much of the debate centered on new genomic evidence, including genetic clustering. Esteban Burchard, Neil Risch, and colleagues (Burchard, et al. 2003) argued strongly, as they have elsewhere (Risch, et al. 2002), that classically defined human races represent real biological and genetic divisions in the human species with clinical biomedical significance. They cited the work of Rosenberg and colleagues, as well as other related genetic clustering studies, as evidence for the delineation of genetic variation along continental racial lines and the correlation of self-reported ethnicity with genetic subgroups.

Burchard and colleagues argued that genetic clustering is evidence of gene-based disease susceptibility differences among races. In the opposing editorial, Cooper and colleagues (Cooper, et al. 2003) argued that as yet there is no evidence that the genetic variation that has been found to differentiate continental clusters contains disease-relevant variants. They also point out that Rosenberg and colleagues' 2002 article upheld the findings of three decades of genetic apportionment studies, demonstrating that 93-95% of genetic variation occurs within populations and only a small proportion of variation is exclusive to regional groups. Cooper and colleagues thus argued that socially constructed race categories are not valid proxies for disease-related genetic constitution.

In 2004 *Nature Genetics* devoted a supplemental issue to the question of race and genomics in biomedical research. Most of the contributors argued that new genomic data confirms that the bulk of human genetic variation is shared among populations and is distributed in relatively continuous clinal geographic patterns (Jorde and Wooding 2004; Keita, et al. 2004; Rotimi 2004; Tishkoff and Kidd 2004). For these authors, the evidence that some genetic variation can be used to delineate regional clusters does not overshadow the generally shared nature of most human genetic variation. Additionally, Tishkoff and Kidd pointed out that non-random population sampling could explain much of the evidence for 'racial' genetic clustering.

This important point was demonstrated further by David Serre and Svante Paabo in 2004 when they replicated the genetic clustering study of Rosenberg and colleagues using a geographic rather than population-based sampling strategy. When individuals were sampled continuously across geographical space rather than from continentally disparate populations, distinct subgroup clustering was not found and individuals appeared admixed among the inferred clusters (Serre and Paabo 2004). These findings mirror those of Rosenberg and colleagues

themselves, since in their study distinct continental clustering did not hold when more than five groups were specified and many individuals were too admixed among the subgroups to make definitive designations.

The debate around race, genes, and health is thus based largely on differing interpretations of the new data made available by genomic research. All genetic researchers agree that the large majority human genetic variation occurs between individuals in populations and that only a small proportion of variation is specific to regional or population groups. However, those variants that are population specific, as well as alleles that have measurably different frequencies across populations, can be used to cluster some individuals into continental ancestral subgroups, as long as geographically intermediate populations are ignored. The question, then, is whether those imperfectly formed clusters, based on small portions of genetic variation, are medically and biologically meaningful and justify the use of racial categories as valid proxies for genetic disease susceptibility. For many geneticists, biologists, epidemiologists, physicians, and social scientists who have weighed in on this issue, the answer to that question is no; race is thought to be too imperfect a marker of genetic constitution, and the use of actual disease related susceptibility markers and individual ancestral genotype information is thought to be more useful (Bamshad, et al. 2004; Cooper, et al. 2003; Feldman, et al. 2003; Foster and Sharp 2004; Jorde and Wooding 2004; Keita, et al. 2004; Kittles and Weiss 2003; Ossorio and Duster 2005; Rotimi 2004; Sankar, et al. 2004; Serre and Paabo 2004; Tishkoff and Kidd 2004).

Neil Risch and colleagues (2002) have stated that "a decade or more of population genetics research has documented genetic, and therefore biological, differentiation among the races." They and others believe that conventional race designations are suitable proxies for genetic ancestry and gene-based disease risk (Burchard, et al. 2003; Mountain and Risch 2004;

Risch, et al. 2002; Sarich and Miele 2004; Satel 2002b; Wade 2002). This belief was the justification for the first race specific pharmaceutical, BiDil, approved by the FDA and released for market in 2005 (Kahn 2004). BiDil, a combination of two generic vasodilators (isosorbide dinitrate and hydralazine), is a heart failure treatment that was initially rejected by the FDA because clinical trials in the early 1990s did not show a clear benefit of the combination therapy. However, following the Revitalization Act push for minority inclusion in clinical trials and given the documented disparity in heart failure mortality between black and white Americans, a subsequent trial was initiated to test the drug's efficacy in an exclusively African American sample. This trial tested BiDil against a different standard therapy as the initial studies, and demonstrated a clear benefit of the drug.

Debate between opponents and supporters of BiDil has been intense since testing of the drug began, and serves as a case study for examining the broader contemporary debate around genes, race, and health. Supporters view the drug as tailored therapy for a medically disadvantaged group and consider the use of race as a prescribing guide to be clinically relevant and beneficial (Satel 2002a). However, critics point out that since the drug was only tested in an African American sample, its marketing as a race-specific therapy is misleading and potentially dangerous (Kahn and Sankar 2006). They argue that if race is used as a drug response diagnostic and prescribing tool, physicians risk missing a more effective therapy for black heart failure patients and denying the potential benefits of BiDil to patients of other races. Accepting race to be an imperfect but valid proxy for either genetic disease susceptibility or chemical drug response is seen by many to have the potential to lead to misunderstandings of disease etiologies and poor clinical practice.

Conclusion

The current health disparities debate is thus at somewhat of an impasse: each side of the debate has a radically different interpretation of what race is and what new genomic evidence tells us. Social constructionists view new genomic evidence as supporting the overall unity of the human species. They argue that since most genetic variation is shared across groups, all races have the same underlying, innate essence, and racial differences in health are the product of differential socio-cultural environments. Genetic-race theorists, on the other hand, argue that some genetic variation segregates between races, and that variation may be important for health. They suggest that residual racial health differences that remain after taking social-environmental factors into account must be the product of genetic difference. This view reflects the dominance of the modern synthesis genetic paradigm in contemporary biomedical thinking – genes are the biological units of essentialism and ultimate determinants of adult traits, while environmental influences are relegated to relatively secondary effects.

The continuities between the historical and contemporary manifestations of the race debate are hard to miss. Earlier race theories debated the degree to which racially variable traits were molded by environmental exposures or were reflections of innate difference; whether races had fixed biological essences or were merely populations who had adapted over time to particular circumstances. These race theories mirrored those of the broader debate in biology over whether the traits of adult organisms were predetermined by some fixed, form-giving essence, or emergent through a dynamic and environmentally responsive process of development. As with the environmentalist – essentialist and epigenesist - preformationist debates in the 18th and 19th centuries, one side of the current debate sees unity where the other sees difference. Kant's comment on the state of the race debate in 1781 is remarkably applicable

to the current discourse: “Their argument shows nothing more than the twofold interest of reason, of which each party takes one side to heart,…namely the differences between the maxims of natural diversity or of natural unity,” (quoted in Voegelin 1998: 137).

At the beginning of the 21st century, as health disparities are receiving considerable attention across disciplines, the race debate is again in the scientific spotlight. The intensity of the current debate and polarization over health disparities suggests how important questions of race and health are to contemporary biomedical and social sciences. However, the stalemate that characterizes the current debate over the genomic evidence suggests that novel approaches are needed. Environmentalist, epigenesist, and developmental approaches to race prior to the modern synthesis gave primacy to the roles of external circumstances across the lifespan in the formation of adult traits. Social constructionist models of health that return to this perspective can offer powerful alternatives to the preformationist, gene-centered view of health inequality.

Chapter 3

Chronic Psychosocial Stress: A Pathway to Disease for African Americans

Conventional risk factors for chronic cardiovascular disease, such as diet, lifestyle, and health behaviors, do not fully explain the development of CVD or group-level disparities in its prevalence (Pickering 1999). As a result, opposing theories have emerged to explain CVD disparities, which focus on significant, health-related differences between racial groups. One set of theories holds that essential genetic differences between races account for inequalities in disease prevalence. This racial/genetic view suffers from limitations, however. First, while genes likely play a role in the development of cardiovascular diseases, the complex and polygenic nature of the relationship has made isolating specific causative variants at the population level difficult (Cooper 1999). Second, as discussed in chapter 2, the racial/genetic model of health disparities assumes that real, genetic differences between races exist – an assumption that does not seem to be supported by most genomic evidence and which has sponsored intense, critical debate among many geneticists, epidemiologists, and social scientists.

While genetic differences between races do not appear to be tenable, or at the very least remain undemonstrated, real aggregate-level differences between races do exist with regard to social experience and circumstances. Since the 1960s, many social scientists have accepted the view that, while races do not represent genetic categories, race groups are real social categories with significant social consequences. Since the social environment constitutes the site of known racial difference, social constructionist theories of health disparities posit that this is the locus for the emergence of health inequalities, and have explored ways in which social experiences can influence health. A primary pathway through which the social environment is thought to affect

health is via stress. Biological and epidemiological data over the past 20 years supports a significant role for stress in the etiology of chronic disease, and suggest areas in need of further research to understand the role of stress in racial health inequalities.

Why is stress implicated in health disparities?

In addition to the historical legacy of social inequalities that African Americans have experienced in the United States, contemporary social disadvantages associated with racial inequality are profound and constitute potentially significant sources of psychosocial stress. For instance, Massey and Denton (1993) have documented extensive racial residential segregation that has characterized most US urban areas since the middle of the 20th century, as well as strong institutional maintenance of that segregation despite policies aimed at preventing it. Residential segregation has served as a foundation for segregated schooling, and thus dictates limited higher educational, career, and economic opportunities for black Americans (Williams and Collins 2001). Racially segregated, low SES neighborhoods also have less access than higher SES areas to quality grocery stores offering healthy, fresh, and affordable foods (Zenk, et al. 2006). Fewer economic resources in racially segregated neighborhoods also lead to limited access to medical care.

African Americans have lower socioeconomic status across multiple indicators, including educational attainment, occupational status, income level, and home ownership rates (Williams and Jackson 2005). African Americans are significantly less likely to be employed in white collar jobs, to have completed a college degree, or to be living above the poverty level than white Americans (Williams and Jackson 2005). Significant advances have been made in closing the income gap between black and white Americans in recent decades. However, many have noted

that economic success does not eliminate racial disadvantage. Steinberg (1995) has described the persistent oppression of occupational apartheid in the US, where African Americans in managerial and professional classes are still confined to limited and segregated positions within those tiers. Feagin and Sikes's (1994) ethnographic observations among middle class blacks have demonstrated that economically successful African Americans often encounter significant racism as they challenge patterns of residential and occupational segregation and interact on a daily basis with predominantly white institutions. Additionally, Shapiro (2004) has documented the ways in which systems of wealth inheritance in the US perpetuate racial inequality, as African Americans who earn higher incomes cannot accumulate enough wealth to preserve a competitive class status for the next generation. Many black Americans experience chronic exposure to these sources of psychosocial stress, and this experience may be a principal cause of the differential disease burden of African Americans.

What is Stress in a biological sense?

The word 'stress' in biology is often interpreted to mean a threat to the physiological stability – homeostasis – of an organism. The idea of biological stability is traced to Claude Bernard, who proposed in 1865 that the *milieu interieur*, or internal environment of organisms, is regulated as a whole-body system in response to external environments and stimuli (Cassidy 1999; Cziko 2000). Bernard emphasized stability as the defining characteristic of the internal environment, and suggested that the goal of all physiological processes was "to maintain the uniformity of life in the internal environment" (Cziko 2000). In 1932 Walter Cannon introduced the concept of homeostasis to expand Bernard's *milieu interieur* and to further emphasize the state of equilibrium maintained in the bodies of organisms (Cannon 1935). Homeostasis has been

described as “stability through constancy” (Sterling 2004), and emphasizes the control that organisms seek to maintain in the face of short-term threats and stresses (Cziko 2000).

In 1956 Hans Selye introduced the concept of the General Adaptation Syndrome to describe the physiological processes by which organisms respond to stressors in their environment and maintain homeostasis (Goldstein and McEwen 2002; Schulkin 2004). Building on Cannon’s view of homeostasis, Selye suggested that the body’s physiological response to threats, and maintenance of equilibrium, would be the same whether the source of stress was physical, biological, or emotional. The generality of Selye’s general adaptation syndrome thus referred to the non-specificity of the source of stress, not to process of maintaining homeostasis. Selye in fact described a specific and typical stress response of the body to demands, primarily involving the hypothalamic-pituitary-adrenal (HPA) axis (Schulkin 2004; Sterling 2004).

In 1988 Sterling and Eyer introduced the concept of allostasis to replace homeostasis. Sterling and Eyer suggested that, rather than maintaining stability through constancy, organisms maintain stability through change. The allostatic concept emphasizes the adaptive nature of the body’s response to external demands, and the necessity of physiological systems to be variable in order to meet those demands. While homeostasis posits that internal parameters are regulated at fixed setpoints, the allostatic model suggests that setpoints are statistical illusions that represent the average values of a continually variable system (Sterling 2004). While the homeostatic model suggests that deviations from setpoint values represent pathology, the allostatic model sees these deviations as beneficial adaptive responses designed to help the organism deal with stress.

The concept of allostasis also emphasizes the use of prior information and experience to help predict stress and fine-tune the body’s response to it. Thus, understandings of stress in the latter half of the 20th century have emphasized the role of individual perception and cognition in

the stress response. Drawing on the post-WWII emphasis on the psychological and emotional components of stress, the contemporary stress concept views individual appraisal and coping ability as important determinants of the physiological response to stress (Jones and Kinman 2001; Kugelmann 1992). As a result, the stress concept has become somewhat muddled, referring to not only itself, but also its cause and its outcome, and this has made untangling the role of stress in health and health disparities challenging.

What are the biological mechanisms through which stress can influence health?

Acute Stress Response

The physiological response to stress exhibits some specificity to particular sources or perceptions of threat. However, the body adapts to most stressors, particularly emotional and psychological stressors, with a relatively consistent interactive response of the central and peripheral nervous systems (CNS and PNS). The components of the CNS and PNS that participate in this response – the stress system - coordinate signals and information from both neurosensory and blood-borne pathways to control the duration and intensity of the body's response (Chrousos 1998). The general purpose of this response is to promote behavioral changes, such as increased attention, memory, and vigilance, and physical changes, such as increased oxygen and nutrient flow, that are necessary for the stressor to be effectively met (Chrousos 1998).

The central components of the stress system are located in the paraventricular nuclei (PVN) of the hypothalamus and the locus ceruleus-norepinephrine system (LC/NE) in the brain stem. Parvocellular corticotrophin releasing hormone (CRH) and arginine-vasopressin (AVP)

neurons in the PVN, and catecholaminergic neurons of the LC/NE are the central actors in this system. In addition to having interactive effects on each other, these central components of the stress system control, respectively, the peripheral hypothalamic-pituitary-adrenal (HPA) axis and sympathetic/adrenomedullary (SAM) systems (see Figure 3.1), which have effects throughout the body and on all organs during the stress response (Tsigos and Chrousos 2002).

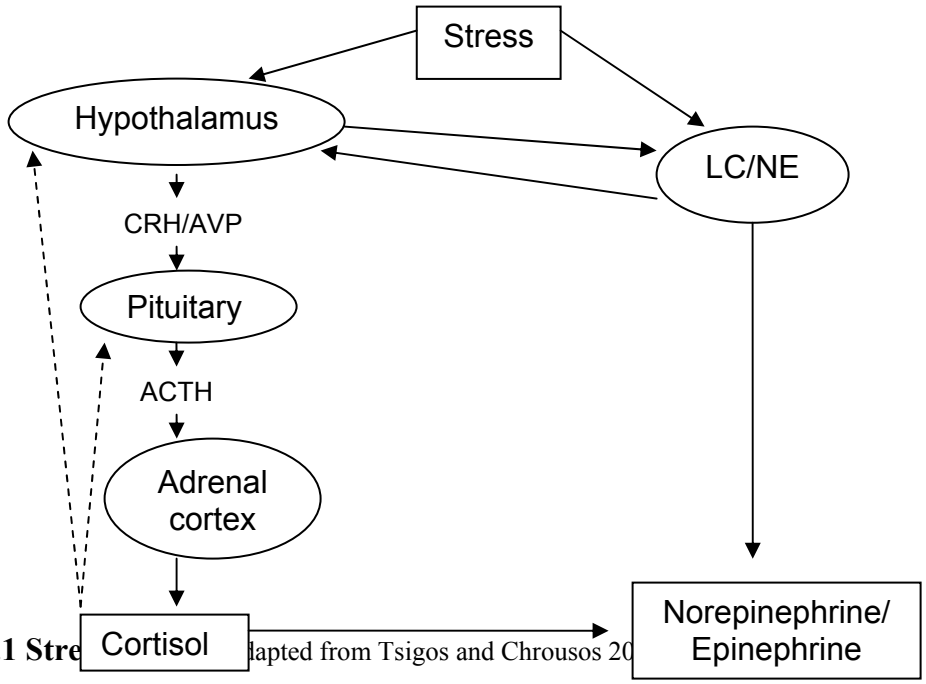


Figure 3.1 Stre dapted from Tsigos and Chrousos 20

CRH released from the PVN into the local blood supply of the hypothalamus, as well as AVP working synergistically with CRH, stimulate the anterior lobe of the pituitary gland to produce adrenocorticotrophic hormone (ACTH) (Clow 2001; Miller and O'Callaghan 2002). ACTH is the chemical messenger that enters the general blood supply and stimulates the adrenal cortex to release glucocorticoids (GCs) (Chrousos 1998; Miller and O'Callaghan 2002). GCs – cortisol in humans – are the final product of the HPA-axis cascade and, due to their steroid chemical nature, have wide-reaching access and effects throughout the body (Chrousos 1998;

Clow 2001). Specifically, cortisol prepares the body energetically to deal with stressors by inhibiting the actions of insulin in glucose uptake and simultaneously liberating stored glycogen energy reserves into circulating glucose (Clow 2001; McEwen 1998), freeing-up stored fats and proteins (Clow 2001), and promoting brain stimulation of hunger for high-fat, high-energy foods (Sterling 2004). Once cortisol is circulating in the bloodstream, it regulates the activity of the HPA axis via negative feedback effects on the production of CRH and ACTH. By binding to glucocorticoid receptors in the hippocampus, hypothalamus, and elsewhere in the stress system, circulating cortisol functions to terminate the stress response and its own production, ensuring that the response to threat is not prolonged or overshot (Chrousos 1998; De Kloet and Derijk 2004).

In addition to the HPA axis, the sympathetic adrenomedullary system also participates in the stress response. Activation of LC/NE system stimulates the adrenal medulla to release the catecholamines norepinephrine and epinephrine (Clow 2001; Mello, et al. 2003). Unlike the HPA axis cascade which takes ~15 minutes to reach peak levels of cortisol, the SAM response releases the catecholamines immediately into the circulating bloodstream. Epinephrine and norepinephrine quickly promote the delivery of energy to the brain and muscles by increasing heart rate, and constricting blood vessels to raise blood pressure and increase the circulation and volume of oxygen and blood throughout the body (Clow 2001). It has been suggested that epinephrine secretion is more responsive to emotional and mental stress triggers, while norepinephrine release is more closely linked to physical threats and changes (Goldstein 2003). The SAM stress response terminates when the stressor is removed or is no longer perceived to be a threat.

The HPA axis and SAM components of the stress response also have feed-forward and interacting effects with each other (Mello, et al. 2003). In addition to the suppressive effects of glucocorticoids on HPA axis activity, Sapolsky and colleagues (2000) have described stimulating and permissive effects of GCs, in which they act to prime or enhance additional hormonal responses to stress. For instance, GCs are permissive of cardiovascular responses to stress via numerous pathways: CRH stimulates an increased rate of LC neuronal firing, enhancing general SAM activity (Vanitallie 2002); GCs produced in the adrenal cortex stimulate the rate-limiting enzyme PNMT (phenylethanolamine-N-methyltransferase) in the adrenal medulla to synthesize epinephrine from norepinephrine (Miller and O'Callaghan 2002; Sapolsky, et al. 2000; Wurtman 2002), thus increasing circulating levels of epinephrine; GCs also enhance the actions of the catecholamines by inhibiting their negative feedback and prolonging their cardiovascular actions (Sapolsky, et al. 2000).

GCs and catecholamines also each play a role in priming, or preparing, the stress response system for future threats. Activation of the central neuronal components of the stress system is influenced by cognitive assessment of the presence and level of threat that a stressor poses (Vanitallie 2002). The amygdala and hippocampus are both brain regions with strong links to contextual and fear-related memory formation as well as emotional responsivity (McEwen 2000). Both of these regions have high concentrations of GC and CRH receptors, and it is thought that they play an important role in the cognitive and emotional components of the stress response (Miller and O'Callaghan 2002; Schulkin 2003; Vanitallie 2002). Acute stress is known to enhance memory formation, and both catecholamines, through increased delivery of glucose to the brain, and GCs, through general increased hippocampal activity, play a role in this (Sapolsky, et al. 2000). Since the amygdala and hippocampus are involved in initiating both of

the central components of the stress system (Chrousos 1998), the emotional and fear-related memory processes of these brain regions are thus closely linked to the production and the effects of the peripheral stress response effectors (Rosen and Schulkin 2004). Through the memory based anticipation of threats, the stress response systems thus have feed-forward effects, as emotional fear produces the physiological effects that enhance the memory of those initiating cognitive processes (Power 2004).

The Long-term Response to Stress

The short term allostatic response to stress - interactive GC and catecholamine-mediated mobilization of energy reserves and emotional memory enhancement - constitutes a beneficial, adaptive response. However, long term activation of the stress response system can lead to dysregulated and pathological states, and is associated with chronic disease. The cumulative wear and tear on multiple organ systems that results from long-term activation of the body's stress response has been called allostatic load (McEwen and Stellar 1993). Allostatic load can result from four different scenarios: First, frequent activation of the stress system by different stressors can lead to repeated elevations of allostatic mediators; Second, habituation to a single repeated stressor can fail, leading again to frequently elevated hormonal responses; Third, the stress response feedback process can fail, leading to prolonged activation of the stress system following a threat; and Fourth, the stress response can become inadequate, reflecting a general dysregulation with potential consequences for other systems (McEwen 1998). Since the process of allostasis involves multiple systems in the body, chronic activation of the allostatic mediators can have wide-ranging pathological effects on cardiovascular, reproductive, growth, metabolic, and immune functions (Chrousos 1998; Vanitallie 2002).

Dysregulation of HPA axis is a primary mechanism through which chronic stress can result in pathology. In addition to the acute response to stress, the HPA axis releases cortisol into the bloodstream throughout the day to facilitate normal physiological functioning. The hypothalamus triggers the HPA axis cascade in an ultradian rhythm of approximately one pulse per hour (De Kloet and Derijk 2004). This pulsatile release of the cortisol hormone also follows a typical circadian rhythm, with a sharp spike in cortisol release ~30 minutes after waking in the morning, followed by rapid decrease, and then gradual decline in circulating levels of the hormone over the course of the day, with the nadir occurring in the evening. Chronic stress activation of the HPA axis can disrupt this circadian cycle, causing a blunted waking rise in cortisol and higher basal levels throughout the day (Boulos and Rosenwasser 2004). Chronic stress can also cause a dysreguation in the negative feedback response of the HPA axis, resulting in an inability to shut off the stress response when activated and chronically elevated circulating cortisol.

These dysregulations of the HPA axis can have profound physiological consequences. Through the combined effects of promoting fatty food-seeking behavior and liberating glucose, chronically elevated HPA activity can lead to metabolic imbalances and increased central fat deposition (McEwen and Wingfield 2003; Miller and O'Callaghan 2002). Increased circulating fats and glucose also promote deposition in arterial walls creating the development of atherosclerotic plaques (McEwen 2003; McEwen and Wingfield 2003). Elevated epinephrine and norepinephrine levels also contribute to these processes through the chronic elevation of blood pressure (McEwen and Wingfield 2003). Hypertension promotes the formation of atherosclerotic plaques (McEwen 2003; McEwen 2004), and, with chronically elevated pressure on arterial walls, can lead to structural vascular changes and stiffening (Plante 2002).

Hypertension alone is a major risk factor for cardiovascular disease, and was the sole cause of 6% of cardiovascular-related deaths in 2003.

Biological mechanisms thus exist to suggest a role for chronic activation of the stress response in multi-system pathologies, including cardiovascular diseases and the metabolic syndrome (Rosmond 2005; Vanitallie 2002). Recent epidemiological evidence provides further evidence that, in addition to being biologically plausible, real associations exist between stress activation and chronic disease states. Wallerius and colleagues (2003) have found dysregulated morning cortisol levels to be positively associated with multiple indicators of the metabolic syndrome in men, including abdominal obesity, body mass index, glucose levels, insulin, and triglycerides. Additionally, Rosmond and Bjorntorp (2000) found that abnormal circadian cortisol rhythms were strongly associated with major risk factors for cardiovascular disease, type II diabetes, and stroke in adult men, including systolic and diastolic blood pressure, heart rate, body mass index, waist-hip circumference ratio, abdominal diameter, fasting insulin and glucose, triglycerides, and cholesterol. These findings suggest a powerful role for the physiological consequences of chronic stress in the development of chronic disease.

Chronic stress and psychological states

In addition to physical health consequences, chronically elevated stress can also have an impact on cognitive and emotional factors, through the direct effects of allostatic mediators on emotion centers in the brain. While the response to acute stress stimulates adaptive memory enhancement and emotional reactivity in the hippocampus and amygdala, chronic activation of the stress system is associated with pathological psychological states. Chronically elevated cortisol has been found to be associated with loss of hippocamal mass and neurons (Sapolsky

1996), and memory suppression (McEwen and Wingfield 2003). When persistently activated, glucocorticoid and catecholamine-induced emotional and fear responses can become pathologically overexpressed (Schulkin 2003), leading to chronic anxiety states. Dysregulated negative feedback of the HPA axis, resulting from chronic stress, has been found to be associated with clinical depression (Mello, et al. 2003; Miller and O'Callaghan 2002; Schulkin 2003). And post-traumatic stress disorder (PTSD) has been found to have strong associations with both abnormal cortisol profiles and increased catecholamines (Hellhammer, et al. 2004; Vanitallie 2002).

While clear associations have been documented between stress and clinical psychological disorders, the relationships between stress response mediators and general psychological or personality factors have been more mixed. For instance, some studies have found no association between cortisol profiles and depressive symptoms (Kirschbaum, et al. 1995; Marshall, et al. 1998; Semple, et al. 1988; Vedhara, et al. 2003) while others have (Melamed, et al. 1999; Schulz, et al. 1998). One factor influencing these disparate results is the type of cortisol measurement used in epidemiological studies, since different aspects of the diurnal rhythm may be related to different psychological parameters. For instance, Vedhara and colleagues (2003) found that perceived stress and anxiety symptoms were related to the rate of change in the diurnal cortisol curves, but not to total cortisol levels. Similarly, Polk and colleagues (2005) found that both trait negative and positive affect are associated with morning cortisol responses and patterns of diurnal variation, but state positive affect was related to total cortisol levels.

Psychosocial Stress and Health

As described above, laboratory evidence has demonstrated that psychological/emotional stressors elicit predictable physiological responses involving the HPA axis and SAM system. Activation of those responses has short-term biological consequences throughout the body, involving organ systems and process linked to multiple chronic health disorders as well as cognitive function. Epidemiological evidence has further suggested that chronic activation of stress response systems is associated with risk factors for cardiovascular diseases and the metabolic syndrome, as well as clinical psychological disorders and, to an extent, general psychological symptoms. With biological plausibility established through the stress response system, epidemiological studies have also examined whether chronic health outcomes are associated with differences in the exposure to or experience of stressors at the population level, and whether those differences map onto health disparities.

Epidemiological literature examining the relationship between psychosocial stress and health has generally focused on three primary domains of stressors: negative emotional states, social relationship factors, and chronic life stressors (Everson-Rose and Lewis 2005; Pickering 1999; Rozanski, et al. 2005; Strike and Steptoe 2004). Negative emotional states that have been investigated in relation to health include depression and anxiety disorders, hostility, anger, type-A personality, and John Henryism, or high effort coping. Social relationship factors include social support, social ties, and social conflict. And chronic psychosocial stressors include work related stress, marital stress, caregiver strain, socioeconomic status, and negative life events.

Negative emotional states

Numerous studies have documented associations between clinical depression or depressive moods and health. In a meta-analysis of prospective cohort studies, Rugulies (2002) found that 7 of 11 studies showed an association between depression and increased risk for the

development of coronary heart disease. Clinical depression was most consistently predictive of CHD development in this meta-analysis, while associations between depressive symptoms and CHD were more variable. Additional reviews have confirmed this observation that clinical depressive disorders are more consistent predictors of health than depressive symptoms (Everson-Rose and Lewis 2005; Stansfield and Fuhrer 2001). However, other studies have found that, in addition to the health impacts of clinical depression, the relative strength of depressive symptoms are related in gradient fashion to the likelihood of adverse cardiac events, both among healthy patients and those with coronary artery disease (Rozanski, et al. 2005). The CARDIA Study also found that high depressive symptoms predicted multiple cardiovascular risk factors, including the development of hypertension over a five year period, smoking, body mass index, and physical activity (Davidson, et al. 2000; Knox, et al. 2006).

The type-A behavior pattern, characterized by hostility, time-urgency, and competitiveness, was first linked to coronary heart disease in 1975 (Rosenman, et al. 1975). Since that time Type-A, and its associated personality factors, have been inconsistently linked to disease (Rozanski, et al. 2005; Strike and Steptoe 2004). A meta-analysis in 1996 found hostility and anger personality traits to be fairly consistent risk factors for coronary heart disease morbidity and mortality (Miller, et al. 1996), and many subsequent studies, including the Multiple Risk Factor Intervention Trial (Matthews, et al. 2004), the Normative Aging Study (Niaura, et al. 2002), the Atherosclerotic Risk in Communities Study (Williams, et al. 2001), and the CARDIA Study (Yan, et al. 2003), have confirmed those findings. However, some studies have found no evidence for a relationship between hostility or anger and health (Strike and Steptoe 2004; Sykes, et al. 2002). Similarly, John Henryism, a personality trait characterized by high effort coping and striving and thought to be more common among African Americans, has

been found to have very inconsistent associations with cardiovascular health (James and Thomas 2000).

Social Relationships

Numerous epidemiological studies have provided evidence that having lower numbers of social contacts, or social ties, as well as having smaller social networks, are associated with higher cardiovascular morbidity and mortality (Brummett, et al. 2001; House, et al. 1988; Kaplan, et al. 1988; Orth-Gomer, et al. 1998). In addition to these quantitative components of social relationships, qualitative aspects, namely social support, or the feeling that support is available when dealing with problems, have also been found to be associated with cardiovascular outcomes (Strike and Steptoe 2004). Rozanski and colleagues' (1999) review of this literature found that most studies showed significantly increased risk of coronary artery disease with lower perceived social support.

Chronic Stressors

Sources of stressful experience (stressors) have been measured in epidemiological literature in a variety of ways. Life events checklists, first introduced by Holmes and Rahe in 1967, measure individual burdens of stressful events or life changes over a period of time. These checklists, of which there are many versions covering acute and chronic stressors and spanning multiple time ranges and subpopulations, have been used extensively to document associations between stress exposures and psychological symptoms or disorders (Dohrenwend 2006). A higher burden of negative life events have also been found to be associated with cardiovascular risk factors, such as higher cholesterol (Melamed, et al. 1997; Niaura, et al. 1992; Twisk, et al. 1999) and blood pressure (Theorell and Emlund 1993), as well as with acute myocardial infarction (Magni, et al. 1983; Rafanelli, et al. 2005).

Much research into the effects of life events on health has focused on specific categories of life stressors. For instance, occupational stressors such as job strain and effort-reward imbalance have been found to be associated with multiple cardiovascular outcomes, although the findings are not entirely consistent (Everson-Rose and Lewis 2005; Rozanski, et al. 2005; Strike and Steptoe 2004). Domestic stressors, especially marital stress or caregiver strain, have also been shown to be associated with cardiovascular outcomes in multiple studies (Everson-Rose and Lewis 2005; Rozanski, et al. 2005; Strike and Steptoe 2004).

The relationship between socioeconomic status (SES) and health has received an enormous amount of research attention. In contrast to the historical relationship between absolute poverty and health, socioeconomic status, typically measured as a composite of income, education, and occupational status variables, shows a graded relationship with health across the entire range (Adler, et al. 1994; Marmot 2001b). Thus, even those in the middle of the economic ladder are worse off in terms of health than those at the top of the hierarchy. This socioeconomic gradient in health has been observed consistently for multiple indicators, including all-cause mortality (Adler and Ostrove 1999; Siegrist and Marmot 2004), hypertension (Adler and Newman 2002), metabolic syndrome, diabetes, arthritis, gastrointestinal diseases, and some cancers (Adler and Ostrove 1999; Kaplan and Keil 1993; Matthews, et al. 1989).

While SES is associated with lifestyle and health behavior risk factors, such as smoking, cholesterol, BMI, and physical inactivity, only about 25% of the SES gradient in cardiovascular disease is explained by these conventional risk factors (Marmot 2001a; Pickering 1999). Additionally, health care access and quality, which also differs according to SES, does not explain the health gradient (Marmot 2001a). Wilkinson (1992) has noted that the level of income inequality in a community or nation is associated with health, and that relative economic position

within unequal hierarchies is more important for disease than absolute economic status. Adler and colleagues (2000) have shown that subjective interpretations of socioeconomic status may be as important for health as actual economic indices, supporting Wilkinson's interpretation that SES has more psychosocial, than material, effects on health. Lynch and colleagues (2000) have suggested, alternatively, that income inequality is related to more social-structural factors and unequally distributed negative health exposures. All of these recent interpretations suggest that the SES gradient in health is indexing elements of inequality in social status, whether psychosocial or social-structural, that extend beyond absolute levels of economic wealth – an interpretation which is consistent with animal models of social status and health that suggest relative position in particularly hierarchical social status systems is most predictive of stress response activity and health (Goymann and Wingfield 2004; Sapolsky 2004).

A final measure of chronic life stress, which incorporates elements of personality and psychological disposition, is perceived stress. Higher levels of perceived stress have been found to be associated with the development of coronary heart disease over a three year period among older women (Strodl, et al. 2003), as well as higher mortality from stroke and CHD among men and women in Japan (Iso, et al. 2002). Perceived stress was also measured in the INTERHEART Study (Rosengren, et al. 2004), an international case-control study of cardiovascular disease involving over 24,000 people from 52 countries. Perceived stress at work and home, as well as financial stress and self-reported life events over the past year were all found to be significantly associated with occurrence of acute MI. When combined with a scale of depressive symptoms to create a composite psychosocial stress index, these factors were found to confer as high or higher odds of MI than conventional risk factors, such as hypertension, BMI, and diet (Yusuf, et al. 2004).

Race, Psychosocial Stress, and Health: Epidemiological Evidence

As reviewed above, epidemiological literature suggests that, in addition to the relationship between biological stress responses and long-term health, multiple aspects of psychosocial stress are associated with chronic health outcomes. Social constructivist views of race hold that African Americans are exposed to a higher burden of psychosocial stressors due to entrenched social disadvantage and institutionalized discrimination. Health disparities research has thus investigated the impact of psychosocial stress on African American health, and its potential role in explaining racial health differences. However, as LaVeist (2005) has pointed out, many studies with measures of psychosocial factors do not have large enough numbers of minority participants to make racial comparisons, and those studies that do have large minority group samples have, until recently, failed to collect psychosocial data. Thus, with the exception of socioeconomic factors, less is known about the relationship between psychosocial stress and health among African Americans.

There is limited evidence that personality factors may play a role in differential disease rates between races. Early data from the CARDIA Study (Davidson, et al. 2000) suggested that depressive symptoms may confer greater risk for CVD development among African Americans than whites. Similarly, in the National Health Examination Follow-Up Study (NHEFS) anxiety and depression were associated with a greater risk of hypertension and stroke for African Americans than for whites (Jonas and Lando 2000; Jonas and Mussolino 2000). However, data from more recent waves of the CARDIA study have not found race differences in emotional or personality effects on health (Yan, et al. 2003). Studies examining the relationship between hostility and health for African Americans have also been inconsistent and somewhat

contradictory, and suggest that any effect of hostility on health likely involves complex interactions with social support and other factors (Brownley, et al. 1996; James and Thomas 2000).

Few studies have examined the role of life stressors in African American health. In the Study of Women's Health Across the Nation (SWAN), a composite stress score, including stressful life events, was found to be associated with cardiovascular risk for African American, but not white, women (Troxel, et al. 2003). Some evidence suggests that occupational stressors, in combination with personality-related coping strategies, are related to greater CVD risk for African Americans (Light, et al. 1995). Lower perceived stress has been found to be associated with lower self-reported general health among African American women (Young, et al. 2004). And McDade and colleagues (2006) recently found perceived stress to be associated with higher levels of c-reactive protein, an inflammatory marker of CVD risk, among a biracial sample of older adults. In that study, racial differences in CRP levels were eliminated when perceived stress and behavioral factors were controlled (McDade, et al. 2006).

Overwhelmingly, the greatest research attention to psychosocial stress factors in African American health has been given to socioeconomic status. This is because economic factors, such as income, occupational status, and educational attainment, are known to exhibit pronounced differences between African Americans and whites. Early health disparities literature anticipated that SES differences between races would largely account for racial health inequalities, and race and SES have often been used as interchangeable, proxy measures for each other (Pappas 1994; Williams and Collins 1995). However, studies have repeatedly shown that, while SES often seems to be important for health across racial groups, it is not the sole source of health disparities. Multiple studies have demonstrated that lower socioeconomic status is associated

with poorer health and increased CVD risk for both blacks and whites (Kawachi, et al. 2005; Williams and Jackson 2005; Williams and Collins 1995). However, studies also show that within every socioeconomic tier, blacks have worse health than whites (Kawachi, et al. 2005; Williams and Jackson 2005), and that controlling for SES in statistical models does not eliminate significant racial differences in health (Cooper 1993; Krieger and Fee 1994; Otten, et al. 1990; Pappas, et al. 1993; Rogers 1992). Some studies have even found that higher SES is only associated with better health for whites, and has no effect on the health of African Americans (Farmer and Ferraro 2005; Muntaner, et al. 2004). Thus, there is strong evidence that socioeconomic status, at best, only explains a portion of the racial difference in disease burden.

In response to this lack of an SES explanation of racial health inequality, many researchers have begun examining another source of psychosocial stress known to be more prevalent among African Americans – racism. Racism and discrimination towards blacks exist on both institutional and interpersonal levels, and include unequal housing and occupational opportunities, as well as explicitly unfair or derogatory treatment in everyday workplace and public domains (Williams 1999). Studies examining the relationship between health and self-reported experiences of racism, either in general or with reference to specific professional or public spheres, have yielded inconsistent results (Harrell, et al. 2003; Williams and Neighbors 2001). Reviews of this literature show that, while many studies have found significant associations between experiences of racism and both mental and physical health outcomes, a substantial number of studies have found no associations (Brondolo, et al. 2003; Williams, et al. 2003; Wyatt, et al. 2003). Large studies that have examined this issue include the CARDIA Study, in which the association between racism and blood pressure was found to involve complex interactions with gender and coping style (Krieger and Sidney 1996), the SWAN Study,

in which unfair treatment was associated with specific aspects of cardiovascular risk (Guyll, et al. 2001; Troxel, et al. 2003), and the Black Women's Health Study, in which no associations were found between racism and incident hypertension (Cozier, et al. 2006).

Race, Psychosocial Stress, and Health: Methodological Problems and Research Gaps

The above literature review highlights the complex nature of the relationships among race, psychosocial stress, and health. There is fairly strong evidence that activation of the body's stress response system has consequences for chronic disease, and African Americans are known to experience higher levels of certain psychosocial stressors – namely low SES and racism. However, thus far racial health inequalities have not been explained by these chronic psychosocial stress factors in epidemiological studies. Essentialist racial theories attribute the inability of social-environmental factors to account for health disparities to innate, genetic differences in disease susceptibility between African Americans and whites. However, this view assumes that current models of social-environmental health inequalities are complete. In fact, there are three major areas of stress research which have not been fully developed with respect to African American health, and which may clarify the psychosocial origins of health inequalities. These research areas are: 1) comprehensive modeling of the stress process, 2) accurate and meaningful measurement of "stress" and the cultural and social environment, and 3) developmental components of the relationships between stress and health.

Measuring Stress as Process

Epidemiological literature investigating the effects of psychosocial stress on health, and the role of stress in racial health disparities, has been hindered by methodological inadequacy and inconsistency in the measurement of "stress". This is due in part to the multidimensional

nature of the stress concept: "stress" encompasses the biological response of the body to an acute threat or chronic strain, the cognitive or emotional experience of an acute or chronic stimulus as stressful, as well as the source of stress, or stressor, that elicits those psychological and biological responses. The conceptual model underlying research on stress and health involves all of these components of stress. People are exposed to different levels of social-environmental stressors in their everyday lives, and higher levels of stress burden can chronically activate biological systems linked to disease. However, individuals exposed to the same social stressor may exhibit completely different biological responses, depending on personality, appraisal and coping factors. Individual personality factors, such as depression, anxiety, and hostility, thus act as "filters" (Sapolsky 2004; Williams 2005) of the experience of social stress, and influence whether stress burden will lead to disease burden.

Rarely, however, do epidemiological studies of stress and health disparities incorporate all of the components of stress simultaneously. As evident from the above reviews, much research focuses on individual components in isolation: chronic stressor (e.g. SES) → health outcome; biological response → health outcome; personality or social relationship factor → biological response or health outcome; chronic stressor → personality factor. This is due in part to different interpretations of how stress should be studied; alternate schools of thought, primarily in the field of psychology, have placed emphasis differentially on the specificity of stress exposure measurement or on the individual emotional experience of stress. Early in stress research, emphasis was placed on assessing sources of stress (stressors) as objectively as possible, leading to the development of life events checklists. These instruments have been heavily criticized, however, for their internal validity problems: many items on life events checklists are confounded with the psychological or physical health problems that they aim to

objectively predict (Dohrenwend 2006), and positive responses to event checklist items may be derived from widely varying underlying experiences. As a result, considerable effort has been directed in life events research at modifying, specifying, and elaborating measurement tools.

In contrast to the life events approach, which has focused on the specificity of stressor measurement, other approaches have focused more on emotional and cognitive experiences. This focus stems largely from Schachter's cognitive theory of emotion (Cassidy 1999), which placed emphasis on the cognitive appraisal processes that mediate between physiological responses and emotions. The cognitive approach was further advanced by Lazarus and Folkman's (1987) transactional theory, which views stress as a relationship between an individual and their social environment that is experienced through cognitive appraisal processes (Jones and Kinman 2001). This transactional theory of stress has become the dominant approach in psychological stress research (Jones and Kinman 2001). With an emphasis on the cognitive filters of stress exposure, however, this approach tends to diminish the significance of differential burdens of social-environmental stressors – the very factors that are seen to define the social experience of race in the United States and to constitute the basis for health inequalities. Thus, psychosocial stress and health disparities research should incorporate a more comprehensive model of the stress process, which tests whether psychological factors mediate relationships between stress exposures and biological outcomes (see Fig. 3.2). This will allow for better elucidation of the mechanisms linking social environments and health.

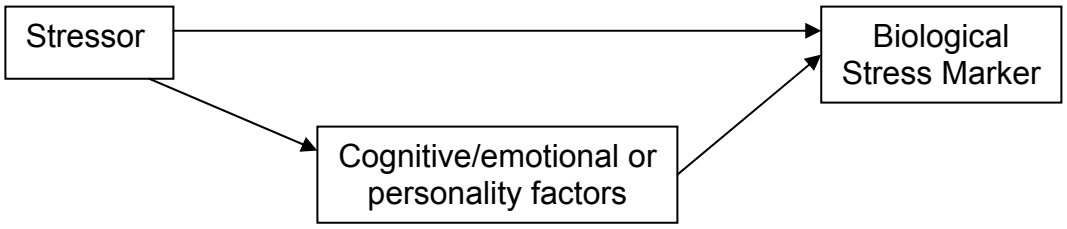


Figure 3.2 Psychosocial Stress Process

Where is the Culture in stress research?

In addition to lacking comprehensive models of the stress process, research on stress and health has almost universally ignored the issue of culture when measuring the social environment. Many anthropologists have pointed out the essential role of culture in shaping the experience of stress, and the need to incorporate culture into stress research (Dressler 1988; Gravlee and Dressler 2005; Helman 2001; McDade 2001; Pollock 1988; Young 1980). Culture provides the context in which social stressors are produced, and imbues events and exposures with the critical element of meaning that shapes the stress experience (Kugelmann 1992; Pollock 1988; Young 1980). Both life events and cognitive approaches to stress treat the experience and appraisal of stress as if it exists in a social vacuum, ignoring the fact that a given event or circumstance does not have an abstract or independent identity as a 'stressor' (Helman 2001). Rather, that identity is conferred within a social and cultural context; a context which constructs sources of stress through institutional structures and social interactions, and influences the meaning that stressful experiences have for individuals (Pollock 1988; Young 1980).

Anthropological research on stress has highlighted the critical contextualizing role that culture plays in the stress process. Studies of migration and modernization, for instance, have

illustrated the marked and complex stresses associated with culture change (Brown and James 2000; Brown, et al. 2003; Brown, et al. 2006; Brown, et al. 1998; Brown, et al. 2001; James, et al. 1987; James and Brown 1997). Disruptions in cultural practices and value systems as well as alterations in social networks and relationships resulting from migration and modernization have been found to constitute significant sources of stress and predictors of biological stress markers (Goodman, et al. 1988; James and Brown 1997; McDade 2002). Anthropologists have also pushed the study of social status beyond conventional economic indicators, by drawing on multifactorial Weberian models of status that include culturally-influenced behavior, consumption, and lifestyle components (Dressler 1988; Dressler 1996b; Dressler and Bindon 1997). Dressler and colleagues (1998b; Dressler and Bindon 2000) have found that conforming to cultural ideals of status through behavior and material consumption is significantly associated with better health among African American adults. Additionally, McDade (2001; McDade 2002) and Dressler (Dressler 1988; Dressler 1990b; Dressler 1991a; Dressler 1991b) have demonstrated that inconsistencies between different elements of an individual's status are associated with biological markers of stress and health risk.

The anthropology of stress thus offers key insights into the relationship between stress and health and is relevant to contemporary health disparities research. Anthropological studies of social status indicate that conventional SES measures of income, occupation, and education are insufficient, and highlight the essential role of culture in infusing individual attributes with the social meaning that will allow them to convey status. These observations shed light on the current state of SES and health literature, which has found that relative social positioning and cultural- and institutional-level investments in social welfare, rather than simple absolute levels of economic wealth, appear to be the real factors underlying the SES gradient in health (Adler, et

al. 2000; Lynch, et al. 2000; Wilkinson 1999). Moving beyond an approach to stress research that Young (1980) argues 'naturalizes' and 'somaticizes' stress by locating it only in individuals and ignoring its socio-cultural production and context, is necessary to understand how social environments result in differential health burdens. Prominent researchers have suggested that anthropological approaches highlighting social and cultural processes are needed in psychosocial stress research (Kaplan and Lynch 1997; McEwen 2001), and that attention to the role of culture in stress will help yield an "epidemiology of everyday life" (Kaplan and Lynch 1997) that is critical to understanding health disparities.

What about developmental components?

A third and final area in need of additional attention in stress and health disparities research is that of the developmental process. Almost all racial health inequalities research is conducted as cross-sectional examinations of adult samples. However, evidence from multiple sources suggests that both early life and cumulative exposures and experiences are important in determining how stress may affect health.

Some of this evidence comes from studies examining lifecourse socioeconomic exposures as determinants of adult chronic disease. In their review of lifecourse research, Pollitt and colleagues (2005) identified four primary conceptual models that have been employed in epidemiological studies. The latent effects model, which posits that low SES in early life directly influences later adult health, has generally found support in studies of adult CVD morbidity and mortality (Frankel, et al. 1999; Gliksman, et al. 1995; Kaplan and Salonen 1990; Smith, et al. 1998; Vagero and Leon 1994). Effects of early life exposures on adult health are often absent if analyses are adjusted for adult SES and health risk factors, however, this may be the result of

over-adjustment for the pathways through which these effects operate (Pollitt, et al. 2005). Related to this issue, the pathway model, which suggests that early life SES opportunities shape later life economic and lifestyle health risk factors, has found considerable support in epidemiologic studies (Brunner, et al. 1999; Lynch, et al. 1997a; Poulton, et al. 2002; Smith, et al. 1998; van de Mheen, et al. 1998). Studies employing the social mobility model, which views changes in socioeconomic status from childhood to adulthood as predictive of adult health, have yielded inconsistent results (Hart, et al. 1998; Kaplan, et al. 1971; Poulton, et al. 2002; Wadsworth, et al. 1985). It has been suggested that relatively low rates of social mobility and SES change over the lifecourse may partly explain this. Fewer studies have examined the cumulative effects model, which assumes that health risks and adverse circumstances accumulate over the lifespan to influence health. However, almost all of those studies have found considerable support for the hypothesis that cumulative low SES exposure is associated with CVD morbidity and mortality (Case, et al. 2002; Karlamangla, et al. 2005; Lynch, et al. 1997b; Pensola and Martikainen 2003; Smith, et al. 1997). While all of these conceptual models of lifecourse SES suggest that exposure to low economic status in earlier life can have profound effects on adult cardiovascular health, African Americans and other minorities have been almost entirely excluded from this research. Therefore, the role of early life SES in racial disparities in CVD is unknown.

Other evidence for developmental components of adult disease comes from physiological and psychological studies that suggest pathways through which early life environments can influence later life health. Prenatal environments, in particular, are thought to program physiological development in ways that lead to disease in adulthood. Barker's fetal origins hypothesis was the first to suggest prenatal origins of adult disease, and has been supported by

multiple observations that altered fetal growth and low birth weight are associated with obesity and CVD risk in later life (Barker 1990; Barker and Fall 1993; Curhan, et al. 1996; Edwards, et al. 1993; Moore, et al. 1996; Rich-Edwards, et al. 1997; Seckl 1998). Additional evidence now suggests that maternal stress can play a significant role in this process. High glucocorticoid levels during pregnancy can lead to lower birth weight babies (Seckl and Meaney 2004), and is associated with elevated blood pressure at birth (Kari, et al. 1994) and in adulthood (Seckl and Meaney 2004). These effects are likely due to the role of glucocorticoids in the development of brain structures and the central nervous system. In animal models, high glucocorticoid levels in pregnancy reduce the number of hippocampal glucocorticoid and muneralocorticoid receptors in the developing fetus's brain, permanently raising GC levels in later life by limiting negative feedback responsivity of the HPA-axis (Levitt, et al. 1996; Welberg, et al. 2001).

Other evidence suggests that stress exposure in infancy and early childhood can have similar effects on HPA-axis development and adult disease risk. Exposure to abuse, distant parental relationships, or neglect in childhood, for instance, are associated with increased risk for physical and mental illness in adulthood (Charmandari, et al. 2003; Zhang, et al. 2004). Losing a parent during childhood is associated with the development of depression and other psychiatric and emotional problems later in life (Mello, et al. 2003). In rats, maternal deprivation or separation during infancy is associated with heightened stress reactivity, illness susceptibility, and fearful and anxious behaviors (Charmandari, et al. 2003; Zhang, et al. 2004). Handling of rats in infancy, in contrast, is associated with decreased stress reactivity and more sensitive negative feedback of the HPA axis (Zhang, et al. 2004). These effects provide strong evidence that infancy and early childhood are critical developmental windows during which exposure to stress can profoundly influence physiological functioning and health risk in later life.

In addition to the importance of prenatal and early childhood exposure to stress, adolescence is also a vulnerable developmental period during which stress can have long-term consequences for physiology and health (Rosmalen, et al. 2005). It is well established that exposure to stress during adolescence is associated with significantly increased risk of developing psychiatric disorders and mental pathologies, such as clinical depression and anxiety, in adulthood (Goodyer 2002; Grant, et al. 2003; Hayward and Sanborn 2002; Masten 2004; McCormick and Mathews 2007; McGue and Iacono 2005; Romeo and McEwen 2006; Turner and Lloyd 2004). While the mechanisms through which this occurs are not as well researched as those operating prenatally and in childhood (McCormick and Mathews 2007), adolescence is known to be a critical time for HPA-axis programming and structural brain development in regions that are involved in emotional processing and stress reactivity (McCormick and Mathews 2007; Romeo and McEwen 2006). Adolescence is thus a critical window during which the stress response system can be programmed for over-activation or dysregulation later in life, leading to increased risk for mental and physical health disorders in adulthood (Romeo and McEwen 2006). Additionally, because of the heightened plasticity of the developing stress system, adolescence can serve as a critical period for reversing or altering adverse developmental consequences of prenatal and early childhood stress (Romeo and McEwen 2006). For instance, in rats, environmental enrichment in adolescence has been found to reverse some of the cognitive, behavioral, and HPA-axis programming effects of prenatal stress exposure as well as maternal neglect and separation in infancy (Bredy, et al. 2003; Francis, et al. 2002; Laviola, et al. 2004; Morley-Fletcher, et al. 2003). Adolescence is thus a significant developmental period, and is critical for understanding how stress influences disease and health inequality.

Conclusion

The hypothesis that the higher disease burden of African Americans may be due to chronic psychosocial stress exposure rather than innate genetic difference has received support from multiple lines of evidence. Exposure to various sources of stress is known to elicit a complex physiological response that has far-reaching effects throughout the body. While this stress response is a beneficial adaptation in the short term allowing for efficient delivery of resources throughout the body, it may be linked to pathological processes if chronically or repeatedly activated. Epidemiological evidence suggests that chronically activated stress systems, indicated primarily by dysregulated HPA-axis functioning, is associated with psychological health disorders as well as cardiovascular disease. Additional epidemiological evidence suggests that both the psychosocial stressors thought to stimulate the stress response and the personality factors that may participate in the cognitive appraisal of stress are associated with multiple cardiovascular health outcomes. While this research provides strong evidence for the significance of psychosocial stress exposure in the etiology of chronic disease, it has, thus far, not been able to explain the prominent and persistent disparities in disease rates between African Americans and whites.

A better understanding of how psychosocial stress is related to health for African Americans may come from addressing three major areas of needed research. First, much epidemiological health disparities research investigates either the relationship between a psychosocial stress exposure and health or between a personality/cognitive appraisal factor and health, which yields a limited understanding of how the stress process functions. A more comprehensive evaluation should include a simultaneous investigation of all three aspects of stress – a stress exposure, the psychological experience of stress, and a biological/health outcome

– and should explore whether cognitive and emotional factors mediate the effect of a stressor on biology. Second, stress research in general, and especially health disparities research, has almost entirely neglected the issue of culture. Culture is a critical component of the stress experience, since it is both a site of production of psychosocial stressors and the context within which stress is given meaning. Incorporating culture into stress research is thus critical for understanding the role of psychosocial stress in health inequalities. Third, most health disparities research is focused at the adult level, but there is substantial evidence that early life environments play a key role in the relationship between stress and health. Studies suggest that adolescence is a critical developmental window during which stress exposure can have a profound effect on biology and later health.

In order to better understand health disparities, research is needed that addresses all of these issues in the study of stress. The developmental components of chronic disease must be addressed in health disparities research by exploring the relationship between stress and health risk for African Americans at key vulnerable time points. Additionally, the central role of culture in the stress experience must be incorporated into the study and measurement of stress. And the full stress process, including exposures, cognitive appraisal and mediation, and biology, must be investigated as comprehensively as possible.

Chapter 4

Qualitative and Quantitative Methods of Research

To understand the role that stress plays in the higher cardiovascular disease burden of African Americans, research must address the following three issues: 1) examine the complete stress process, including exposure to stressors, individual appraisals and perceptions of stress, and biological stress responses, and understand how all of these elements of stress fit together; 2) explore the developmental components of stress and health disparities, particularly the effect of stress on health risk during the critical developmental period of adolescence; and 3) incorporate the element of culture – the element that imbues stressful exposures (stressors) with meaning and allows them to be translated into individual psychological and physiological experiences – into the measurement of stress and the design of research studies examining the relationships between stress and health.

This doctoral research study addresses all three of these issues. The study addresses developmental components of health disparities by examining relationships between stress and health risk for high school-aged African American adolescents from a low income, predominantly black community in the Chicago area. The complete stress process is modeled in this study by employing: 1) measures of stress exposures, 2) individual personality and appraisal factors, and 3) biological stress responses. Additionally, this study uses an innovative anthropological technique to operationalize cultural dimensions of stress. The specific objectives and hypotheses (H) of the study are:

- Objective 1: To develop cultural models of stress and coping for African American youth.

- H1: Youth in this study will share cultural models of salient sources of stress, social support, and social status.

❖ Objective 2: To explore relationships between exposure to culturally salient stressors and biological indicators of stress and health risk.

- H2.1: Higher burden of salient sources of stress will be associated with higher blood pressures and abnormal cortisol profiles (described below).
- H2.2: Lower attainment of social status and low access to social support will be associated with higher blood pressures and abnormal cortisol profiles.

❖ Objective 3: To examine the roles of individual psychological parameters as mediators of biological responses to stress exposure.

- H3: Significant associations hypothesized in H2.1 and H2.2 will be at least partly explained by higher feelings of perceived stress, anxiety, and depression.

The Study Site: Maywood, Illinois

This study was conducted in Maywood, Illinois, a predominately African American, low income community on the west side of Chicago. Like the Chicago area in general, Maywood is a relevant location for the study of health disparities. Hypertension and cardiovascular disease rates in this community are relatively high compared to higher SES white communities, and are consistent with national prevalence rates for African Americans (local data available for early 1990s: (Kaufman, et al. 1997)). Maywood also has potentially high levels of community-based stressors, due in part to its complex and at times tense racial and socioeconomic history.

The community of Maywood, which sits 10 miles west of Chicago, was chartered in 1869 by a group of New England businessmen. Almost immediately the community became a

popular suburb, with rapid population growth following the 1871 Chicago fire and continuing through the early 20th century (Deuchler 2004). The Norton Can Works tin canning company, which established a plant in Maywood in 1885, became the American Can Company in 1901 and constituted the largest industry and employment source in the community throughout most of its history.

With the stable employment opportunities offered by American Can and other small industries, Maywood became a destination for African American resettlement during the post-WWI Northern Migration. As a result, during the first half of the 20th century, Maywood experienced rapid racial and ethnic diversification. Between 1900 and 1960, the African American population in Maywood rose from 0.4% to 19.1% (Guarino 2004). Despite this relatively early diversity, racial segregation was high in Maywood throughout much of its history. During the early 20th century African Americans could only own property in Maywood within a designated 'black neighborhood' between Ninth and Fourteenth Avenues (Deuchler 2004). Even as the population of Maywood rose, suburban real estate and development practices kept the community tightly segregated for decades.

With the total population remaining stable at ~27,000, the African American population of Maywood continued to rise after 1960, reaching 84% by 1990. Significant racial tension arose during the course of this massive demographic shift. Civil rights demonstrations occurred in Maywood throughout the 1960s. Black Panther leader Fred Hampton, originally from Maywood and a graduate of the local high school, helped to organize some of the civil rights activities in the community (Deuchler 2004). In the late 1960s the local high school became the site for a series of race riots that attracted national media attention. In addition to the immediate impact of this violence on the local community and high school students, two planned industrial relocation

projects in Maywood fell through after the highly publicized riots, signaling the start of a major economic downturn. In the early 1970s the American Can Company relocated and the Maywood plant was shut down. This was shortly followed by the closing of most of the major service and retail employers in the community (Guarino 2004).

Today, approximately 13% of the Maywood population, and 16.3% of youth under the age of 18 in the community, live below the poverty line (Illinois.com). The community has one of the highest crime rates in the Chicago area (Illinois.com), including one of the highest youth murder rates in the state during the last decade (Maywood police chief, indirect communication). In a community of just under 27,000, there were 20 murders in 2003 alone. In the past year, a highly publicized murder of a police officer took place in Maywood, two blocks away from the after-school center where much of the research for this study was conducted. High rates of violent crime in Maywood contribute to the broader public health problem of violence in Illinois, where young people are disproportionately victimized. In 2004, 22% of all gun-related deaths in Illinois were youth under the age of 18, compared to only 9.8% nationally (IVPA).

Given the economic strains in this community and the high rates of crime and violence, much of which directly effect youth, there are many potential stressors to which adolescents in Maywood can be exposed. Determining the most salient and meaningful stressors for youth in Maywood is critical for understanding how stress is related to health risk for adolescents in this community and requires an exploration of the cultural meanings youth attach to these source of stress.

The Analysis of Culture

Cultural Models

The importance of incorporating culture into stress research has been emphasized within the field of anthropology (Dressler 2006; Gravlee, et al. 2005; McDade 2002; Pollock 1988; Young 1980), as well as in other disciplines, such as public health (Kaplan and Lynch 1997; McEwen 2001). However, culture is an inherently difficult construct to measure. Ethnographic methods, which are typically used to explore cultural attributes, aim to capture lived experiences in detail, and to provide rich descriptions of social environments and everyday life. The range of interview and observational methods used to conduct ethnographic research are ideal for elucidating these nebulous, complex, and situational aspects of cultural phenomena. However, the qualitative textual and narrative forms of data that they produce are challenging to incorporate into epidemiologic models. If the cultural dimensions of stress are to be studied with respect to biological and health outcomes, they must be measured in a way that can be quantified.

The first step in operationalizing culture is to define what culture is and what the appropriate units of cultural analysis are. Definitions of culture and its analytical components have been wide-ranging in anthropology. Many definitions have polarized towards 1) a Geertzian approach, in which culture is thought to exist only in its public practice and social exchange, or 2) a cognitive approach, in which culture is thought to exist in individual mental constructions (Shore 1996). An alternative approach advocated by Shore, D'Andrade, and others, views culture as a system of models, or schemas. This approach combines elements of mental and practice-oriented views of culture, since cultural models can "exist both as public artifacts 'in the world' and as cognitive constructs 'in the mind' of members of a community" (Shore 1996). In particular, this approach defines culture by the relationship between these public and

individual components – as cognitive models that are shared by the members of a community or cultural group (D'Andrade 1995; D'Andrade 2001). In other words, while individuals have personal mental models that are part of their own, idiosyncratic way of seeing the world, they also have cognitive models that are shared with other members of their community. Conventions of telephone greetings or traffic laws, for instance, exist as individual cognitive models that are shared among the members of a cultural group. It is only those cognitive models that are shared among the members of a community that are truly cultural, and therefore represent and reflect public practice and social interaction.

The Consensus Approach

As Bradd Shore (2002) has noted, the idea of cultural models gives culture an "epidemiological character" as a system of individual cognitive schemas. While the nebulous, public practice aspects of culture, richly captured by ethnographic methods, cannot be quantified, its representations as individual mental models can. The cultural consensus/consonance approach is an innovative anthropological technique that draws on this cognitive definition of shared cultural models to operationalize cultural phenomena. The cultural consensus approach, developed by Romney, Weller, and Batchelder (1986), combines qualitative and quantitative methods to determine the shared, and therefore cultural, components of individual cognitive models. The consensus approach assumes that the mental models of each individual in a culture group differ from each other somewhat, and therefore cultural information is not shared by everyone equally. Correlations that exist among individual cognitive models are a reflection of their approximation to a shared cultural model. By examining the extent to which individual models of a given cultural domain correlate with each other, consensus analysis statistically

assesses whether these personal mental constructions are reflecting a shared cultural model, and ultimately what that model is.

The consensus approach typically involves two phases: an elicitation phase and a statistical phase in which consensus is formally tested. In the elicitation phase, individual mental models of some cultural domain are constructed. A cultural domain is a particular category of cultural information that is of research interest. For instance, some cultural domain research has examined local categories of illness and disease (Weller, et al. 1991). Structured interview techniques can be used to effectively elicit individual cognitive models of a domain. A free-listing task is generally considered to be the most useful of these structured interview techniques, and involves asking respondents to list all of the components of a cultural domain that they can think of (Weller and Romney 1988). With the example of 'illness', participants would be asked to describe that domain by listing all of the different illnesses they know. Once free-lists are compiled, cultural domains can be analyzed with simple tabulation or can be used to generate more structured quantitative measures.

In order to formally test cultural consensus, survey data that quantitatively measures the components of a given domain must be used. Free-list data from a sample of informants can be seen to represent the universe of possible components of a cultural domain, and can be quantitatively assessed by having respondents rank the pooled data or respond to true/false, multiple choice, or rating questions about each component (Weller and Romney 1988). Once this quantitative data is attained, cultural consensus can be formally assessed. Cultural consensus analysis draws on procedures used in psychometric test construction and reliability theory to statistically test whether individual cognitive models are intercorrelated enough to assume that they reflect a shared cultural model (Romney 1999). While psychometrics and reliability theory

are concerned with assessing intercorrelations among items across participant responses, consensus analysis tests intercorrelations among respondents across sets of response items. Therefore, in consensus analysis the survey response matrix is transposed, such that individual respondents are treated as variables. The formal test of consensus involves factor analyzing the intercorrelations among respondents to determine whether they represent an underlying latent construct – in this case, "culture."

Performing consensus analysis in this way will produce three important pieces of information: 1) a measure of cultural agreement in the form of an eigenvalue associated with the latent construct (culture), 2) the correlation of each individual informant with the latent culture construct in the form of factor loading scores ('cultural competence'), and 3) an 'answer key' for the cultural domain, which can be constructed by weighting each respondents' survey answers by their competence score and averaging the responses for each component of the domain (Romney 1999). In formal consensus analysis, the assumption that a single unified culture exists is tested. If this assumption is true, and all respondents are drawing on a single cultural model, then certain conditions must be met in the consensus analysis: 1) the first factor must account for more variation than any other factor, and the ratio of the eigenvalue of the first factor to that of the second must be at least 3 to 1, 2) all respondents must have higher loadings on (correlations with) the first factor than on any other factor, and 3) no respondent can have a negative loading on the first factor (Romney, et al. 1986). If these conditions are met, then respondents can be interpreted as drawing on a single shared cultural model, and the first latent construct, or factor, represents that model.

However, consensus analysis has been criticized for the potentially over-limiting assumption of a single unified culture. Handwerker (2002), and Caulkins and Hyatt (1999), for

instance, have argued that culture, particularly in contemporary global contexts, is fluid, contested, and multidimensional. They suggest that important cultural diversity around a domain can exist within a community or culture group, and that elements of cultural models may extend across groups. Additionally, individuals may draw on multiple cultural models in different contexts and social interactions. Handwerker has advocated for a more general application of factor analytic procedures to assess inter-respondent correlation, or the 'construct validity of cultures,' as he calls it (2002). Handwerker (2002), and Caulkins and Hyatt (1999), have shown that weak consensus, moderately high alternate factors, differentially distributed factor loadings, and negative factor loadings can all be useful data, and can signal cultural contestation, subcultural groups, and cultural 'turbulence'. Thus, rather than dismiss models that fail to meet the conditions of formal consensus analysis, these models can be interpreted in a more general fashion, and can reveal important information about the distribution and coherence of cultural information.

Both formal consensus analysis and the more informal approach advocated by Handwerker have been successfully employed to explore cultural beliefs around a number of different domains, including illness categories (Weller, et al. 1993), kinship terms (Romney, et al. 1996), knowledge and process in organizations and social movements (Caulkins and Hyatt 1999), everyday practices and identities (Caulkins 2001), parent – teacher partnerships (Handwerker 2002), material lifestyle (Dressler, et al. 1998b), social support sources (Dressler, et al. 1997), and skin color categories (Gravlee and Dressler 2005), among many others.

Cultural Consonance

The cultural consensus procedure allows cultural constructs to be quantitatively assessed, which opens up the possibility of incorporating measures of culture into statistical models. In particular, the cultural 'answer key' that is generated in consensus analysis allows for individual attributes to be assessed in relation to that cultural model. The cultural consonance approach developed by Dressler (1996a) measures individual behavioral approximation of the cultural models revealed by consensus analysis. For each item determined to be part of the shared cultural model for a community or group, individual behavior with respect to that item can be quantitatively measured. For instance, Dressler (1996a) used a consensus-based cultural model of material lifestyle success for African American adults to measure individual ownership of important material items, such as a home, car, and appliances. Dressler and Bindon (2000), and Dressler and colleagues (1998b) found that having higher consonance with the cultural model, in terms of material item ownership, was associated with lower blood pressure for African American adults. Thus cultural consonance is an innovative approach that allows cultural information to be assessed at the individual level and incorporated into statistical and epidemiological models – a critical tool for examining the cultural dimensions of stress, health, and differential disease burdens.

Methods of Data Collection and Analysis Used in the Present Study

This study consisted of three phases of data collection and analysis. For all phases of research, high-school aged adolescents from the Maywood, Illinois area were recruited. With one exception, participants attended one of two high schools of the Proviso Township School District in the Maywood area. The three phases of research consisted of: 1) An elicitation phase, in which individual models were described in ethnographic interviews, 2) A survey phase in which

cultural consensus was tested, and 3) A consonance phase, in which cultural consonance, biomarkers, and covariates were measured. Each phase of research, its sampling and recruitment strategy, and data collection and analysis procedures will be described in detail. A conceptual model for the overall study is presented below:

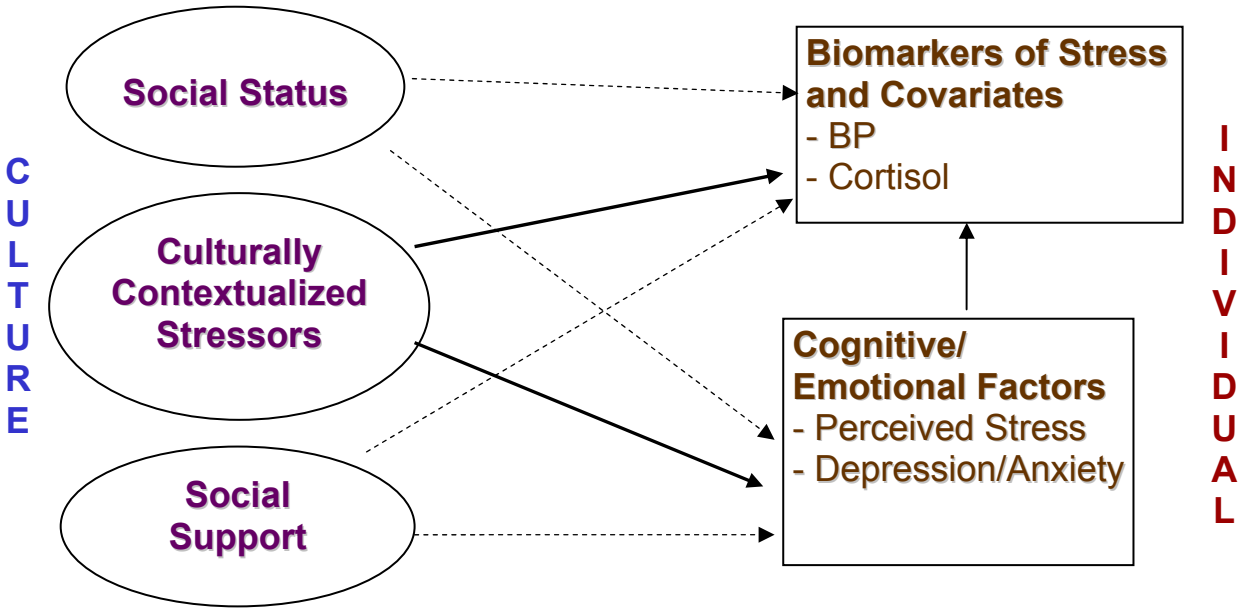


Figure 4.1. Conceptual Model for Study

Phase 1: Elicitation

Purpose, Sample, and Recruitment

In the first phase of research, ethnographic interviews were conducted with participants to elicit the universe of possible components that define three cultural domains: psychosocial stress, social status, and social support. Phase 1 participants were recruited from a local after-school arts program that offers courses in performing arts to school-aged youth from Maywood and the surrounding communities. This arts center is a well-known and well-respected

organization in the community of Maywood. Additionally, since it is staffed by community members and parents, and is centrally located in the downtown area, it offered a safe and convenient location in which students could participate in the study.

A non-random sampling strategy, consistent with previous cultural consensus research, was used in this study. As Handwerker and Wozniak (1997) have shown, the collection of cultural data, unlike individual level data, does not require randomly drawn samples. Rather, when a cultural domain is being defined, drawing samples purposively to maximize cultural knowledge among the participants is beneficial, and using convenience samples is acceptable (Handwerker and Wozniak 1997; Johnson 1990). Since permission to recruit participants directly from the two local high schools had not been granted by the start of the first phase of this project, the high school students that were recruited from the after school arts center represented a convenience sample. Since these students were engaged in extracurricular activities at this center and at their schools that encouraged extensive social interaction with their peer set, the students that were recruited for the study also represented a purposive sample of likely cultural experts.

Assuming that a fairly coherent model exists, twenty to thirty participants are recommended to elicit the definition of a cultural domain (Weller and Romney 1988). In this study, variation in demographic factors that could affect the distribution of cultural beliefs, such as social class, race/ethnicity, age, and community of residence, were very low. Therefore, the lower recommended sample size was selected, and twenty participants were recruited for the first phase of research. The recruitment procedure consisted primarily of information sessions that were held at the beginning of high-school level classes at the arts center. The purpose of the study was described to students, as well as the specific activities they would be involved in if they chose to participate. It was emphasized to students that their participation was entirely

voluntary and that all information provided during their participation would be kept confidential. Interested students were given consent materials to take home to read and to give to their parents. Follow-ups were conducted at the arts center three to four times a week, and interviews were scheduled with participants who returned both the signed adolescent and parent consent forms.

Data Collection

All interviews were conducted on-site at the arts center in an empty classroom. Because of participants' class schedules at the center, some interviews had to be conducted in segments. Therefore, individual interviews averaged 16 minutes, and ranged from 6 minutes to 35 minutes. Interviews were digitally recorded onto a laptop computer as mp3 files, using RealPlayer software and a Labtec external microphone. During the interview, participants were asked to think about the kids at their school and the high school-aged kids in their community, and to respond to three primary questions. First, to define the domain of social status, participants were asked to "describe the kids at your school that have high status; what are the things that make someone have high status, or be popular, at your school?" Second, to define the domain of stress, students were asked, "what are the biggest sources of stress for kids your age in the community or at your school?" Third, to define the domain of social support, participants were asked to list, by relationship category (friend, parent, teacher, etc), those people that high school aged kids in their community would most likely turn to in various situations. The specific situations about which participants were asked were derived from the Social Support Microsystem Scale (Seidman, et al. 1995), and included "when I have a personal problem," "when I need money and other things,", and "I have fun with this person."

For each of the three cultural domains, participants were asked to list as many things as they could think of. Standard interview probes, such as "you mentioned _____ was an

important source of stress for kids, can you think of anything else?", were used to facilitate the elicitation process (Weller and Romney 1988). Participants were probed until they could not think of any further responses to the interview questions. At the end of each interview, participants were compensated for their time with a $5 gift certificate to McDonald's restaurants. This form of compensation was chosen because McDonald's was the most widely accessible business for kids in the Maywood community, and because it was recommended by community members who were familiar with the youth population.

Data Analysis

Once finished, all interviews were fully transcribed. Individual free-lists for each interview question were extracted from the transcriptions. Theses lists constituted the personal models for each of the three cultural domains being studied. Individual lists were then pooled into large composite lists, consisting of every item listed by every participant for each cultural domain. The items in each composite list were then tabulated, and their frequency among participant responses was computed. All items occurring in at least 20% of participant responses and most items occurring in 10% of responses were selected for further investigation in phase 2 of the study. Additionally, some less frequently occurring items and single response items were selected to serve as control items in the second phase of research.

Phase 2: Consensus

Purpose, Sample, and Recruitment

In the second phase of research, the extent to which individual models of the three cultural domains were shared among members of the population was formally tested using a general application of cultural consensus analysis. As with the free-listing technique, purposively

drawn samples of likely cultural experts are ideal for this type of cultural analysis (Handwerker and Wozniak 1997). Snow-ball sampling strategies, in which individuals with relationships to a core group of key informants are recruited for study, are useful for obtaining culturally knowledgeable samples for consensus analysis (Bernard 2002). Therefore, for the second phase of this study, a snowball sample was recruited from the core group of key informants who participated in the first phase of research. Specifically, high school aged friends of first phase participants were invited to participate in the second phase of research. Students picked up consent materials and surveys at the arts center and returned them in person or via a friend who took classes at the center.

Assuming relatively high levels of cultural knowledge among informants, relatively small sample sizes (~20) are needed to establish cultural consensus (Weller and Romney 1988). Following prior cultural consensus research conducted in populations with relatively little demographic variation (Dressler and Bindon 2000), 48 participants were recruited for participation in the second phase of research. Eleven of these participants returned either incomplete consent forms or surveys, and were therefore eliminated from the analysis, yielding a total sample size of 37. Additionally, for the cultural domain of social status, the complex nature of the cultural information required that additional surveys be collected, and a further 12 participants were recruited.

Data Collection

In order to statistically test the shared nature of cultural information, quantitative data is needed. Therefore, participants were asked to complete a survey in which they rated the importance of a series of items as elements of the three cultural domains of interest: social status, stress, and social support (See Appendix A for survey instrument). The items on the survey

consisted of the final composite list of items elicited from the phase one interviews. For each domain, participants rated the relevant items as "1 – not important", "2 – somewhat important", or "3 – very important". After completing the survey, participants were compensated for their time with a $5 gift certificate to McDonald's restaurant.

Data Analysis

Survey data were entered into an Excel spreadsheet, and all data analysis was conducted using STATA Statistical Software (StataCorp 2003). Following the general procedures for testing cultural consensus (Romney, et al. 1986), or the construct validity of cultures (Handwerker 2002), survey data was factor analyzed with individual informants treated as variables. The iterated principal factor method was used in STATA, and analyses were performed on the transposed survey data matrix (Romney, et al. 1987). Factor analysis finds latent variables, or factors, that linearly summarize all of the original variables, in this case informants, entered into the analysis. The eigenvalues associated with each factor were then examined. As described in the above discussion of consensus analysis, the eigenvalue for the first factor produced must be considerably larger than the next highest factor for a shared cultural model to be interpreted. As will be discussed in detail later, this condition was met in the present analyses, and sufficient consensus was found to assume that respondents drew on shared cultural models of social support, status, and stress.

The factor loadings produced in factor analysis represent the correlation of each original variable with the latent factors. In this case, factor loadings were produced for each individual informant and represented their correlation with the shared cultural model. In other words, the factor loadings, or cultural competence scores (Romney, et al. 1986), can be seen as a measure of individual knowledge of, or agreement with, the broader culture. These factor loadings were used

to weight the original survey responses of each informant, such that the responses of those informants with higher 'knowledge' of the cultural model received a higher weighted score. The weighted responses of each informant to the original survey questions were then averaged for each item on the survey. This produced a final list of weighted average 'importance' scores for each item in each cultural domain, constituting a cultural 'answer key' for the sample. Following previous research (Dressler 1996a) all items with a weighted average score above 2 (at least "somewhat important" on average) were considered to be part of the shared cultural model for each domain. These items were further investigated in the third phase of research.

Phase 3: Cultural Consonance and Biomarkers

Purpose, Sample, and Recruitment

In the third phase of research, cultural consonance, or behavioral agreement with the cultural models, was measured, and provided an individual attribute that could be statistically evaluated with biological and psychological indicators of stress and health risk. High school students were recruited for this phase of research primarily from summer school classes at Proviso East High School and from four psychology classes at Proviso West High School. Additional students attending one of these two schools were recruited from the local after-school arts center and the Parks and Recreation summer camp program. In all cases, information sessions were held during classes or as scheduled meetings to explain the study to interested students and distribute consent materials. Only those students who returned both the signed adolescent and parent consent forms were eligible to participate. All phase three participants received $10 in McDonald's gift certificates as compensation for their time.

Previous research examining the relationship between cultural consonance and health has found effect sizes in multiple regression analyses to be around $f^2 = 0.186$ ($R^2 = 0.157$) (Dressler and Bindon 2000). In this study, approximately 6 predictors are expected to be included in most multiple regression models. Under this condition, 80 participants are required to find the anticipated magnitude of effect, with an alpha level (α) of 0.05 and desired statistical power (β) of 0.80 (Faul, et al. 2007). A total of 109 participants were recruited in this study for the third phase of research. This sample size provides more than sufficient statistical power to detect the anticipated effects, and allows for additional predictors and covariates to be considered in multiple regression models.

Data Collection

Cultural Consonance - Cultural consonance was measured via survey as individual behavioral agreement with the cultural models of social support, stress, and social status (See Appendix B for survey instrument). Specifically, to measure consonance in social status, participants were asked to report (yes/no) whether they participated in activities or claimed identities that were determined in phase two to constitute elements of the cultural model of social status for youth in this community. For material status items, participants were asked to report whether they owned items, and for clothing to report how many items they owned. To measure consonance in stress, or stress exposure, participants were asked to report (yes/no) whether they had experienced any of the items determined in phase two to constitute the cultural model of salient stressors for youth in this community. To measure consonance in social support, participants were given a list of people determined in phase two to be salient sources of social support for youth in this community, and asked to report who they turned to for support in different situations. The same

three situations used in phase one and derived from the Social Support Microsystem Scale were used to assess cultural consonance in social support in phase three.

Blood Pressure - Systolic and diastolic blood pressure were measured following the official recommendations of the American Heart Association (Pickering, et al. 2005) and the Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) (Chobanian, et al. 2003). Participants were seated comfortably in a chair and instructed to let their feet rest flat on the floor. Participants remained seated and resting for approximately 5 minutes, while they were asked a series of demographic and covariate questions (described below). All blood pressure readings were obtained from participants' right upper arm. Participants were instructed to rest their right elbow and forearm on the arm of the chair they were seated in, so that their upper arm was approximately level with their heart. Participants were asked to remove sweatshirts and other bulky clothing items and to push the sleeve up as far as possible on their right arm, without restricting blood flow. Each participant's upper arm circumference (UAC) was measured using a standard metric tape measure. Since using an appropriate cuff size is critical for obtaining accurate blood pressure readings, each participant's UAC measurement was used to determine their appropriate cuff size, according to the following AHA guidelines: 22-26 cm = "small adult" cuff; 27-34 cm = "adult" cuff; 35-44 = "large adult" cuff (Pickering, et al. 2005).

After participants had been seated for at least 5 minutes, blood pressure readings were obtained using the Omron HEM-711 electronic blood pressure monitor. This device is recommended by the British Hypertension Society and has passed their extensive validation protocol (O'Brien, et al. 2001). A minimum of two blood pressure readings were taken for each participant, with a minimum time of 1 minute between each reading. If either systolic or diastolic

blood pressure was more than 5 mmHg different between the first and second readings, a third measurement was obtained. The average of each participant's systolic and diastolic blood pressure readings were computed and used in analyses. Two trained research assistants from Northwestern University assisted in measuring and recording blood pressure data.

Salivary Cortisol - Saliva samples were collected from participants in order to measure circulating cortisol levels. Cortisol levels vary diurnally, peaking approximately 30 minutes after waking in the morning and declining gradually throughout the day to an evening nadir. Different aspects of this diurnal curve can be important indicators of stress and health, including basal levels (Hruschka, et al. 2005), the awakening response (Clow, et al. 2004), and the slope of decline over the course of the day (Adam and Gunnar 2001). A saliva collection protocol was chosen that would allow all of these cortisol parameters and the overall diurnal curve to be estimated. Specifically, saliva samples were collected by participants immediately after waking (before brushing their teeth), 30 minutes after waking, and before going to be bed in the evening (Adam, et al. 2006). Following previous uses of this protocol, saliva samples were collected on two consecutive weekdays (Adam and Gunnar 2001), yielding a total of 6 samples for each participant. Because of the additional time and effort required for saliva collection, this aspect of the study was not required of all third phase participants. Therefore, salivary cortisol measures were only obtained for 55 of the 109 phase three participants. Those who provided saliva samples received an additional $5 McDonald's gift certificate.

Participants were given verbal and written instructions for how to collect their saliva samples as well as a brief demonstration. Participants were also given a packet of collection materials, including: an insulated lunch bag with an enclosed freezer pack, a plastic baggie marked "empty tubes and straws" containing six 2 mL plastic screw-top vials and six short

straws, another empty plastic bag marked with their study ID number and the label "full tubes", and a time record card. Participants were instructed to place the bag containing tubes and straws, the time record card, and the instruction sheet next to their bed, and to put the lunch bag containing the freezer pack and empty plastic bag in their freezer. Each plastic vial was marked with a day and sample number, such as "Day 1, #1, Wake". Participants were instructed to provide saliva samples in the appropriate tubes at the appropriate times using the provided straws and a "passive drool" method. They were asked to fill each tube to ~3/4 full, if possible, and to immediately store the sample in the insulated lunch bag in their freezer. Participants were also asked to record on the time record card the exact time that they provided each sample, as well as the exact time that they awoke in the morning. In the event that participants deviated from the protocol, they were encouraged to record their actual times of sample collection and awakening rather than the times that samples should have been given.

After two consecutive days of saliva collection, participants returned all samples and the time record card in the insulated bag provided. Samples were then transported to the Laboratory for Human Biology Research (LHBR) in the Anthropology Department at Northwestern University, and stored frozen until analysis. Laboratory analysis was conducted at the LHBR. Samples were analyzed in duplicate using an expanded range, high sensitivity enzyme immunoassay from Salimetrics, Inc.

Cognitive/Emotional Measures - Three psychological parameters were measured as cognitive indicators of stress, and as potential mediators of relationships between stress exposures and biological outcomes: anxiety, depression, and perceived stress. The Hospital Anxiety and Depression Scale (HADS) was used to measure participants' symptoms of anxiety and depression. This measure is widely used in epidemiological and psychological research (Caci, et

al. 2003) and has demonstrated good validity and internal consistency across studies (Bjelland, et al. 2002). Factor analyses have consistently demonstrated a two-factor structure for the HADS, corresponding to its separate depression and anxiety subscales (Bjelland, et al. 2002). Additionally, the HADS has been used in population studies with African American samples (Dale, et al. 2007) and has been validated for use with adolescents (White, et al. 1999). The 10-item Cohen Perceived Stress Scale (PSS) was used to measure individual perceptions of stress (Cohen, et al. 1983). This instrument is widely used in stress research, has been used with adolescent samples, and shows very high validity and reliability (Cohen 1988; Roberti, et al. 2006).

Covariates - Several general covariates were measured as potential confounders of the relationships under investigation. Basic demographic variables, including self-reported age, gender, school of attendance, and academic grade were assessed via survey. Ethnic or racial identity was measured as an open-ended self-response to a face-to-face interview question during the 5 minutes prior to blood pressure measurement. Responses to the racial identity question were recorded verbatim. Current smoking status and prescription medication usage were also measured via self-report.

Potential confounders specifically related to blood pressure were assessed. To control for conditions at the time of each blood pressure measurement, room temperature was recorded in degrees Fahrenheit using an Oregon Scientific digital indoor/outdoor thermometer. The exact time of each blood pressure measurement was also recorded. As part of the face-to-face interview immediately prior to blood pressure measurement, participants reported whether they had engaged in extensive physical activity or consumed caffeine or alcohol in the 30 minutes before the measurement session began. To control for the effects of body composition, height

(cm) was measured using a Road Rod portable stadiometer, weight (kg) was measured using a Tanita digital scale plus body fat monitor, and body mass index (BMI) was computed as kg/h^2. Physical activity was assessed via self-report with the 2-item PACE+ Adolescent Physical Activity Measure (Prochaska, et al. 2001).

Other Measures of Social Status - Socioeconomic status (SES) was measured in two ways. A brief parental demographic survey was included with consent materials, and asked the parents of participants to report their family income, as well as their own occupation and that of another adult in the household, if present. Only 67 of 109 (61.4%) parents returned the survey, and only 57 (52.3%) reported their income. Therefore, parent reports of income were not used in analyses. Adolescents were asked to report via open-ended survey response their parents' occupations. This data was combined with parental reports of occupation and coded using the Nam-Powers-Boyd Occupational Status Scale for the year 2000 (Nam and Boyd 2004). The Nam-Powers-Boyd scale uses information about the median population income and educational levels associated with a given occupation to compute a status score for every census-listed occupation. Scores on this scale represent a percentile ranking among the list of all occupations, and range from 0 to 100. Since this scale uses information about education and income, in addition to occupation, it represents a general measure of SES. If more than one employed parent was present in a household, the average Nam-Boyd score was used in analyses.

The Subjective Social Standing Scale (SSS) Youth Version (Goodman, et al. 2001) was used to obtain a separate measure of adolescent social status that would allow the cultural consonance measure to be compared with an existing instrument. The SSS consists of two questions, in which participants are presented with a picture of a 9-rung ladder, and are asked to rank the social standing of themselves and their family. Participants are asked to identify the

ladder rung (rank) that best identifies their family within society, as well as the rung that best fits their own social position within their school. This instrument has been found in previous studies to be associated with depression and obesity in adolescents (Goodman, et al. 2001).

Analysis

All statistical analyses were conducted using STATA statistical software, version 8.0 (StataCorp 2003).

Cultural Consonance - For all three cultural domains in this study (stress, status, support), consonance was measured as a weighted sum of individual survey responses. Specifically, for each item on the consonance survey, a participant's response (0,1) was weighted by that item's weighted average consensus score from phase 2. For example, if a participant responded positively (1) to owning a laptop computer, that response was multiplied by the social status importance score that 'laptop computer' was found to have in the consensus analysis (2.052). The sum of each participant's weighted responses was then computed for every domain and constituted individual cultural consonance scores for stress, social status, and social support.

Because the sources of social status included on the consonance scale covered a wide range of material items and experiences, subscales were created in order to investigate adolescents' exposure to specific categories of social status. Both participant-derived and statistically-derived subscales of social status were created. Participant-derived subscales represented general classes of social status that adolescent participants described in elicitation interviews (see chapter 5). Thus, the individual items that make up each of these subscales were specific examples of status categories mentioned by interview respondents, or were responses to interviewer probes about each category. In addition to these participant-derived subscales of status, factor analysis was used to determine whether there were sources of status for adolescent

participants that tended to cluster together. To create this scale, principal components factor analysis was conducted, with an oblique promax rotation and three factors retained. Creating these factor-derived subscales is particularly important for status indicators since some items on the consonance scale are duplicative (such as different brands of cell phone). In this case, certain constellations of status items may be more meaningful for youth than their overall score or material ownership.

Cognitive/Emotional Factors - The HADS and PSS were scored according to standard procedures. Multiple regression analyses were used to examine relationships between each of the cognitive factors and cultural consonance variables, controlling for potential confounders where appropriate. Specifically, anxiety, depression, and perceived stress scores were each regressed separately on cultural consonance in social status, social support, and stress. Potential confounders controlled in analyses included age, gender, SES, BMI, and physical activity.

Blood Pressure - Relationships between blood pressure and the cultural consonance variables were assessed with multiple regression analyses. Specifically, systolic and diastolic blood pressures were separately regressed on cultural consonance in social status, social support, and stress. Covariates controlled in analyses included age, gender, smoking status, BMI, physical activity, and SES. Alcohol and caffeine consumption, medication usage, room temperature, time of BP measurement, school of attendance, and race/ethnicity were not found in bivariate analyses to be related to either blood pressure or cultural consonance variables, and therefore were not included in the multivariate models.

Interactions, Mediation, and Moderation - Interaction terms were included in multiple regression analyses to test whether SES or gender moderated relationships between health outcomes and

cultural consonance. Covariates and main effects for each of the interaction components were included in these analyses. If interaction terms were found to be statistically significant predictors of an outcome, the moderation effect was further explored by running analyses separately for each category of gender (male/female) and SES (tertiles).

Mediating effects of psychological variables on statistically significant relationships between blood pressure and cultural consonance were formally tested following the recommendations of Baron and Kenny (Baron and Kenny 1986). If a potential mediator was found to be independently related to both blood pressure and cultural consonance, it was entered into the original multiple regression analysis and the change in coefficient for the main predictor (a cultural consonance variable) was examined. If the association between blood pressure and cultural consonance was significantly attenuated, the psychological parameter was interpreted to be a mediator of the original relationship (see figure 4.2).

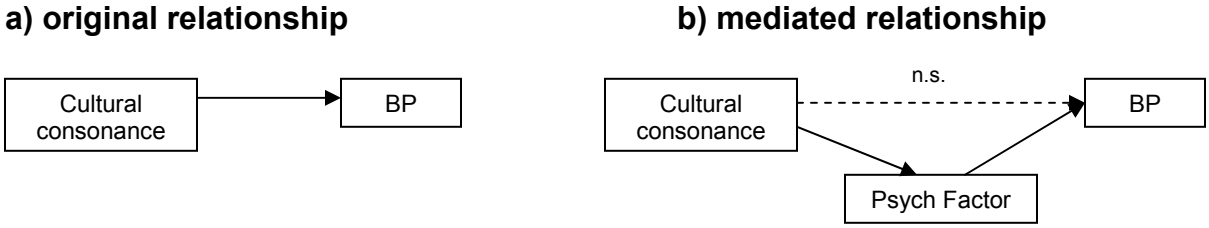


Figure 4.2 Mediation

Cortisol - Salivary cortisol was analyzed in multiple ways. Exploratory analyses were conducted separately for each individual parameter of the diurnal cortisol curve (waking levels, morning peak, and basal bedtime levels), as well as the awakening response (peak-wake) and slope of decline (peak-bed). Associations of each of these parameters with cultural consonance variables were assessed in multiple regression analyses, controlling for the effects of age, gender,

smoking, and race/ethnicity. For each parameter, cortisol values across the two days of sampling were combined and averaged. Additionally, since cortisol values at each time point were strongly right skewed, all cortisol variables were log transformed prior to analyses to normalize their distributions.

Salivary cortisol was further explored with hierarchical linear modeling (HLM) procedures. HLM, or multilevel modeling, is an extension of regular regression analysis designed to handle nested data structures, such as occasions within individuals, individuals within classes, classes within schools, etc (Raudenbush and Byrk 2002). Unlike standard regression analyses in which only one residual error term is included, HLM describes error at each level of the data structure. Thus, in addition to exploring relationships between an outcome and predictors at multiple levels of analysis, HLM describes variability at both the within- and between-group levels (Snijders and Bosker 1999). In the case of salivary cortisol data, measurement occasions (wake, wake + 30 minutes, bed) are nested within individuals. There are thus two levels of data, and two levels of HLM analysis, in the present study. Level-1 predictors of cortisol are the measurement time points that define individual diurnal curves, while level-2 predictors are individual-level variables such as gender, SES, and cultural consonance.

At level one, individual diurnal cortisol levels can be expressed as a function of measurement occasion (time) in a linear growth model, as summarized by the following equation:

Level-1 (within-person):

$$\mathbf{lncort = \beta 0i + \beta 1i\ Time + \beta 2i\ Time2 + \beta 3i\ Day + \beta 4i\ CAR + \mathit{e}}$$

At level two, both the intercept and growth rate (slope) can be allowed to vary as a function of individual-level (level-2) characteristics. The following equations summarize the level-2 effects:

Level-2 (between-person):

β0i = γ00 + γ01 Consonance + γ02 Demographics and Covariates + *r*0i

β1i = γ10 + γ11 Consonance + γ12 Demographics and Covariates + *r1*i

β2i = γ20 + *r2*i

β3i = γ30 + *r3*i

β4i = γ40 + γ41 Consonance + γ42 Demographics and Covariates + *r1*i

At level one, the slope parameter (β_{1i}) represents the rate of diurnal change in cortisol for individual *i* and the intercept (β_{0i}) represents the cortisol value for individual *i* at time = 0 (wake). At level-2, with the slopes and intercepts as outcomes, variation between individual waking cortisol values and rates of diurnal change are predicted by individual-level variables. The level-2 HLM model thus examines whether diurnal cortisol parameters differ as a function of individual demographic and exposure differences (i.e. Do individuals with higher cultural consonance in social status have different waking cortisol levels or rates of diurnal change than individuals with lower cultural consonance in social status?). The level-2 effects can thus be interpreted as interactions.

The level-1 and level-2 models specified above were estimated using the HLM statistical program, Student Version 6.04 (Raudenbush, et al. 2005-2008). Each set of analyses was run with the time variable (representing hours since waking) centered at midday in order to capture average daily diurnal elevation, and with level-2 predictors centered at their mean.

Summary

A chart summarizing the three phases of data collection and analysis is presented below:

Table 4.1. Summary of Research Phases

Research Phase	**Objective**	**Sample**	**Data Collection**	**Analysis**
1) Elicitation	Elicit universe of possible components for three cultural models (stress, status, support)	20 key informants Purposive sample	Semi-structured ethnographic interviews	Tabulation
2) Consensus	Determine whether youth share cultural models of stress, status, support Construct 'cultural answer keys'	37 informants (+12 for status model) Purposive snowball sample	Surveys	Factor analysis of informants (consensus analysis)
3) Consonance and Biomarkers	Determine relationships between consonance, biomarkers and psychological factors	109 informants Convenience sample	Surveys Blood Pressure Salivary Cortisol Covariates	Multiple Regression HLM

Chapter 5

Ethnographic and Consensus Results: Cultural Models of Stressors, Social Status and Social Support

The study of youth has a long, but inconsistent, history in anthropology. Margaret Mead's *Coming of Age in Samoa* (1928) introduced the study of youth to anthropology, and explored adolescence as a part of broader family, kin, and cultural systems. However, after Mead's pioneering work youth were largely understudied in anthropology. Throughout much of the 20th century, anthropological research that included adolescents tended to consider them more as a means for understanding broader cultural practice and life stage development than as their own topic of research (Bucholtz 2002; Caputo 1995; Schwartzman 2001). For instance, during the 1950s and 1960s, adolescence was treated mainly as a vehicle through which topics considered more anthropologically interesting, such as ritual, rites of passage, and cross-cultural patterns, could be explored (Schwartzman 2001). In the 1970s and 1980s, focus shifted to socialization and the ways in which variations in parenting practices and other cultural attributes could influence the behavioral and psychological development of youth (Schwartzman 2001). Thus, historically, anthropological research has approached the topic of adolescence from the viewpoint of adulthood. By focusing on adolescence as merely a liminal position in which the process of becoming adult takes place, and by viewing youth primarily as reflections of adult behaviors and cultural practices, 20th century anthropology largely ignored adolescents as interesting research subjects in their own right (Bucholtz 2002; Schwartzman 2001; Wulff 1995).

Youth as a primary topic of study has been more common within the field of sociology. The sociologist Talcott Parsons popularized the term 'youth culture' in the 1950s as a reference

to the leisure activities of adolescents navigating the transitional stage between childhood and adulthood (Wulff 1995). During the 1950s and 1960s, youth became a major focus of the Chicago School of sociology, which viewed adolescence primarily as a site of rebellion and deviant subculture (Bucholtz 2002). The prominent Birmingham School also helped to popularize the view of adolescence as subculture. This British sociological approach focused primarily on working class youth and the material and symbolic contexts that were seen to shape youth identities of resistance (Bucholtz 2002; Wulff 1995). The sociological focus on youth subculture helped to identify adolescence as an important research topic in its own right. However, this approach also tended to limit its scope to particular class identities and aspects of youth culture, and to maintain an adult vantage point - defining youth subculture mainly by its deviance from normative adult worlds (Bucholtz 2002).

Recently anthropology has borrowed from the sociological study of youth subculture to begin examining adolescence as its own topic of research. In particular, the new anthropology of youth is focused on adolescents as cultural agents. Rather than simply rebellious deviants or objects of adult socialization, this approach views youth as active creators of their own rich cultural worlds (Hardman 1973; Speier 1976). Anthropologists are now concerned with understanding how young people engage in the production of meaning, not just in alternative subcultural contexts, but in their everyday social lives (Caputo 1995; Prout and James 1990; Wulff 1995).

This study draws on the new anthropology of youth to explore adolescents' everyday experiences with three domains related to psychosocial stress: sources of stress, social status, and social support. Ethnographic results are discussed below which describe the cultural meanings African American adolescents give to these aspects of psychosocial stress. Quantitative results

are presented and discussed which test the first hypothesis (H1) of this study: that adolescents in Maywood share cultural models of salient sources of stress, social status, and social support.

Phase 1 and 2 Participant Characteristics

Of the 20 adolescents who participated in the ethnographic phase of the study (Phase One), 15 were female and 5 were male. All but two of the phase one participants attended one of the two local high schools in the Maywood area. One participant attended another nearby high school in a neighboring district, and one participant attended a private Catholic school. The Catholic school student was also the only Phase One participant who identified their race/ethnicity as white. All other participants in Phase One identified as African American.

Of the 37 adolescents who participated in the cultural consensus phase of the study (Phase Two), 26 were female and 11 were male. When defining the cultural domain of social status, an additional 11 adolescents participated, 6 of whom were female and 5 male. All Phase Two participants attended one of the two Maywood area high schools. Two of the Phase Two participants identified their race/ethnicity as white, and one identified as Hispanic. All other Phase Two participants identified their race/ethnicity as African American.

Adolescent Stressors

Background

Despite the importance of developmental aspects of stress for psychological and physical health, adolescents have not received the same attention as adults in stress research (Grant, et al. 2003). Most studies have examined stress only in relation to cognitive or psychological

outcomes, and few have developed theoretical models of stress specific to youth. Stressful event checklists are the most widely used method for measuring adolescent exposure to stressors (Grant, et al. 2004). Eleven general stress event checklists have been developed for adolescents, as well as more specific checklists related to divorce and abuse (Grant, et al. 2004). However, these checklists often constitute modified versions of adult measures, and include stressful events that researchers determine to be of particular interest to them or that they determine are likely to be significant. The meanings given to checklist events as sources of stress are thus determined solely by adult investigators, not by the adolescents under study. Individual, cultural, and context-specific differences in what constitute meaningful sources of stress for adolescents are ignored in these measures.

Attempts have been made recently in psychological research to develop more accurate and appropriate measures of adolescent stress, primarily through the use of the Stressor Interview method. With this approach, lists of stressful events are generated from individual interviews with adolescents, helping to create a more meaningful set of stressors for youth. However, the level of threat associated with each stressor generated through interviews is then determined by an external rater (adult investigator) (Grant, et al. 2003). Therefore, the 'stress' meaning given to life events and the decision regarding which stressors are included and excluded from an ultimate stressor index are decided by adult researchers rather than youth themselves.

Similarly, researchers have recently tried to develop stressor measurements that are more appropriate for urban, low income, and minority populations. However, almost exclusively, these measures have focused on adolescent exposures to community and household violence (Chandra and Batada 2006; Grant, et al. 2004). While exposure to violence is likely an important stressor for many urban, minority youth, the meaning given to potential stressful events in these measures

is once again determined by adult investigators rather than the adolescent populations under study. These measures also homogenize and constrain the stressor experiences of urban African American youth by excluding the other school, peer, and general life-related stressors that researchers assume to be meaningful for white youth.

Thus, most measures of adolescent stressors are based on the perceptions of adult investigators regarding what life and everyday events are and are not stressful. Additionally, almost all adolescent stressor event checklists are designed for and used among middle class, white youth populations, and fail to consider sources of stress that are more relevant to urban, lower income, and minority adolescents. Finally, the few stressor measures designed for urban minority youth focus exclusively on violent exposures, severely limiting the range of stressors that likely affect youth in these populations. The need for better measures of stressor exposures for urban African American youth has been recognized by a number of researchers (Chandra and Batada 2006; Grant, et al. 2004; Reynolds, et al. 2001). The data presented below represent results from the first (elicitation) and second (cultural consensus) phases of this dissertation study, and describe culturally salient sources of stress for urban African American youth.

Phase 1 Results: Stressors

In elicitation interviews, participants discussed sources of stress related to school and academics, home and parents, peers, and general life strains. Regarding school and academic stressors, a number of participants discussed the pressures they face to get good grades and balance academic and extracurricular responsibilities. One participant described this pressure in the following way:

> Getting everything done. That goes with the grades, cause like after school many people have activities. Like I was on the track team but I had to get off because I had to come here for dance practice every day. And I had to do my homework every day after school so I could get good grades, and when I had track practice I didn't have time to do my homework and then come here. I had to do my homework really late.
>
> (Participant #3, female)

Another participant described a similar situation:

> For me it's like getting good grades and stuff. Cause like it's hard sometimes coming here and then going to work and then trying to go to school and try to fit in time to sleep and time to socialize, and time to do homework, that's usually what gets left out is the homework.
>
> (Participant #4, female)

Also related to school and academic pressures, older participants described thinking about life after graduation and going to college as significant sources of stress. For instance, one participant said:

> That [stress] for me is college stuff. I think about the future a lot. And there's like how they expect you to determine your future, at this age, like everything in high school - your grades, your college choice, everything - is going to affect your future…
>
> (Participant #10, female)

Issues with parents constituted another major source of stress described by adolescents in interviews, particularly regarding the balance of responsibilities and independence. One participant, for instance described general strain in her relationship with her parents: "…they just expect so much from me. I guess it's with me being the oldest, but they don't listen to nothing I have to say," (Participant #4, female). Another respondent described stress around trying to gain independence from her parents:

> …teenagers want to do what they want to do, but parents always have input cause they say, you know, "I'm older," and you just want to find things out on your own. And then sometimes parents was right and then you get mad 'cause they was right.
>
> (Participant #9, female)

Social issues around popularity, peer interaction, peer pressure, and physical appearance were another major category of significant stressors discussed by participants. Regarding popularity, participants described the pressures they face to fit in at school and attain social acceptance. As one participant described:

> …you gotta hang out with a certain group to be considered cool. But like sometimes you don't hang out with that group, but you'll have another group to hang out with that they don't consider cool, so then they might try to label you as like a lame or just a geek or something.
>
> (Participant #11, female)

Related to the stressor of popularity were issues of physical appearance, including wearing popular clothes and being attractive in order to gain acceptance. A few participants mentioned weight issues as a major source stress, and all of them indicated that being either underweight or overweight would be equally stressful. One participant described these issues in detail:

> …the clothes thing. Cause some people, they might not be able to afford new clothes and new shoes. So you might still have those two year old [Air Force] Ones or two year old K-Swiss's and they could be all dirty and beat up and everything, but you can't help that, the way your family income is right now or whatever…so that might put a little stress on you…
>
> Your weight, your physical appearance. Like your best friend might be a little bit skinnier, or might be more fit, …you don't want to be big cause you have to stay fit and everything… 'Cause you don't want to get too fat, cause people make fun of you, but you don't want to get too skinny. 'Cause this one girl she's really skinny and they call her a stick, and that makes her upset. So some girls may not have boobs or booty, some girls may have too big of the two.
>
> (Participant #14, female)

Participants also described how being perceived as failing to meet popularity and physical attractiveness ideals could result in further stress from social stigmatization:

> Getting talked about, period, in general. I mean certain people laugh about it. Like I'm a type of person… I'm outgoing so I laugh about it, but I know this girl in my school, she get talked about or whatever, and she go home and start cutting her wrists…
>
> (Participant #16, female)

Other participants described peer pressure around sex as a particularly salient stressor for youth. One participant simply stated that girls at her school experienced a lot of pressure "to have a boyfriend, to have sex with your boyfriend," (Participant #16, female). Boys also described this pressure: "like some boys they may be scared that like their girls don't want to have sex, but they might not want to have it," (Participant #12, male).

Each individual source of stress described by a participant was extracted from their interview transcript and compiled to create a stressor free-list for each respondent. Individual respondent free-lists averaged 7.94 items, and ranged from 4 to 13 items. A sample individual free-list is presented below:

Participant # 10 (female)

- Trying to be popular
- Trying to fit in at school
- Getting talked about at school
- College stuff; thinking about the future
- Grades [in school]
- Peer pressure [of any kind]
- A lot of people are afraid to excel – assumption you're stuck up
- Your parents treat you like children
- Trying to be more independent [from parents]
- The whole boy situation
- Pressure to have sex
- Having rumors [about sex] spread about you

Figure 5.1. Sample Free-list of Stressors

A composite list of stressors was then formed that constituted a pooled collection of all individual free-lists. The composite list included specific stressors mentioned by participants, as well as more general categories of stressors that were represented across free-lists (such as "having controlling or overprotective parents"). The composite list of stressors included a total of 32 items. Seventeen of the stressors had a frequency greater than 20% across participant free-lists, nine stressors had a frequency across individual lists between 10% and 20%, and six stressors occurred in less than 10% of participant free-lists. Twenty nine items were included on the phase 2 survey to assess cultural consensus.

Phase 2 Results: Stressors

Results for the first three latent factors of the cultural consensus analysis for stressors are presented in Table 5.1. The analysis revealed that the first factor was significantly larger than the second, and all subsequent, latent variables. Specifically, the eigenvalue of the first factor was 32.22, explaining 87% of the total variance. By contrast, the second largest factor had an eigenvalue of 1.37 and accounted for only 3.7% of the total variance. The ratio of the first to the second eigenvalue in this analysis was 24:1. Since this ratio far exceeds the standard threshold for establishing cultural consensus of 3:1, the results are interpreted as evidence that a single cultural model of salient stressors is shared among the participants.

Table 5.1. Factor analysis of participant responses for stressors

Factor	**Eigenvalue**	**Proportion of Variance**
1	32. 21956	0.871
2	1.36818	0.037
3	0.98318	0.027
		Ratio of 1st to 2nd eigenvalue = 24:1

Providing additional support for this interpretation are the competence scores for individual participants. The competence scores, or factor loadings from the analysis, indicate the correlation of each participant with the first factor, and thus constitute a measure of individual 'knowledge' of the cultural model of stressors. The average cultural competence across participants in this analysis was 0.93 (SD=0.174), indicating that respondents have high knowledge of the cultural model. High average competence scores are another indication that the cultural model is coherent and strongly shared, since the difference between individual cultural beliefs and the composite cultural belief is very low.

After each participant's survey responses were weighted by their cultural competence score, the average of the weighted importance scores for each stressor on the survey was computed. Since the survey response coding was "1 – not important" through "3 – very important," a weighted average score of 2.0 indicates that, on average, participants rated that stressor as "somewhat important." Each stressor with a weighted score of at least 1.5 was considered to be part of the cultural model. The twenty-four stressors that met this criterion, and their average importance ratings, are listed in Table 5.2.

Table 5.2. Cultural Model of Salient Stressors (stressor and weighted score)

Stressor	Score
Thinking about college and the future	2.48
Trying to get a job	2.30
Getting good grades in school	2.23
Time management, getting things done	2.23
Parents in general	2.16
Having a "bad home life"	2.08
Meeting parents' expectations	2.07

Getting money	2.05
Having controlling or overprotective parents	2.03
Having a parent pass away	2.03
Gaining independence from parents	2.02
"Boys" or "Girls"	1.96
Teachers being "down on you"	1.89
Having conflict among friends	1.84
Feeling too skinny or overweight	1.82
Peer pressure (of any kind)	1.78
Keeping up with the latest looks and trends	1.73
Experiencing racism	1.71
Having rumors about sex spread about you	1.71
Being stereotyped	1.71
Peer pressure to have sex	1.71
Experiencing gang violence (witness or knowing a victim)	1.69
Trying to be popular	1.69
Being talked about at school	1.62

Discussion

As discussed above, most research examining stress among African American youth has focused only on violence-related issues. While experiencing gang violence was a significant source of stress for these youth, other school, home, and peer-related issues were more prominent in participants' interviews and were considered to be more salient in quantitative results. Research that reserves these broader sources of stress for white, middle class youth only is thus likely ignoring many of the most meaningful stressors that minority adolescents face.

The prominence of school and academic-related stressors in both participant interviews and the cultural consensus results also challenges stereotypes about minority academic values. It

is commonly assumed that high academic performance is not valued within minority youth culture and is stigmatized as "acting white" (Fordam and Ogbu 1986; Peterson-Lewis and Bratton 2004). However, just as not all white adolescents are high academic achievers, clearly not all minority youth value low achievement. It could be that the adolescents who participated in this study were biased towards high academic success since they were highly active in their school and extra-curricular activities. However, that is not believed to be the case. The school district in which this study was conducted does not have an official attendance policy due to difficulties with enforcement. As a result, youth who have no interest in formal education often do not attend school. Thus, while the ethnographic and consensus samples in this study may not be representative of all youth in the community, they are believed to accurately represent the school-attending youth population from which participants for all phases of research were drawn.

Adolescent Social Status

Background

Among adults, low socioeconomic status (SES) is thought to be an important index of psychosocial stress exposure. SES is a strong independent predictor of health at the population level, and plays a role in adult racial health inequalities. Because the social environments of young people are heavily influenced by the social and economic contexts of their households, parental SES is often used as a predictor of child and adolescent health. For infants and young children, parental or family-level SES is indeed consistently associated with health outcomes. However, for adolescents, the SES gradient in health is less consistent, due likely to the inadequacy of parental SES as a measure of youth status (Goodman, et al. 2001; West 1997).

Parental SES may not be a meaningful measure of adolescent social status and stressful social contexts for two important reasons. First, research has shown that, unlike adults, adolescents tend to have inaccurate perceptions of their family's socioeconomic status, believing it to be higher than it actually is (Goodman, et al. 2000). Therefore, while adult SES may have an objective influence on the social environments of youth, adolescents' subjective experiences of socioeconomic status may not map onto their family's actual economic position. Since subjective interpretations of SES are thought to be an important component in the relationship between SES, stress, and health, this limitation may seriously undermine the utility of using adult measures of status to approximate adolescent experiences.

Second, peer-based social hierarchies may be of more immediate importance to adolescents' social lives than their family's economic position within broader society (Goodman, et al. 2001; West and Sweeting 2004). During adolescence, youth develop their own systems of social stratification, and become aware of their own social status position within their school or peer set (Goodman, et al. 2001). Thus, measures of social status that capture adolescents' own social positions may be more meaningful for their experiences of stress and development of health risk than their family's socioeconomic status.

Recognizing the importance of adolescent peer-based social hierarchies, Goodman and colleagues (2001) developed a youth-specific measure of perceived social status. The MacArthur Scale of Subjective Social Status – Youth Version is a measure of perceived status that asks adolescents to identify their relative status position within their school, as well as their perception of their family's relative position within society. Using this scale, adolescents' subjective social status has been found to be associated with both obesity and depressive symptoms, and peer-based status was found to be a stronger predictor of both outcomes than

family's position in society. This finding highlights the importance of measuring adolescent social status at the peer level.

The adolescent Subjective Social Status scale, however, does not provide an objective measure of social position for youth. As discussed above, youth are active cultural agents, and adolescence is an important site for the production of cultural meaning. The particular meanings attached to material items or behaviors within youth culture will determine their relevance as indicators of status and thus the potency of youth status as a source of stress. The findings from ethnographic interviews and results of the cultural consensus analysis presented below describe culturally meaningful sources of social status for youth in Maywood.

Phase 1 Results: Social Status

In elicitation interviews, participants discussed social status indicators related to both material consumption and behavior. Behavioral aspects of status included hanging out with a popular crowd, being an upper classman, and participating in team sports or activities at school. In particular, participants mentioned that people with high social status at their schools were often on basketball, football, or track teams, or were members of a cheerleading or dance troupe. People with high status were also described as being outgoing and talkative, going to parties on weekends, and talking about other kids at school. Gang membership was contested as a status indicator in interviews; while some participants indicated that belonging to a gang could be a marker of status, others stated that it was looked down upon.

Material items were the most consistently and frequently mentioned indicators of social status. Wearing brand name clothing was often described as an important marker of status. Specific clothing and shoe brands that participants discussed included: BabyPhat, Girbaud, Ecko.

Rocawear, Apple Bottoms, Air Force One's, and Jordan's. Cars and technology items also occurred frequently in participant free-lists, and included cell phones, iPods, and laptop computers. Physical appearance factors also featured prominently in participant interview responses. Appearing well groomed, with styled hair, and clean, preferably new, clothes and shoes were listed as important markers of status.

In general, participants described having high social status as looking and acting the part, including having the resources to keep up with the latest looks and trends. As one participant said, "It's a whole big thing, like if you're not up to date you're not cool" (Participant #1, female). Some respondents elaborated on specific examples of keeping up to date with a high status image:

> We talk about anybody basically, if you not perfect you gonna get talked about. And like if your shoes raggedy, you get talked about. Even if you have on Air Force Ones, if they're raggedy you get talked about…You can't wear the same shoes 3 days in a row in one week. Cause…you making your image look bad…That's what it's about, acting like you got money. So everything is about who got the most money. So I refuse to wear my Jordans 3 days in a week.
>
> (Participant #4, female)

> Say you have on some dirty gym shoes, like K-Swiss or something, and the boys, they'll talk about you and your shoes...
>
> (Participant #12, male)

> Cell phones. The latest - that's the most important thing… if a new cell phone come out, people will stop their plan - in order to stop a plan it costs like $250, then to start a new plan it costs like another $250, then the phone is like $300, and people do all this just so they can have the latest phone.
>
> (Participant #10, female)

However, some participants also indicated that material items and appearances were not the most important indicators of status:

> You don't have to wear makeup and everything, you don't have to be the prettiest girl or the good lookingest boy. Just kind of get active, get to know people. You might not be

> dance coordinated, but maybe you can get together after school or something with a couple of girls and they can teach you some moves, or get with a couple boys so you can shoot hoops or whatever.
>
> (Participant #14, female)

Similarly, a number of respondents emphasized personality factors, such as being friendly and well liked, and having many friends, as being more important markers of high social status than material items.

Individual free-lists for social status indicators averaged 21.8 items, and ranged from 8 items to 38 items. A sample individual free-list for social status indicators is presented below (Figure 5.2):

Participant # 4 (female)	
Play a sport	Hang out at 'The Brac'
Basketball	Hang out at a restaurant with friends
Football	Date someone on a team
Cheerleading	Have a car
Dance team	Have a cell phone
Name brand clothes	Have a RAZR cell phone
New pair of shoes every week	Wear color coordinated outfits
Hang out in a big group	Wear Apple Bottoms brand clothes
Show school spirit	Wear Rocawear brand clothes
Parties every month	Boys wear big earrings
Getting good grades	

Figure 5.2. Sample free-list of Social Status Indicators

When all of the individual free-lists were compiled, 48 items had a frequency greater than 20%, 29 items had a frequency between 10% and 20%, and 31 items were only mentioned by one participant.

Phase 2 Results: Status

The results for the first three factors of the cultural consensus analysis for social status are presented in Table 5.3. As with the consensus analysis for stressors, the first factor in the analysis of social status indicators was significantly larger than all other latent factors. Specifically, the eigenvalue for the first factor was 47.73, accounting for over 97% of the sample variance, while the eigenvalue for the second factor was 0.65 and accounted for only 1% of the total variance. The ratio of the first to the second eigenvalue in this analysis was 73.7:1, far exceeding the conventional threshold for establishing consensus of a 3:1 ratio. The results of the consensus analysis thus indicate that the participants in this study strongly share a single cultural model of social status.

Table 5.3. Factor analysis of participant responses for indicators of social status

Factor	Eigenvalue	Proportion of Variance
1	47.73084	0.975
2	0.64738	0.0132
3	0.10020	0.0020
		Ratio of 1st to 2nd eigenvalue: 73.73:1

As with the consensus analysis of stressors, average competence among participants for social status was very high, at 0.986 (SD=0.043). This indicates that, on average, individual participant responses correlate over 98% with the consensus model for social status. Individual

knowledge of culturally meaningful sources of social status thus deviates very little from the shared composite knowledge of adolescent participants. These high competence scores provide further evidence that a single model of social status is robust and strongly shared among youth in Maywood.

Competence scores for social status were applied as weights to participant survey responses in the same manner as for stressors. For each item on the consensus survey, a weighted average score of 2.0 indicated that, on average, participants rated that item as "somewhat important" as an indicator of social status among their peers. The complete cultural model of social status indicators is presented in Table 5.4.

Table 5.4. Cultural Model of Social Status (indicators and weighted scores)

Social Status Indicator	Score
K-Swiss Shoes	2.29
iPod	2.17
Being on the track team	2.15
Hanging out at a restaurant with friends	2.14
Having a nice car	2.09
Being a senior or junior	2.09
Being a member of a dance troupe	2.07
Being involved in school activities	2.07
T-Mobile cell phone	2.05
Sidekick	2.05
Laptop computer	2.05
Being a cheerleader	2.02
Having a big truck (Escalade, Expedition, etc)	2.01
Not being too skinny or overweight	2.01
Going bowling with friends	2.01
Being on the football team	2.00
Bluetooth	1.98

Playing laser tag with friends	1.98
RAZR cell phone	1.96
Getting good grades	1.95
Hanging out with a popular crowd	1.92
Unlisted shoes	1.92
Ecko brand clothes	1.92
Going to the club 'Nitro'	1.89
Being in a gang	1.88
Talking about kids at school	1.87
Going to house parties on weekends	1.87
Acting like you have money	1.87
Having money	1.82
Juicy brand clothes	1.82
Being on the basketball team	1.78

Discussion: Contested Items and Inconsistencies in the Status Domain

Despite the remarkably high consensus that was found for the cultural model of adolescent social status, there were a few inconsistent or contested items that were noticed during the interview and survey processes. First, being on the basketball team and wearing the Rocawear clothing brand were two of the most frequently mentioned status items in elicitation interviews, each occurring in over 68% of individual free-lists. However, both items had relatively low weighted average scores based on the consensus analysis. Similarly, Ecko brand clothing had a relatively low frequency across participant free-lists, at 21%, but was one of only two clothing brands to receive high scores from the consensus analysis.

A focus group held with some of the phase one participants after the completion of phase two provided potential explanations for these inconsistencies. When presented with a list of high vs. low scoring status items, participants noted that some of the clothing and shoe brands in the

lower status column were no longer in style. While only three months had passed since the phase one interviews, it had been enough time for several items to fall out of fashion within this fast-changing youth culture. As many participants pointed out in interviews, having the most up-to-date styles are key to attaining high status. Therefore, at the time of the consensus surveys, several brands may no longer have been the most up-to-date, and thus may have received somewhat lower scores, or vice-versa.

Related to the issue of fast-changing trends is that of the relative status of phase one and phase two participants. In particular, many of those focus group participants who noted the rapid trend changes had self-identified in interviews as having high social status within their school. Individuals with relatively high status are likely to be closer to the forefront of changing styles, and thus the social positions of study participants may have influenced their knowledge of what the most up-to-date status items were. K-Swiss gym shoes offer a particularly interesting example of this phenomenon. It was clear from interviews that K-Swiss shoes were a highly contested status item: while some participants identified the brand as high status, others described K-Swiss as a low status brand. One of the self-identified high status participants explained some of the disagreement over K-Swiss shoes:

> They got a song about shoes that you can't wear no more. Everybody used to wear these [K-Swiss] shoes and now all of a sudden they say they call you names if you wear these shoes…They say that you a 'bust down' if you wear them, 'cause K-Swiss cheap…So I guess they made the song about it, like really forcing you not to wear them…you could be at school and somebody sing it to you, or you at a party or something with a whole bunch of kids and they'll sing it to you and push you out in front of everybody. So you can't afford to wear the shoes.

Thus, the K-Swiss brand was one clearly undergoing a transition from high to low status during the course of the first two phases of the study. The fact that K-Swiss shoes had the highest status score after the consensus analysis suggests that many of the phase two participants may not have

been aware yet of the changing status of that brand, or may have been unwilling to abandon them as a status item because of their relatively low cost. Since the relative social status of phase one and two participants was not directly assessed, however, it is unknown how this may have influenced the results of the study regarding K-Swiss or other status items.

Juicy brand clothing was another contested status item that yielded interesting information about the overall social status domain. Juicy clothes were mentioned only once during elicitation interviews, by the only Phase One participant who identified as 'white' and who attended a private school outside of the community. As such, Juicy brand was included on the phase two consensus survey as a control item, since it was assumed not to be a meaningful status indicator for youth in the Maywood community. When focus group participants were asked about Juicy's surprisingly high consensus score given its low frequency in interviews, some of them indicated that indeed Juicy was considered to be both a very high status and very expensive clothing brand. However, other participants, particularly those who had not self-identified as high status, indicated that they were unfamiliar with the brand. The case of Juicy brand thus provides an excellent example of cultural knowledge differences between relatively high and low status youth. Because Juicy is a relatively high priced brand, it was likely identified as a very important status indicator by those phase two participants who were "in the know." However, the exclusivity of this brand and the low likelihood that adolescents with lower social status and/or economic resources would have encountered it, calls into question the widespread cultural meaning of this status item for youth in Maywood.

As the preceding examples illustrate, the cultural domain of adolescent social status is full of complexity and nuance, despite the remarkably high agreement found among participants in the Phase Two consensus analysis. Both the economic and peer-based social standing of

participants may have had a considerable impact on their cultural knowledge of social status indicators and may have affected the relative importance of some items in the consensus analysis. Without systematic measures of economic and social status for all Phase One and Two participants, fully exploring these complexities is not possible with this dataset. However, future research should attempt to unravel some of these complicated nuances of youth social status.

Adolescent Social Support

Background

As with adults, the presence of social support is hypothesized to be an important psychosocial factor affecting adolescent health, either as a main effect or as a buffer of the negative consequences of stress. However, empirical support for relationships between social support availability and health outcomes has been inconsistent in studies of youth stress. Some studies have found the presence of social support to be associated with lower levels of depression, perceived stress, and other negative outcomes in adolescents (Schmeelk-Cone, et al. 2003; Schraedley, et al. 1999; Sheeber, et al. 1997). Other studies have found no association between social support and psychological or physical health (Burton, et al. 2004; Windle and Windle 1996). Still others have suggested that the relationship between social support and health for teens is dependent upon the type of support available. Parental support, in particular, has been suggested to be more consistently related to adolescent psychological and physical health than peer support (Schmeelk-Cone, et al. 2003; Zimmerman, et al. 2000).

As with other indicators of adolescent psychosocial stress, most research on social support has been conducted among middle class, white youth. Therefore more research is needed

that explores relationships between social support and health for urban, lower-income, and African American adolescents. Measuring adolescent social support in a way that accounts for cultural meaning is also important. Dressler's work with adults (Dressler and Bindon 2000) has shown that that the cultural appropriateness of the types of social support individuals draw on can be important for health. The findings presented below describe a culturally meaningful model of social support for African American adolescents in Maywood.

Phase 1 Results: Support

In elicitation interviews, participants described appropriate or commonly used sources of support for adolescents in three different situations: when faced with a personal problem, when faced with a money problem, and when they just want to have fun. For a personal problem, most participants listed mothers as the most common source of support. Other frequently described sources of support for a personal problem included friends, best friends, other immediate family members (dad, sister, brother), and extended family members, such as grandmothers and cousins. For money problems, friends and immediate family members, especially fathers, were the most frequently mentioned sources of support. Grandmothers also were commonly mentioned as sources of support for money problems. Friends and best friends were the most commonly discussed sources of support for fun. Immediate and extended family members, such as mothers, sisters, and cousins, were also frequently mentioned.

Phase 2 Results: Support

In the consensus phase of the study, participants ranked each source of social support with respect to how commonly youth would turn to them in each of the three situations. The

consensus results are presented below (Table 5.5). For both personal and money problems, consensus was low with respect to the ranking of social support sources (eigenvalue ratios of 2.11:1 and 2.27:1, respectively). For people to have fun with, consensus was relatively high, with an eigenvalue ratio of 6.15:1.

Table 5.5. Factor analysis of participant responses for sources of social support

Personal Problem		
Factor	**Eigenvalue**	**Proportion of Variance**
1	11.55775	0.5025
2	5.47043	0.2378
3	2.65291	0.1153
		Ratio of 1st to 2nd eigenvalue: 2.11:1
Money Problem		
Factor	**Eigenvalue**	**Proportion of Variance**
1	11.13396	0.4841
2	4.89455	0.2128
3	2.21906	0.0965
		Ratio of 1st to 2nd eigenvalue: 2.27:1
Fun		
Factor	**Eigenvalue**	**Proportion of Variance**
1	17.67285	0.7684
2	2.87540	0.1250
3	1.62384	0.0706
		Ratio of 1st to 2nd eigenvalue: 6.15:1

The cultural model of social support for these adolescents is thus not as robust as the model of salient stressors and social status indicators. As a result, unweighted average rankings for each source of support will be presented (Table 5.6).

Table 5.6. Unweighted Average Rankings for Social Support Sources

Personal Problem	
best friend	2.25
mom	3.428571
sibling	3.75
other friend	4.185185
cousin	4.666667
grandma	5.678571
auntuncle	6.296296
dad	6.37037
teacher	7.892857
Money Problem	
mom	1.75
dad	3.333333
grandma	4.75
sibling	5.111111
boyfriend	5.285714
job	5.607143
aunt	5.925926
friends	6.035714
cousin	6.814815
For Fun	
best friend	1.107143
other friend	2.392857
sibling	3.285714
cousin	3.785714
mom	4.428571

Discussion/Conclusion

Most adolescent research measures stress from the perspective of adults, with researchers assigning meaning to the stressors that youth face (Chandra and Batada 2006). But as active agents in the production of cultural meaning (Bucholtz 2002), youth play an important role in defining their own experiences of psychosocial stress. Thus, this study used an innovative technique to explore and define the cultural beliefs of adolescents around key aspects of psychosocial stress. Confirming the first hypothesis of the study, adolescent participants were found to strongly share cultural beliefs regarding each of the three domains under investigation: sources of stress, indicators of social status, and sources of social support.

Unlike previous approaches that have ignored or limited minority youth stressors, the cultural models that youth shared in this study described complex, multifaceted experiences of stress and coping. Youth in Maywood do experience the neighborhood violence and gang activity that are typically associated with the experiences of black urban adolescents. However, stressors related to school achievement, peer pressure, and family issues were found to be just as salient in these adolescents' lives. Defying stereotypes about the achievement values of minority youth, issues related to academic success ranked among the most important stressors for youth in Maywood. While the cultural model of social support was not shared as strongly among participants as that of salient stressors, several commonly utilized supporters were also identified by these adolescents.

As with the measurement of adolescent stress, research examining youth social status has also been limited. Most research examining social status and health among adolescents has used parental measures of SES as a proxy for adolescents' experiences. However, the emergence of

peer-based social hierarchies and youth's perceptions of their own social positions are thought to be more meaningful (Goodman, et al. 2001). The cultural model of social status that Maywood youth described was shared to a remarkably high degree, and included both material items, such as cell phones and designer clothes, and behavioral indicators, such as being on a sports team. Incorporating adolescents' own perspectives on these issues created more multidimensional pictures of the sources of stress, status, and support that are meaningful in the everyday lives of these minority youth. These youth-based models should allow for more accurate and meaningful measurement of the psychosocial stress experience of Maywood adolescents.

Chapter 6

Adolescent Stress and Health: Sample Characteristics, Cultural Consonance and Blood Pressure

The overall objective of this study is to examine how exposures to culturally meaningful stressors influence adolescent biomarkers of stress and health risk. Blood pressure is a primary biomarker in this study because it is both associated with the body's physiological response to stress (see chapter 2) and is a key indicator of cardiovascular health. It is increasingly recognized that blood pressure is an important cardiovascular risk factor beginning in childhood, and that researchers should look toward youth for the roots of adult cardiovascular diseases. However, the role that stress plays in shaping these early trajectories of cardiovascular health is an open question.

Adolescent Blood Pressure as CVD Risk Factor

Blood pressure, an important marker of the physiological stress response, is also a key indicator of cardiovascular risk. Clinically high blood pressure, or hypertension (defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg), was alone responsible for 5% of all cardiovascular deaths in 2002 (AHA 2005). Several large longitudinal studies have confirmed that elevated blood pressure is a significant risk factor for the development of cardiovascular diseases (CVD) and incidence of adverse cardiac events. The Framingham Heart Study, involving over 13,000 participants and 30 years of follow-up examination, found hypertension to confer a 2-3 fold increased risk for the development of coronary heart disease (Levy, et al. 1996). The INTERHEART Study, including participants

from 52 countries, found that individuals with hypertension were 2.5 times more likely to experience acute myocardial infarction (Yusuf, et al. 2004).

In addition to this critical threshold of clinical hypertension, blood pressure has also been found to be a significant indicator of morbidity and mortality across almost the entire range of observed values. Several studies have found a continuous, graded relationship between both systolic and diastolic blood pressure and risk of cardiovascular disease and mortality (Chobanian, et al. 2003; Kannel, et al. 2003; Pickering, et al. 2005; Vasan, et al. 2001). The Framingham Study found a continuous, graded association between non-hypertensive categories of blood pressure (optimal, normal, and high normal) and incidence of any cardiovascular event, with high-normal blood pressure conferring a 2.5 times higher adjusted risk for women and 1.6 times higher risk for men (Vasan, et al. 2001). The Multiple Risk Factor Intervention Trial (MRFIT), with over 350,000 male participants, found a step-wise increased risk for coronary heart disease (CHD) mortality with every 10 mmHg increase in systolic blood pressure (Neaton, et al. 2005). Similarly, the Chicago Heart Association Detection Project in Industry found that every one standard deviation increase in systolic and diastolic blood pressure were associated with ~1.2 times increased risk for CHD mortality (Miura, et al. 2001a). And a meta-analysis of 61 prospective cohort studies (The Prospective Studies Collaboration) found a consistent 2-fold increased risk of CVD mortality for each 20 mmHg increase in SBP and 10 mmHg increase in DBP across the blood pressure range, as low as 115/75 mmHg (Lewington, et al. 2002).

While the above statistics all describe the health risk associated with adult blood pressure, it is now well established that the origins of that risk are found earlier in life. Prior to the 1970s, it was widely believed that high blood pressure in young people was solely the result of secondary, often genetic, conditions, and thus was not consistently monitored (Falkner and

Sadowski 1995). But after a National Heart, Lung, and Blood Institute task force published the first standards for classifying pediatric blood pressure in 1977, the issue began receiving more attention (Sadowski and Falkner 1996). It was soon recognized that high blood pressure in children and adolescents was far more common than was previously realized, and was often primary, or essential, hypertension. With the concomitant recognition that atherosclerosis could also be found in young people, researchers began to increasingly look to youth for the development of cardiovascular disease risk and comorbidity (McGill and McMahan 2003).

Several longitudinal studies have now found that the percentile ranking of an individual's blood pressure within the population distribution tends to remain fairly consistent across the lifespan, from childhood through adulthood (Bao, et al. 1995; Berenson and Srnivasan 2005; Cook, et al. 2000; Ingelfinger 2004; Lawlor and Smith 2005; Vos, et al. 2003). The Bogalusa Heart Study was the first major epidemiological study to establish this phenomenon of blood pressure tracking (Berenson, et al. 1982), and has continued to document the pattern. Specifically, with over 30 years of follow-up, the Bogalusa Study has found tracking correlations between childhood and adult blood pressure to be between 0.36 and 0.50 depending on gender for systolic pressure, and between 0.20 and 0.42 for diastolic pressure (Bao, et al. 1995). That study also found that being in the top quintile of systolic blood pressure in childhood confers a 3.6 times increased risk for hypertension in adulthood, and high diastolic pressure is associated with an increased risk of 2.6 (Bao, et al. 1995). Other studies, including the Atherosclerosis Risk in Young Adults Study (Vos et al 2003) and the Odense Schoolchild Study (Lambrechtsen, et al. 1999) have found similar blood pressure tracking patterns. Additionally, Cook and colleagues (Cook, et al. 2000) have found that combining multiple measurements from individual years,

rather than using single measures for each time point, significantly increases tracking correlations and improves the power of childhood blood pressure levels to predict adult values.

Like adult cardiovascular risk factors, childhood comorbidities, and their tracking across the lifespan, tend to cluster together (NHLBI 2004). Body mass index (BMI) is by far the strongest correlate of childhood and adolescent blood pressure (Chen, et al. 2007; NHLBI 2004; Sorof, et al. 2004). Hypertension has been found in approximately 30% of overweight children (NHLBI 2004), and recent increases in the documentation of pediatric hypertension are highly correlated with trends of increasing childhood obesity (Ogden, et al. 2002). Other metabolic risk factors, including high serum low-density lipoprotein (LDL) cholesterol levels, low high-density lipoprotein (HDL) levels, and altered glucose tolerance are also often associated with high blood pressure in childhood and adolescence (Berenson and Srnivasan 2005; Chen, et al. 2007; NHLBI 2004). Like blood pressure alone, the clustering of these risk factors tends to track across the lifespan (Chen, et al. 2007), and are associated with the emergence of atherosclerosis in youth and an increased severity of the condition in adulthood (Berenson, et al. 1998; McGill, et al. 2001).

As in adults, race is also often associated with higher blood pressure and other risk factors in childhood and adolescence, suggesting that racial disparities in cardiovascular health begin early in life (Lane and Gill 2004). While some studies have not found race to be associated with blood pressure in youth (Sorof, et al. 2004), the majority of studies that have examined this issue have found African American youth to have significantly higher blood pressure than their white peers (Alpert and Fox 1993; Lane and Gill 2004). Specifically, the Bogalusa Heart Study (Berenson, et al. 1982) and third National Health and Nutrition Examination Survey (NHANES III) (Muntaner, et al. 2004), as well as several smaller community studies (Alpert and Fox 1993;

Hlaing, et al. 2006; Lane and Gill 2004; Rabinowitz, et al. 1993), have all found African American youth to show consistently higher blood pressure than white youth. Some studies have found these racial differences to be higher among females (Rabinowitz, et al. 1993) and in older adolescents (Muntaner, et al. 2004). The dramatic increase in obesity rates among young African American females may contribute to these observed patterns (Berenson 2002). However, racial differences in blood pressure and other cardiovascular risk factors in youth have been found to remain after controlling for BMI, socioeconomic status, and other covariates (Lane and Gill 2004; Winkleby, et al. 1999).

Is stress associated with adolescent blood pressure or CVD risk?

While obesity and other conventional risk factors explain some of the prevalence of pediatric high blood pressure and its higher rate among African American youth, psychosocial stress may also play a role in these emerging health disparities. Relatively little research has examined the impact of stress on adolescent blood pressure. Several studies have found that low socioeconomic status, a potential psychosocial stressor, is associated with higher blood pressure in youth (Chen, et al. 2004; Chen, et al. 2002; Weinrich, et al. 2000). Exposure to acute stress, in the form of experiencing a natural disaster, has been shown to be associated with higher diastolic blood pressure in African American and white adolescents (Weinrich, et al. 2000). Higher blood pressure has been found among African American adolescents who self-report having experienced intra-familial conflict (Clark and Armstead 2000). Observing or personally experiencing violence has been found to be associated with higher systolic and diastolic blood pressure among black and white urban teenagers (Murali and Chen 2005). And in an intervention trial for lowering blood pressure among African American high school students, a transcendental

stress reduction program was found to have a greater impact on blood pressure than a health education intervention (Barnes, et al. 2004). These findings provide additional indirect evidence of the importance of stress for youth blood pressure (Barnes, et al. 2004). One study has reported no relationship between perceived stress and adolescent blood pressure (Caputo, et al. 2000), but this study was conducted among very young adolescents (6^{th} grade).

Other research exploring stress and adolescent blood pressure has focused on personality and psychological factors. In laboratory tests, adolescents who interpret stressful situations as threatening have been found to exhibit higher DBP reactivity, and those who interpret stressors as challenging show greater SBP reactivity (Chen, et al. 2004). Adolescents who exhibit an anxious attachment orientation have been found to have higher ambulatory systolic and diastolic blood pressure (Gallo and Matthews 2006). An agonistic striving personality style has also been associated with higher diastolic pressure in black and white adolescents (Ewart and Jorgensen 2004). And several studies have found associations between anger, especially suppressed anger, and adolescent blood pressure in both black and white males and females (Ewart and Kolodner 1994; Johnson 1989; Johnson, et al. 1987a; Johnson, et al. 1987b; Weinrich, et al. 2000). These studies suggest that cognitive/emotional and psychosocial stress factors do influence adolescent blood pressure. However, clearly more research is needed to better elucidate the impact of stress on youth blood pressure and its potential role in the emergence of health inequalities.

Phase 3 Sample Description

Characteristics of the 109 high school aged participants in phase three of the study are presented in Table 6.1. The percentage of current smokers, as well as means and standard

deviations for systolic and diastolic blood pressure, cultural consonance variables, psychological variables, SES, and covariates are presented for the total sample and separately by gender.

Table 6.1. Sample Characteristics for Phase 3 Participants, total sample and by gender (Mean (sd) or %)

Variable	***Boys***	***Girls***	***Total***
Consonance - Stressors	18.9 (6.76)	18.60 (6.33)	18.69 (6.43)
Consonance – Status	27.82 (8.16)	29.10 (9.65)	28.71 (9.20)
Consonance - Support	4.2 (1.57)	4.51 (1.03)	4.29 (1.35)
Mother's Occupational Status (SES)	47.64 (30.63)	47.45 (25.57)	47.5 (26.86)
Father's Occupational Status (SES)	46.48 (31.92)	41.89 (26.66)	43.19 (28.10)
Perceived Stress	20.94 (6.58)	23.33 (6.98)	22.58 (6.91)
Depression	2.94 (1.46)	3.16 (2.29)	3.09 (2.06)
Anxiety	8.55 (2.17)	9.31 (3.25)	9.08 (2.98)
SSS - Student	7.03 (1.30)	7.49 (1.90)	7.35 (1.74)
SSS - Family	6.32 (1.3)	6.13 (1.62)	6.18 (1.53)
SBP*	132.2 (11.03)	119.57 (10.44)	123.47 (12.09)
DBP	69.82 (8.32)	70.20 (9.68)	70.09 (9.25)
Height*	177.34 (7.23)	164.51 (6.60)	168.43 (9.00)
Weight*	77.48 (21.07)	68.33 (19.14)	71.13 (20.09)
BMI	24.68 (6.96)	25.15 (6.52)	25.01 (6.63)
Age	16.73 (0.67)	16.92 (1.22)	16.86 (1.08)
Physical Activity (days/week)*	4.83 (2.14)	3.97 (2.09)	4.18 (2.40)
% Smokers*	18%	3%	7.4%
N	34	75	109

* statistically significant gender difference, $p<0.05$ for t-test of means or χ^2 test of proportions.

Demographics and Covariates

As with the first two phases of research, more girls participated in phase 3 of the study than boys (75 girls, 34 boys). This may reflect a gender bias in those Maywood youth who have

chosen to remain in high school despite the lack of an enforced attendance policy, or simply a bias in those students who were willing to participate in this study. The average age of participants was between 16 and 17 years (16.86). While there was relatively little variation in age among this sample and most participants were within a year of the average (SD = 1.08), the full age range for phase three participants was 14 – 20 years. There were no significant gender differences in age. Smoking prevalence was very low among this adolescent sample, with only 7.4% of participants reporting that they currently smoked. The reported smoking rate for males was significantly higher than for females (18% vs. 3%, p = 0.005).

The mean Nam-Powers-Boyd occupational status score for mothers of participants was 47.5 (sd=26.86), with no significant difference between the mothers of male and female participants. The mean occupational status score for fathers was 43.19 (sd=28.10), again with no difference between girls' and boys' fathers. Both mothers' and fathers' occupational scores are consistent with, but slightly lower than, national averages of 51.0 for men and 48.8 for women. Scores are also fairly consistent with, but slightly higher than, national data for African Americans (mean=42.4). Both mothers' and fathers' occupational status scores exhibited considerable variation within the sample, ranging from 0 to 86 for mothers and 0 to 93 for fathers. To provide some context for what these scores represent, an occupational status score in the mid-40s was associated with such occupations as truck driver and factory machine operator for fathers and several billing, clerical, and healthcare assistant jobs for mothers. At the more extreme ends of the range, a score of 0 indicated a parent was unemployed and scores in the 80-90 range were associated with such jobs as architect, business owner, and engineer.

After providing a definition of "physical activity", the two-question PACE+ physical activity measure asked participants to self-report how many days (0 – 7) in the past week they

had been active for at least an hour, as well how many days in a typical week they are active for at least an hour. Participant responses were very similar for 'past week' (4.18, sd=2.40) and 'typical week' (4.27, sd=2.07). Thus, according to standard scoring procedures for this instrument (Prochaska, et al. 2001), these two variables were averaged to create a single measure of self-reported physical activity. Using this combined measure, participants averaged just over four days of physical activity per week (4.18, sd=2.4). Boys were found to report significantly higher physical activity levels than girls in this sample (4.83 days vs. 3.97 days, $p = 0.05$).

The average body mass index (BMI) of adolescent participants in this study was 25.01 (sd=6.63). While girls had, on average, higher BMI than boys (25.15 vs. 24.68), this gender difference was not statistically significant. For both boys and girls, mean BMI levels were above average. Among adults, BMI of 25.0 is the threshold for defining overweight status. In children and adolescents, BMI is categorized by age, rather than with fixed thresholds. According to the CDC's BMI-for-age growth charts, the average (50^{th} percentile) BMI for boys aged ~16.8 years is 21.0. For girls of that age, the 50^{th} percentile is a BMI of 20.8. The average body mass indices for both boys and girls in this sample are at approximately the 85^{th} percentile, which is classified by the CDC as "at risk for overweight".

Blood Pressure

Average systolic blood pressure for this adolescent sample was 123.47 mmHg (sd=12.09); however there were large gender differences. Boys had significantly higher SBP than girls (132.2 mmHg vs. 119.57 mmHg, $p = 0.00$). Average diastolic blood pressure was 70.09 mmHg (sd=9.25), and was not significantly different between boys and girls ($p = 0.85$). Child and adolescent blood pressure is categorized by age and height percentiles, rather than by standard thresholds. The mean height of boys in this sample is 177.35 cm (sd=7.24), and their

mean height percentile for age is 56.94. Girls have a mean height of 164.51 cm (sd=6.60), and a mean height-for-age percentile of 57.57. At this height percentile and age, the average SBP for boys, according to the CDC is between 116 and 118 mmHg. For girls, average SBP at that height and age is between 111 and 112 mmHg. The average SBP of boys in this sample is thus far higher than the average for other boys of their age and height. In fact, the mean SBP of boys in this study is between the 90th and 95th percentiles for other boys of their average height. Girls in this sample, on the other hand, are only at approximately the 80th percentile for other girls of their age and mean height. The mean diastolic blood pressures of this sample are, by contrast, much lower, with the mean for both boys and girls at approximately the 60th percentile for their age and average height.

When compared to data from NHANES 1999-2000, adolescents in this study appear somewhat worse off with respect to blood pressure than when compared to CDC growth charts. In the national NHANES sample, mean systolic blood pressure for African American adolescent boys aged 16-17 was between 116 and 118 mmHg, and diastolic pressure was between 63 and 64 mmHg (Muntner, et al. 2004). For African American girls of that age, systolic pressure was 108 mmHg, and diastolic pressure was between 62 and 66 mmHg (Muntner, et al. 2004). Thus, compared to this national sample, teens in Maywood have notably higher blood pressure. To illustrate these findings, Figure 6.1 plots the mean systolic and diastolic pressure for boys and girls in this study against the blood pressure growth curves of the NHANES 1999-2000 sample (all race/ethnic groups).

The remarkably high systolic pressures seen among boys in the Maywood sample are unusual, particularly since diastolic pressures are comparatively low. This phenomenon of high pulse pressure (indicated by the difference between and individual's SBP and DBP), or isolated

systolic hypertension, is primarily seen in older populations and is attributable to the stiffening of arterial walls over time (Miura, et al. 2001b). The phenomenon of high pulse pressure has, however, been noted among young adults, particularly adolescent males, and is thought to be due to the stretching of arterial walls during rapid height increases (Pickering, et al. 2005). These temporary changes in arterial wall elasticity can cause systolic pressure in the brachial artery to be elevated while diastolic and mean pressures are normal. In this adolescent sample, height is a significant predictor of systolic pressure (B=0.56, p=0.00). While this is not a measure of how recently these youth may have experienced growth spurts, it suggests that increases in height could have contributed to the high pulse pressures observed.

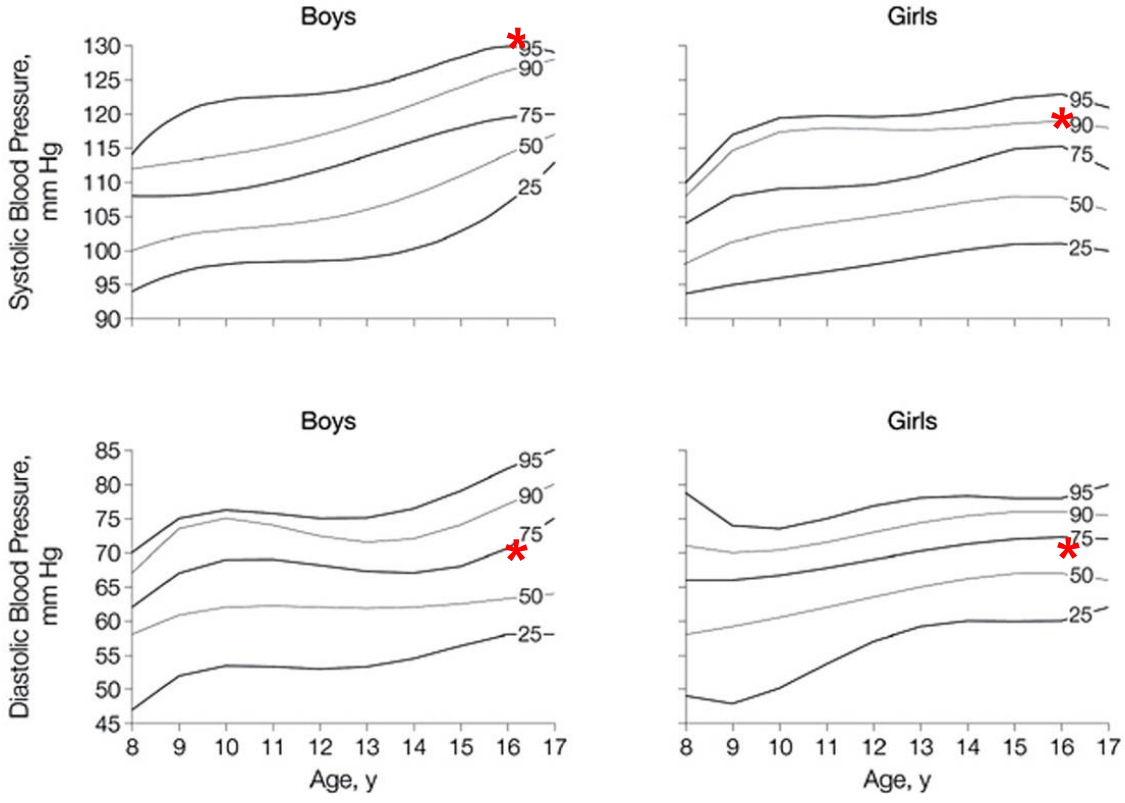


Figure 6.1. Comparison of Phase 3 Sample to NHANES 1999-2000 for Systolic and Diastolic Blood Pressure

Figure from Muntner et al 2004.

Psychological Variables

Mean perceived stress (PSS) scores were 22.58 (sd=6.91) for this sample. While girls reported higher perceived stress than boys (23.33 vs. 20.94), this gender difference was only of marginal statistical significance (p = 0.09). National normative data for the perceived stress scale are available only for adults (Cohen 1988), and indicate a mean PSS score of 14.2 for younger adults (aged 18-29) and 14.7 for African American adults. A previous application of the perceived stress scale among adolescents (average age of 15 years) found mean PSS scores to be 24.2 for a biracial sample, and 25.2 for African American youth (Goodman, et al. 2005a). The perceived stress scores of adolescents in Maywood are thus consistent with, and slightly lower than, those found for other adolescent samples.

The mean score on the depression sub-component of the Hospital Anxiety and Depression Scale (HADS) was 3.09 (sd=2.06), with no significant differences between genders (p=0.60). For the anxiety subcomponent, the mean score was 9.08 (sd=2.98), again with no significant gender difference (p=0.22). While the HADS has been validated for use with adolescents (White, et al. 1999), normative data for a non-clinical sample of youth are not available. However, among a college-aged sample, mean depression scores were found to be 3.23 and mean anxiety scores were reported at 7.30 (Caci, et al. 2003). Maywood adolescents thus report depression scores that are consistent with other published data, and anxiety scores that are slightly higher than that observed among college-aged young adults.

Mean rankings on the MacArthur Subjective Social Standing (SSS) Scale (youth version) were 7.35 (sd=1.74) for the student subscale and 6.18 (sd=1.53) for the family subscale. Girls ranked themselves slightly higher than boys with respect to their status within the school (7.49 vs. 7.03), however this difference was not statistically significant (p=0.22). Boys and girls ranked

their families' status within society very similarly. Both boys and girls ranked their own status in school higher than their family's status in society. This is consistent with previous research using the SSS scale (Goodman, et al. 2001), which found that mean student rankings were slightly higher than mean family rankings (7.6 vs. 7.2). Goodman et al (2001) also found that girls' mean student rankings were higher than that of boys (7.7 vs. 7.5) and that there were no gender differences in family rankings. Therefore, subjective social standing rankings for youth in Maywood are fairly consistent in value and in the pattern of gender difference for both the student and family subscales. Maywood youth, however, do rank their family status positions within society lower than other teens.

Cultural Consonance in Stressors

Weighted cultural consonance scores for stressors ranged from 2.15 to 36.34, and averaged 18.69 (sd=6.43). With a total possible score of 41.62, this mean score represents a moderate burden of exposure to stressors for these youth. There were no significant gender differences in mean scores for consonance in stressors, and scores were normally distributed. Means and standard deviations are presented in Table 6.2 for cultural consonance in participant-derived categories of stressors. These categories are based on the general classes of stressors that participants described in phase one interviews (see chapter 5). There were no gender differences in mean scores for each of the stressor categories.

Table 6.2. Cultural Consonance in Participant-derived Categories of Stressors (Mean Consonance Score and (SD))

	Boys	***Girls***	***Total***
Home-related Stressors	2.67 (2.06)	2.49 (2.48)	2.55 (2.35)
Peer-related Stressors	5.16 (3.16)	5.20 (2.98)	5.19 (3.02)
General Life Stressors	5.04 (2.97)	5.37 (2.86)	5.27 (2.89)
School-related Stressors	5.05 (1.91)	4.70 (1.79)	4.81 (1.82)

Cultural Consonance in Social Status

Weighted cultural consonance scores for social status ranged from 6.06 to 55.35, and averaged 28.71 (sd=9.20). There were no significant gender differences in consonance in social status, and scores were normally distributed. With a total possible score of 71.7, the average consonance score represents a modest level of cultural consonance in social status for Maywood youth. The relatively low mean social status of youth, compared to the maximum score possible on this culturally-derived scale, is not surprising given the relative economic status of most families in Maywood. Several of the technology items and clothing brands that received high status scores in the phase 2 consensus analysis were relatively expensive (such as laptop computers, iPods, and cars), and many Maywood youth would not be expected to own more than one or two higher priced material items. Means and standard deviations for the two participant-derived categories of social status are presented in Table 6.3. While girls had slightly higher material status and boys had slightly higher behavioral-based status, these gender differences were not statistically significant.

Table 6.3. Cultural Consonance in Participant-derived Categories of Social Status (Mean Consonance Score and (SD))

	Boys	***Girls***	***Total***
Material Social Status	11.36 (4.58)	13.39 (6.38)	12.77 (5.94)
Social/Behavioral Social Status	16.46 (4.92)	15.71 (5.67)	15.94 (5.44)

In addition to these participant-derived categories of social status, factor analysis was used to determine sources of social status that tended to cluster together. The first factor in this analysis had an eigenvalue of 3.57 and explained 12% of the variance in consonance in social status. This factor was associated with a constellation of social status indicators that seemed to

indicate general social popularity, and thus was labeled ‘popular’. This factor included hanging with a popular crowd, going to parties, going out to eat with friends, and talking about other people at school. The second factor, labeled ‘K-Swiss’ was strongly associated with one of the most contested items in phase one interviews – K-Swiss shoes, as well as with two exclusively female indicators of social status – being a cheerleader and being in a dance troupe. The third factor, labeled ‘money’ was associated with several of the most expensive status indicators, including Juicy brand clothes, a nice car, two different cell phones, and Bluetooth. The fourth factor, labeled ‘general’, was associated with several general status items, including a laptop computer, iPod, being involved in school activities and being on the basketball and track teams. Factor loadings for these factors are presented in Table 6.4 (only loadings above 0.30 are listed). These four factors together accounted for 32% of the variance in social status.

Table 6.4. Factor Loadings for Cultural Consonance in Social Status

	Popular	***KSwiss***	***Money***	***General***
Ecko		0.50		
Juicy			0.44	
KSwiss	-0.31	0.70		
Unlisted				0.42
Nice car			0.38	
Big truck		0.32		
Razr phone			0.72	
Nextel phone	0.51			
T-Mobile phone			0.51	
Bluetooth			0.67	
iPod				0.70
Sidekick	-0.31			0.31
Laptop computer				0.61
Basketball team				0.43
Football team				
Cheerleader		0.46		
Dance troupe		0.71		
Track team				0.48
Being in a gang				
Not feeling too skinny or overweight				
‘Talking about’ other people at school	0.62			
Going to house parties	0.71			

Having money	0.31			
Acting like you have money				0.31
Hanging with a popular crowd	0.32			
Being a junior or senior		-0.50		
Going to the club Nitro	0.66			
Going bowling with friends				
Playing laser tag with friends				
Going out to eat with friends	0.36			
Being involved at school				0.34

Cultural Consonance in Social Support

Since consensus was low for the rankings of sources of social support, the phase 2 consensus analysis was used only as a guide for analyzing consonance in social support. In phase 3 respondents provided personal rankings of who they would turn to for support when faced with a personal problem, when they needed money, and when they wanted to have fun. Social support scores for each of those three categories were computed as the number of supporters in the top three of participants' personal rankings that were also in the top three average rankings of the phase 2 consensus analysis. For instance, for a personal problem, the supporters receiving the highest average rankings in the consensus analysis were 'best friend', 'mom', and 'sibling'. Therefore, if a phase 3 participants ranked 'best friend', 'mom' and 'cousin' in their top three personal rankings, they would receive a score of 2 for consonance in social support for a personal problem. Since the total number of supporters listed for the 'fun' category was relatively small, only the top 2 rankings were considered. A composite social support consonance score was then computed as the sum of consonance scores for each of the three categories (personal problem, money, and fun). The minimum possible consonance in social support score was 0 and the maximum was 8. The mean social support consonance score was 4.29 (1.35), with no significant difference between genders ($p=0.27$).

Results: Explaining Variation in Blood Pressure

Standard Covariates

Gender explained the largest portion of the variance in systolic blood pressure, with R^2 = 0.23. BMI and age explained an additional 6% of the variance, and smoking and physical activity levels explained a further 4%. With all covariates included in the model, 33.8% of the variance in systolic pressure was explained (see Table 2). By contrast, gender only explained ~1% of the variance in diastolic blood pressure, and the contributions of age, smoking, and physical activity were equally low or lower. BMI was the strongest predictor of diastolic pressure, and explained ~19% of the total variance. All of the covariates together explained ~22% of the total variance in diastolic pressure (see table 6.5). As mentioned above in the discussion of pulse pressure, height is also a significant predictor of systolic blood pressure in this sample, but does not remain significant when other covariates are added to the model. Since BMI is a stronger predictor of SBP than height alone, only BMI is included in the model in Table 6.5.

Table 6.5. Standard Covariates as Predictors of SBP and DBP in Multiple Regression Analyses (β and (SE))

	SBP	***DBP***
Gender (female)	**-13.97 (2.28)	0.45 (1.90)
BMI	**0.53 (0.16)	**0.65 (0.13)
Age	-0.99 (0.92)	-1.26 (0.76)
Smoker	*-8.37 (3.93)	1.12 (3.27)
Physical Activity	0.45 (0.48)	0.12 (0.40)
R^2	*0.338*	*0.218*

*p<0.05, **p<0.01

Cultural Consonance in Stress

Cultural consonance in stress was not a significant predictor of systolic (B=-0.07, p=0.65) or diastolic blood pressure (B=0.086, p=0.51). Analyses run on participant-derived categories revealed that different types of stressors had different relationships with blood pressure. School/academic stressors, general life stressors, and peer/social stressors all explained ~1% or less of the variance in both SBP and DBP and were not statistically significant predictors of blood pressure. Consonance in home-related stressors, however, was a modestly significant predictor of DBP (p=0.10), but not SBP. As Table 6 shows, when covariates were included in the model, consonance in home-related stressors was a statistically significant predictor of DBP (p=0.049). Given the association of height to SBP in this sample, and its potential contribution to boys' higher pulse pressures, height was also considered as a covariate in separate analyses, but it did not change the pattern of findings presented in Table 6.6.

Table 6.6. Consonance in home-related stressors as a predictor of SBP and DBP in Multiple Regression Analyses (β (SE))

	SBP	*DBP*
Home Stressors	0.29 (0.43)	*0.70 (0.35)
Gender (female)	**-13.89 (2.29)	0.64 (1.88)
BMI	**0.54 (0.16)	**0.66 (0.13)
Age	-0.92 (0.92)	-1.09 (0.76)
Smoker	*-8.17 (3.95)	1.59 (3.23)
Physical Activity	0.48 (0.49)	0.18 (0.40)
R^2	*0.342*	*0.249*

*p<0.05, **p<0.01

Cultural Consonance in Social Status

Cultural consonance in social status was not a significant predictor of systolic (B=-0.07, p=0.52) or diastolic blood pressure (B=0.03, p=0.71). In analyses run on participant-derived categories, neither material-based nor behavioral-based consonance in social status was a significant predictor of blood pressure and each explained less than 1% of the total variance in systolic and diastolic pressure. However, analyses of factor-derived subscales revealed that some aspects of consonance in social status were related to adolescent BP. In particular, higher factor scores on the 'general popularity' subscale were associated with moderately lower systolic blood pressure, but not diastolic blood pressure. By contrast, higher factor scores on the 'K-Swiss' subscale were associated with moderately higher diastolic blood pressure, but not systolic pressure. These results are summarized in Table 6.7. In separate analyses, height was also considered as a covariate, but did not significantly change the pattern of findings.

Table 6.7. Social Status Subscales as Predictors of Systolic and Diastolic Blood Pressure in Multiple Regression Analyses (β and (SE))

Popularity Model	*SBP*	*DBP*
'General popularity' subscale	*-1.84 (0.98)	-1.27 (0.82)
Gender (female)	**-13.87 (2.25)	0.52 (1.89)
BMI	**0.54 (0.16)	**0.65 (0.13)
Age	-1.05 (0.90)	-1.30 (0.76)
Smoker	*-7.58 (3.90)	1.66 (3.27)
Physical Activity	0.39 (0.48)	0.08 (0.40)
R^2	*0.362*	*0.237*
K-Swiss Model	*SBP*	*DBP*
'K-Swiss' subscale	-0.03 (1.14)	*1.72 (0.93)
Gender (female)	**-13.95 (2.49)	-1.00 (2.04)
BMI	**0.53 (0.16)	**0.66 (0.13)

Age	-1.00 (0.95)	-0.88 (0.78)
Smoker	*-8.38 (3.97)	1.73 (3.25)
Physical Activity	0.46 (0.50)	-0.05 (0.40)
R^2	*0.339*	*0.245*

Cultural Consonance in Social Support

Cultural consonance in social support was not significantly related to systolic (B=-0.11, p=0.88) or diastolic blood pressure (B=-0.01, p=0.98), and explained less than 1% of the variance in each. Analyses of sub-categories of social support – for a personal problem, for money, and for fun – also did not reveal any statistically significant relationships.

Psychological Factors

Perceived stress was not a significant predictor of either systolic (B=-0.13, p=0.41) or diastolic blood pressure (B=0.02, p=0.87), and explained less than 1% of the total variance of each. Neither the anxiety nor the depression subscales of the HADS were significant predictors of SBP (Anxiety: B=0.33, p=0.32; Depression: B=0.19, p=0.69) or DBP (Anxiety: B=0.38, p=0.16; Depression: B=0.30, p=0.46), and explained ~1% or less of the variance in each. Likewise, neither of the Subjective Social Standing subscales – student status or family status – was significantly associated with systolic (Student: B=-0.39, p=0.53; Family: B=0.22, p=0.75) or diastolic blood pressure (Student: B=0.05, p=0.92; Family: B=-0.37, p=0.54).

Occupational Status

Neither mother's nor father's occupational status significantly predicted variation in blood pressure. For both systolic (Mother's SES: B=-0.07, p=0.11; Father's SES: B=-0.04, p=0.33) and diastolic blood pressure (Mother's SES: B=-0.04, p=0.20; Father's SES: B=-0.05, p=0.19), occupational status scores explained 1% or less of the total observed variation.

Results: Moderators and Mediators of Blood Pressure Relationships

Gender

Interaction analyses revealed that gender was a significant moderator of the relationship of consonance in home-related stressors to both systolic and diastolic blood pressure (p-values for interactions = 0.014, 0.026, respectively). Specifically, higher consonance in home-related stressors was associated with lower SBP and DBP for boys, but higher SBP and DBP for girls. For both boys and girls, the relationship between home stressors and SBP was approaching statistical significance, while, for DBP, the association with home stressors was only statistically significant for girls. Gender also significantly moderated the association between the 'K-Swiss' social status subscale and blood pressure (p-value for interaction = 0.011). Specifically, this social status subscale was significantly associated with higher DBP for boys, but not for girls. Table 6.8 summarizes these findings. Again in separate analyses height was considered as an additional covariate, but the pattern of findings was not changed.

Table 6.8. Home-Related Stressors and "K-Swiss" Status Scores in Interaction with Gender Predicting Systolic and Diastolic Blood Pressure (β and (SE))*

Home-related Stressors	*SBP*	*p*	*DBP*	*p*
Boys	-1.70 (0.89)	0.07	-0.33 (0.71)	0.64
Girls	0.81 (0.47)	0.09	1.03 (0.41)	0.01
'K-Swiss' Status Subscale				
Boys	3.13 (3.82)	0.42	7.85 (2.44)	0.00
Girls	0.55 (1.24)	0.66	1.18 (1.08)	0.28

* All analyses adjusted for age, BMI, smoking, and physical activity

Occupational Status

Continuous interactions between parents' occupational status scores and cultural consonance variables were tested. When an interaction term was found to be a statistically significant predictor of systolic or diastolic blood pressure, the moderating effect was explored further. Specifically, parents' occupational scores were divided into tertiles, and relationships between cultural consonance variables and blood pressure were examined within each occupational status group. Father's occupational status was not found to significantly moderate any relationship between cultural consonance and blood pressure. Mother's occupational status, however, was a significant moderator of the relationship between blood pressure and the "money" subscale of consonance in social status (SBP: B=-0.04, p=0.03; DBP: B=-0.03, p=0.03). For both SBP and DBP, having higher consonance with the 'money' subscale is associated with *higher* pressure if mother's occupational score is low, but *lower* pressure if mother's occupational status is high. In other words, youth who own expensive status items have lower BP if their mothers have high SES, but higher BP if their mothers have low SES. Table 6.9 summarizes these findings.

Table 6.9. 'Money' status scores predicting Systolic and Diastolic Blood Pressure in Multiple Regression Analyses (β (SE)), by Mother's Occupational Status

	Low SES	*Medium SES*	*High SES*
Predicting SBP	3.96 (2.62)	-0.60 (1.90)	*-3.66 (1.58)
Predicting DBP	**5.16 (1.81)	-1.46 (1.25)	-2.31 (1.45)

Adjusted for age, gender, BMI, smoking, and physical activity *p<0.05, **p<0.01

Cognitive/Emotional Mediation

The first requirement for a variable to be considered as a mediator of a statistical relationship is that the potential mediating variable be significantly associated with both the main predictor and the main outcome variables. The four psychological parameters that were measured – perceived stress, depression, anxiety, and subjective social standing – were not associated with either of the blood pressure outcome variables (see above). Therefore, tests for mediation were not conducted with these psychological factors.

Discussion/Conclusion

Relatively few studies have examined the impact of exposure to stressors on adolescent blood pressure, and even fewer have examined this issue in African American youth. The analyses presented here explore the relationships between culturally meaningful stressors and blood pressure in a predominantly minority youth sample. The findings show that consonance with key aspects of cultural models of stressors and social status was significantly associated with blood pressure, independent of standard covariates.

Higher cultural consonance with the sub-category of home-related stressors – representing a greater burden of exposure to these culturally meaningful stressors – was found to be predictive of diastolic blood pressure (Figure 6.2). This indicates that stressors related to relationships with parents (feeling that parents are controlling, having had a parent pass away) and the home environment (having a 'bad home life') may be particularly important sources of stress for adolescents, in terms of consequences for their health. This finding is particularly meaningful because, of the sources of stress included in the cultural model, home-related

stressors are likely to have had the longest duration of exposure for youth, indicating a strong developmental component to the effect of exposure to stressors on blood pressure.

Interaction analyses revealed that the relationship between higher exposure to home-stressors and blood pressure was only present for girls. By contrast, for boys this relationship was negative and approaching statistical significance only for systolic pressure. It is unknown why the relationship between home-based stressors and blood pressure would be so markedly different for boys and girls. But this finding suggests that girls' experience of stressors related to their home life and parents may have a particularly negative impact on their health, and should be explored in future research.

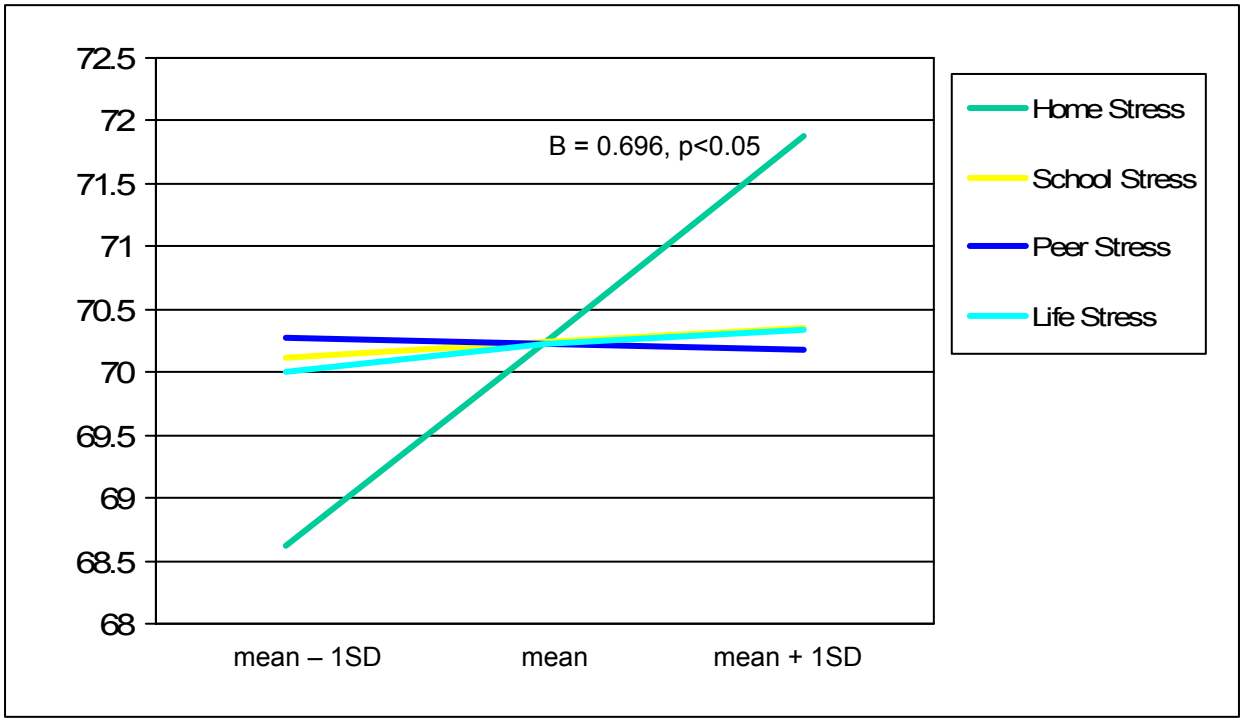


Figure 6.2. Relationships of sub-categories of salient stressors to DBP (adjusted, predicted values for linear relationship

While the statistical relationships were only modest, two subscales of culturally meaningful indicators of social status were found to be related to blood pressure. Specifically,

higher scores on the 'general popularity' social status factor were associated with lower systolic blood pressure. This subscale, which included such status indicators as hanging with a popular crowd, going to house parties, and going to a popular dance club, seemed to represent general social popularity and abundant social interaction. The association of this factor with lower blood pressure is thus not surprising, as high social status and positive social relationships are expected to have a positive impact on health.

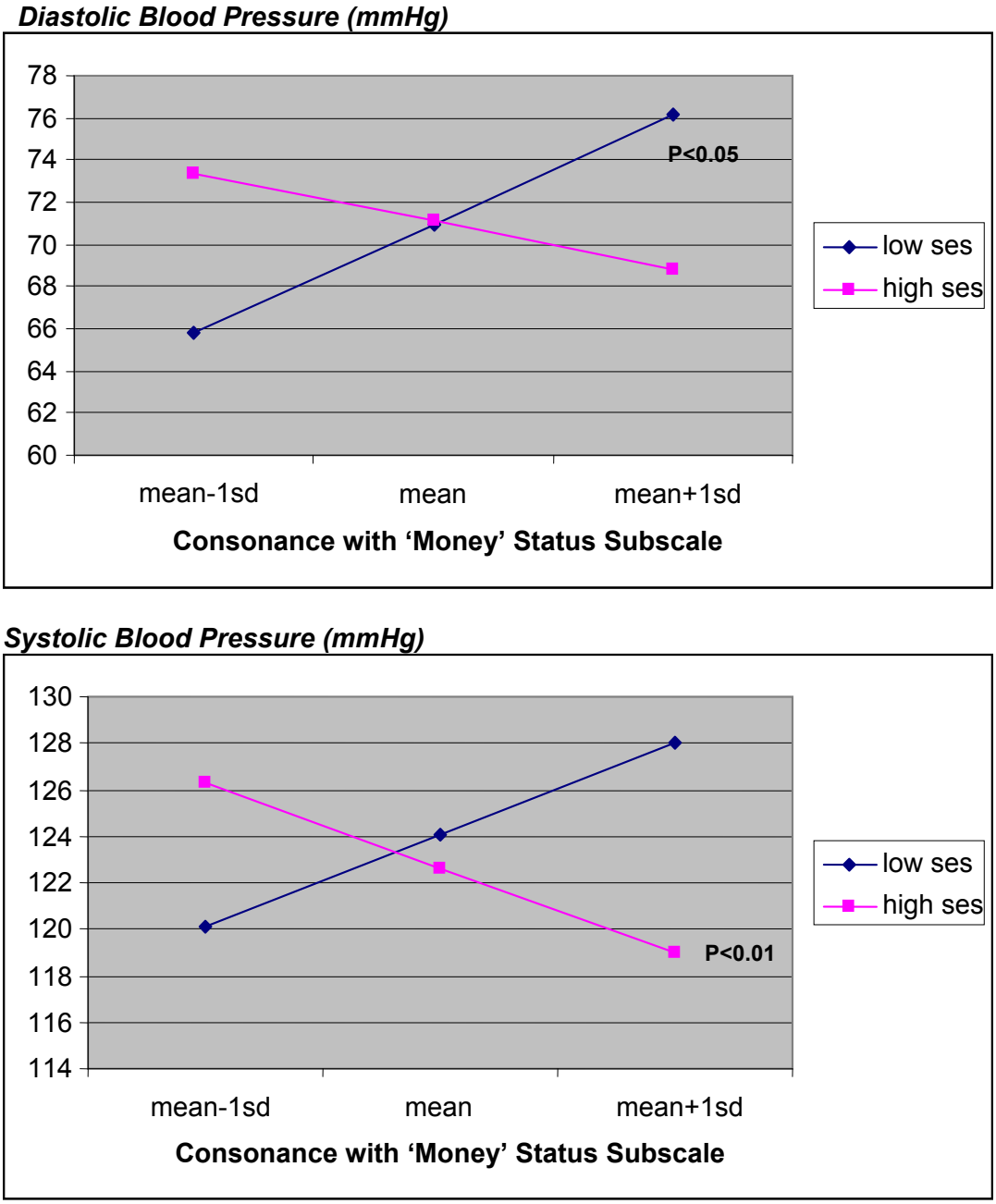
In contrast to this relationship, higher scores on the 'K-Swiss' social status factor were associated with higher diastolic blood pressure. Gender interaction analyses revealed that the relationship between this status factor and DBP was only significant for boys. Since two of the indicators that were strongly associated with this factor - being a cheerleader and being on a dance troupe – were exclusive to female participants, the contribution of each separate item in this factor was explored to see what was driving the association with blood pressure. Wearing KSwiss shoes and the Ecko clothing brand were the two items in this factor that were strongly associated with boys' higher diastolic blood pressure.

As discussed in Chapter 5, the K-Swiss shoe brand was one of the most contested items in phase 1 interviews and the phase 2 consensus analysis. While many respondents considered the brand to be an important indicator of status, a self-identified 'high status' participant described the brand as indicating *low* status and being cheap. This participant also described a popular song that ridiculed kids who wore this brand and the use of the song by other teens to publicly stigmatize students who wore K-Swiss shoes. Ecko brand clothing was also a somewhat contested item in the ethnographic phases of the study, as higher status focus group participants indicated that it was no longer in fashion by the end of second phase of research. It is therefore not entirely surprising that these two brands could be associated with higher blood pressure. In

addition to the direct stigmatization that may potentially be associated with them, wearing these brands may indicate a generally 'outdated' or inaccurate model of social status. For boys, wearing these brands may be particularly problematic because they are associated with being cheap, and as one male interview respondent described, there is specific pressure on boys to have the appearance of money: "when the girls see you getting that type of style…in clothes that cost a lot of money, and they see that you got almost everything on, they'll come after you cause they think you got money and stuff" (Participant #12, male).

Blood pressure was also found to be associated with higher scores on the 'money' factor of cultural consonance in social status, but only in interaction with parental socioeconomic status (see Figure 3). Items that loaded highly on this factor were primarily expensive clothing and technology items, such as the Juicy clothing brand, nice cars, Razr and T-Mobile cell phones, and Bluetooth technology. As was discussed in Chapter 5, the Juicy clothing brand was described as a very high-priced and high-status item, and, in focus groups, only those participants who self-identified as having high social status were familiar with the brand. It is thus unsurprising that attaining such expensive and exclusive social status indicators would only confer benefits for those who have the economic resources to support them, while for those with low financial resources, attaining those status items would be stressful. This finding is consistent with a status incongruity model of SES and health. As described in Chapter 3, several researchers have found that inconsistencies between different aspects of an individual's social status – their income vs. their material lifestyle, for instance – are associated with poorer health and higher stress. The relationship illustrated in Figure 6.3 is clearly an example of the health effects of such status inconsistencies.

Figure 6.3. Plot of Adjusted Predicted Values for Effect of Consonance in "money" status subscale on SBP and DBP, by Mother's Occupational Status



In sum, the findings described in this chapter highlight the importance of using culturally-relevant measures in adolescent stress research. For urban, low income adolescents in Maywood,

exposure to the sources of stress that are most meaningful to youth in their community is what matters for their cardiovascular health, rather than conventional psychological indicators of stress (see Figure 6.4). Similarly, conforming to culturally-relevant norms of social status is an important predictor of adolescent blood pressure. As participants' earlier ethnographic interviews indicated, youth-defined social status is complex, and consists of highly symbolic indicators of social inclusion and material resources. The findings presented here show that those symbols matter for adolescent health, particularly in how they both represent and contradict the underlying socioeconomic reality of growing up in the Maywood community. The stresses that Maywood adolescents face in their everyday lives thus play important roles in shaping their emergent cardiovascular health risk.

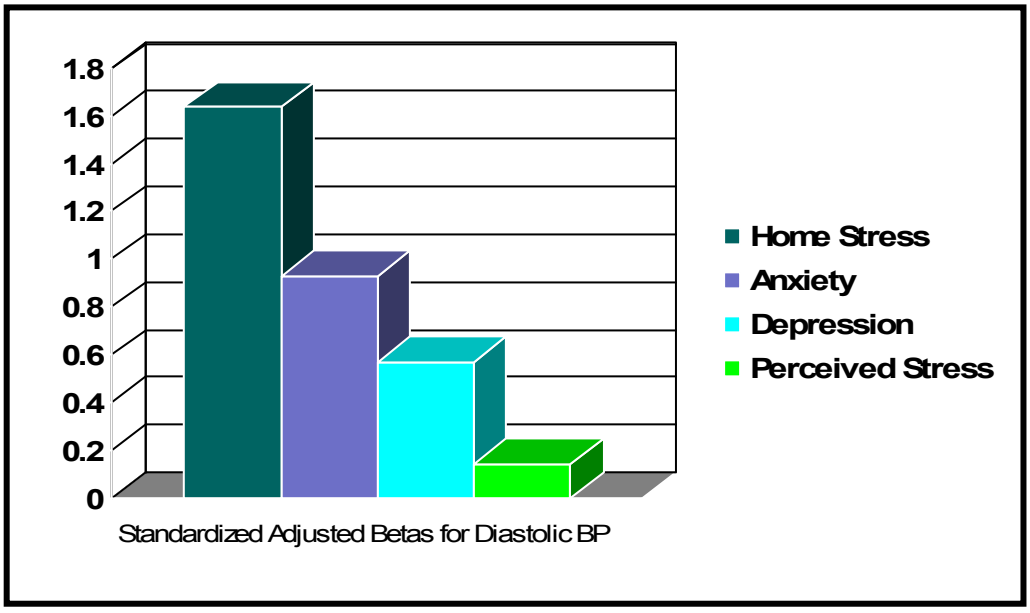


Figure 6.4. Cultural Consonance vs. Subjective Measures
Comparison of standardized adjusted betas for home-related stressors and subjective measures as predictors of diastolic blood pressure

Chapter 7

Adolescent Stress and Health: Psychological Factors, Cultural Consonance and Cortisol

As with blood pressure, adolescence is increasingly being recognized as a critical period for the developmental origins of psychopathology and adverse neurobiological processes (Goodyer 2002; Romeo and McEwen 2006). It is now well established that heightened stress and negative emotional symptoms during adolescence are associated with significantly increased risk of developing psychological disorders, such as clinical depression and anxiety, in adulthood (Goodyer 2002; Grant, et al. 2003; Hayward and Sanborn 2002; Masten 2004; McCormick and Mathews 2007; McGue and Iacono 2005; Romeo and McEwen 2006; Turner and Lloyd 2004). There is also accumulating evidence that the neural and hormonal systems that underlie these disorders and other physical health risks can be programmed during the critical adolescent developmental window.

In addition to being a period of social and emotional transition, adolescence is known to be a critical time for structural development of brain regions linked to emotional processing and stress reactivity (McCormick and Mathews 2007; Romeo and McEwen 2006). It is also an important age for the programming of the hypothalamic-pituitary-adrenal (HPA) axis, which can prime the body's stress system to become chronically over-activated or dysregulated later in life (Charmandari, et al. 2003; Romeo and McEwen 2006). Because of the heightened plasticity of the stress system during adolescence, this can also serve as a critical period for reversing or altering adverse developmental consequences of prenatal and early childhood stress (Romeo and McEwen 2006). Animal models show that environmental enrichment in adolescence can reverse some of the cognitive, behavioral, and HPA-axis programming effects of prenatal stress exposure

as well as maternal neglect and separation in infancy (Bredy, et al. 2003; Francis, et al. 2002; Laviola, et al. 2004; Morley-Fletcher, et al. 2003).

Thus, like prenatal and early life periods, adolescence is a critical developmental window during which physiological and emotional responses to stress can be molded. Hyper-activation of the stress response system during this time can have permanent organizational effects on the brain and body, predisposing individuals to pathological emotional and HPA-axis functioning in adulthood. However, despite the importance of this developmental stage for the origins of adult chronic disease, it has received far less research attention than the fetal and infant periods (McCormick and Mathews 2007). A better understanding is needed of how stress exposure affects adolescent psychological and stress response systems, and how it can influence adult disease and health inequality.

Adolescent Stress and Health

Adolescent stress research has been described as a field "early in its development" (Grant, et al. 2003). While adult psychosocial stress has received abundant research attention (see review in chapter 3), comparatively less is known about the relationships among stress and adolescent emotional and physical health (Goodyer 2002; Grant, et al. 2003). Research that has been conducted, however, does consistently suggest associations between stressful experiences and several psychological outcomes. A recent review found that 53 of 60 studies examining prospective relationships between stressful life events and psychological symptoms in adolescents found evidence to support such relationships (Grant, et al. 2003). Chronic and acute life stressors, daily hassles, and several specific psychosocial stressors, such as sexual and other forms of abuse, poverty, exposure to community violence, and parental divorce have been found to be associated with adverse psychological symptoms (Bolland, et al. 2005; Finkelstein, et al.

2007; Goodyer 2002; McMahon, et al. 2003; Schneiders, et al. 2006). Depression is the most extensively studied psychological outcome, with several studies showing relationships between stressful life events and depressive symptoms in adolescents (Compas, et al. 1993; Espejo, et al. 2007; Goodyer 2002; Grant, et al. 2003; McGue and Iacono 2005; Natsuaki, et al. 2007; Paxton, et al. 2004). Negative affect (Schneiders, et al. 2006), perceived stress (Finkelstein, et al. 2007), antisocial personality traits (McGue and Iacono 2005), problem behaviors (McGue and Iacono 2005), PTSD (McMahon, et al. 2003; Paxton, et al. 2004), and other general internalizing and externalizing psychological symptoms (Bolland, et al. 2005; McMahon, et al. 2003) have also been shown in some studies to be associated with increased exposure to stressful experiences.

Research has also found stressful experiences and negative psychological states to be associated with altered HPA-axis functioning in adolescents. Depression has been shown to be associated with both higher (Goodyer 2002) and lower basal cortisol levels in adolescents (Adam 2006). General negative mood states have shown associations with higher basal cortisol (Adam 2006), and anxiety was found to be related to higher cortisol in pregnant adolescent females (Rondo, et al. 2004). Adolescents who have a parent with depressive symptoms or a psychological disorder have also been found to have higher cortisol levels (Ellenbogen, et al. 2006; Halligan, et al. 2004; Lupien, et al. 2000). Lower cortisol levels have been found among adolescents who experience peer victimization (Kliewer 2006), and among boys who exhibit higher callous-unemotional personality traits (Loney, et al. 2006) and externalizing behaviors (Shirtcliff, et al. 2005). Exposure to community violence has shown varied associations with cortisol, including both lower and higher levels, as well as atypical awakening responses (Kliewer 2006; Murali and Chen 2005). Clearly, as in adults, adolescent cortisol levels vary

considerably in relation to psychosocial stress, and any dysregulation of normal diurnal patterns – whether low or high – may indicate risk for pathology.

Very few studies have investigated whether there are systematic health inequalities in cortisol levels among adolescents, and the findings have been somewhat mixed. While one study found lower family socioeconomic status to be associated with higher basal cortisol levels in adolescents (Lupien, et al. 2000), another study found no association between SES and adolescent cortisol (Goodman, et al. 2005b). African American adolescents have been found to have higher basal cortisol levels than whites (Covelli 2006), as well as flatter diurnal slopes across the day (DeSantis, et al. 2007). In the latter study, racial differences in cortisol levels were not explained by negative emotional states (DeSantis, et al. 2007). More research is needed that examines cortisol levels in minority and disadvantaged youth, as well as relationships between cortisol levels and psychosocial stressors. Understanding these relationships better will help to shed light on the early development of racial health inequalities and the higher burden of stress-related chronic disease in African Americans.

Brief Review of Research Questions and Methods

As described in detail in Chapter 4, this study uses the Cultural Consensus and Consonance technique to examine associations among culturally-relevant aspects of the social environment and both psychological and biological markers of health risk for urban African American adolescents. Specifically, exposure to culturally salient stressors and measures of culturally salient social status and social support are examined in relation to several standard scales of psychological symptoms – perceived stress, anxiety, and depression – as well as salivary cortisol. Cortisol samples were collected by participants 3 times daily – immediately

upon waking, 30 minutes after waking, and at bedtime - for two consecutive days. Multiple regression and hierarchical linear regression (HLM) were used to examine diurnal variation in adolescent cortisol. Results of multiple regression and HLM analyses examining these associations are presented below for the 109 total youth participants in this phase of research, and the 53 participants who provided saliva samples.

Results: Sample Description

A summary of Phase 3 participant characteristics are shown in Table 7.1, with means and standard deviations for demographic variables and covariates, as well as cultural consonance and psychological factors (cortisol data will be considered later).

Table 7.1. Sample Characteristics for Phase 3 Participants, total sample and by gender (Mean (SD) or %)

Variable	***Boys***	***Girls***	***Total***
Consonance - Stressors	18.9 (6.76)	18.60 (6.33)	18.69 (6.43)
Consonance – Status	27.82 (8.16)	29.10 (9.65)	28.71 (9.20)
Consonance - Support	4.2 (1.57)	4.51 (1.03)	4.29 (1.35)
Mother's Occupational Status (SES)	47.64 (30.63)	47.45 (25.57)	47.5 (26.86)
Father's Occupational Status (SES)	46.48 (31.92)	41.89 (26.66)	43.19 (28.10)
Perceived Stress	20.94 (6.58)	23.33 (6.98)	22.58 (6.91)
Depression	2.94 (1.46)	3.16 (2.29)	3.09 (2.06)
Anxiety	8.55 (2.17)	9.31 (3.25)	9.08 (2.98)
SSS - Student	7.03 (1.30)	7.49 (1.90)	7.35 (1.74)
SSS - Family	6.32 (1.3)	6.13 (1.62)	6.18 (1.53)
BMI	24.68 (6.96)	25.15 (6.52)	25.01 (6.63)
Age	16.73 (0.67)	16.92 (1.22)	16.86 (1.08)
Physical Activity (days/week)*	4.83 (2.14)	3.97 (2.09)	4.18 (2.40)
% Smokers*	18%	3%	7.4%
N	34	75	109

The sample characteristics are described in detail elsewhere (see chapter 6). Briefly, there were more female than male participants in this sample, and boys reported significantly higher levels of physical activity and smoking. Perceived stress, anxiety, and depression scores are all comparable to national samples or to scores reported in previous studies. Participants' subjective social standing scores also are consistent with other studies, although Maywood adolescents report somewhat lower perceived societal status for their families. Overall smoking rates are quite low in this sample, while the BMI range is at approximately the 85th percentile. Parental occupational status scores are consistent with national data. Cultural consonance scores are normally distributed and indicate moderate to average exposure to stressors and levels of social status and support.

Results: Cultural Consonance as Predictor of Psychological Outcomes

Perceived Stress

In regression analyses, cultural consonance in both stressors and social support were significantly associated with perceived stress scores. As Table 7.2 shows, a higher total burden of culturally salient stressors (B=0.5, p=0.00), as well as all participant-derived subcategories of stressors – home, school, life, and peer-related – were significantly associated with higher perceived stress when controlling for the effects of gender, age, and BMI ($p \leq 0.01$ for all). Having higher culturally salient social support was significantly associated with lower perceived stress, when controlling for potential confounders (B=-1.20, p=0.02). Adjusting for parental SES lowered the sample size and did not significantly change any of the associations; therefore

analyses adjusting for SES are not presented. Cultural consonance in social status and all social status subscales were not significantly associated with perceived stress.

Table 7.2. Cultural Consonance Variables as Predictors of Perceived Stress in Multiple Regression Analyses (β (SE) and p-value)*

	B (SE)	P-value
Cultural Consonance - Stressors	0.50 (0.09)	0.00
Participant-derived subscales		
Home Stressors	1.11 (0.27)	0.00
School Stressors	1.02 (0.36)	0.01
Life Stressors	0.88 (0.22)	0.00
Peer Stressors	0.66 (0.22)	0.00
Cultural Consonance – Social Support	-1.20 (0.49)	0.02

* Adjusted for gender, age, BMI

Anxiety and Depression

As Table 7.3 illustrates, cultural consonance in both stressors and social support were significantly associated with scores on the Hospital Anxiety and Depression Scale. Higher burdens of cultural salient stressors (B=0.25, p=0.00), as well as each of the participant-derived subscales of stressors ($p \leq 0.02$ for all), were associated with higher scores on the anxiety subscale of the HADS. Higher levels of culturally salient social support were associated with significantly lower anxiety (B=-0.53, p=0.05). Adjusting for parental SES did not change any of the associations.

For the depression subscale of the HADS, total burden of culturally salient stressors (B=0.10, p=0.00), home-related stressors (B=0.37, p=0.00), and peer-related stressors (marginally, B=0.13, p=0.06)) were significant and positive predictors of depressive symptoms. School and life-related stressors and social support were not significantly related to depression

scores. When parental SES was controlled in analyses, total burden of stressors and the home-related stressors subscale remained significant predictors of depression, while peer-related stressors no longer showed a significant association. Cultural consonance in social status was not significantly associated with either the anxiety or depression subscales of the HADS.

Table 7.3. Cultural Consonance Variables as Predictors of Anxiety and Depression in Multiple Regression Analyses (β (SE) and p-values)*

	Anxiety		***Depression***	
	B (SE)	**P-value**	**B (SE)**	**P-value**
Cultural Consonance - Stressors	0.25 (0.04)	0.00	0.10 (0.03)	0.00
Participant-derived subscales				
Home Stressors	0.56 (0.11)	0.00	0.37 (0.08)	0.00
School Stressors	0.37 (0.16)	0.02	0.09 (0.11)	0.41
Life Stressors	0.35 (0.10)	0.00	0.06 (0.07)	0.38
Peer Stressors	0.38 (0.09)	0.00	0.13 (0.07)	0.06
Cultural Consonance – Social Support	-0.43 (0.21)	0.05	-0.17 (0.15)	0.25

* Adjusted for gender, age, BMI

Results: Cortisol

General Description of Cortisol Levels

Characteristics for the sample of 55 who provided saliva samples for cortisol analysis are presented in Table 7.4. There were no significant differences in any measure between the full Phase 3 sample of 109 participants and the smaller sample who participated in saliva collection.

Table 7.4 Sample Characteristics for Phase 3 Sample Providing Saliva Samples for Cortisol Analysis (N=55), Means (SD) or % for total sample and by gender

Variable	*Boys*	*Girls*	*Total*
Consonance - Stressors	18.41 (6.83)	19.23 (6.85)	18.99 (6.79)
Consonance – Status	29.58 (8.57)	29.13 (9.44)	29.26 (9.11)
Consonance - Support	4.25 (1.39)	4.42 (1.32)	4.37 (1.34)
Mother's Occupational Status (SES)	38.14 (29.74)	49.51 (26.51)	46.12 (27.44)
Father's Occupational Status (SES)	45.55 (22.60)	42.00 (31.60)	42.86 (29.41)
Perceived Stress	23.43 (8.77)	22.21 (7.10)	22.57 (7.57)
Depression	2.87 (1.82)	3.32 (2.06)	3.18 (1.99)
Anxiety	9.46 (4.09)	8.97 (3.02)	9.12 (3.34)
SSS - Student	7.00 (1.46)	7.48 (1.78)	7.35 (1.70)
SSS - Family	6.06 (1.53)	6.21 (1.52)	6.17 (1.52)
BMI	24.10 (5.13)	23.86 (5.86)	23.93 (5.60)
Age	16.68 (0.70)	16.57 (0.94)	16.61 (0.87)
% Smokers	18.75%	5.26%	9.2%
N	17	38	55

Table 7.5 shows participants' mean sample collection times for wake, wake + 30 minutes, and bedtime cortisol samples. Since there were no significant differences in sampling times between the two days of collection, times shown are combined across the two days of sampling. Times are presented as hours since waking. Sampling times given for the "wake" saliva samples that were recorded as 30 minutes or more after the recorded wake-up time for that day were treated as "wake + 30" samples, and the "wake" samples for those participants were treated as "missing". Six participants had this adjustment made to their cortisol sample numbers and sampling times for one of the two days of sample collection. Both "wake" and "wake + 30" samples were excluded for one participant due to inaccurate sampling times. After these adjustments were made, the mean combined-day sampling time for the "wake" sample was 0.07

hours since waking. The mean sampling time for the "wake + 30" sample was 0.58 hours since waking, and the mean "bed" sample time was 15.90 hours since waking.

Table 7.5. Mean Sampling Times (Hours Since Waking) for Phase 3 Participants who participated in saliva collection (Means (SD), Minimum and Maximum)

	Mean (SD)	Minimum	Maximum
Wake	0.07 (0.08)	0.00	0.33
Wake + 30	0.58 (0.12)	0.42	1.00
Bed	15.90 (2.07)	5.60	19.55

Table 7.6 presents means, standard deviations, and ranges for raw cortisol values (μg/dL prior to log-transformation) for those phase 3 participants who provided saliva samples (N=55). Values are presented for each collection time point (wake-up, wake-up + 30 minutes, and bed time) for each of the two collection days, as well as averaged across the two days of sample collection. Total mean cortisol values are also presented. Correlations between cortisol values across the two days of sampling were fairly high for each sampling time point: the correlation between waking levels across days was lowest, at 0.20 (p=0.19), while the cross-day correlations for both wake + 30 levels (R=0.80, p=0.00) and bedtime levels (R=0.73, p=0.00) were quite high. Because these cross-day correlations were relatively high, combined-day parameters are used in most analyses. However, in HLM analyses, sampling day was included in the level-1 model as a control variable.

Combined-day mean cortisol values upon waking for this sample were 0.34 μg/dL (SD=0.26). Mean morning peak values (wake-up + 30 minutes) for this sample were 0.46 μg/dL (SD=0.34). Mean bedtime levels were 0.16 μg/dL (SD=0.19). There is very little published data on cortisol levels in African American youth. However, in one study that reported waking and bedtime cortisol levels for a biracial adolescent sample, the values were fairly comparable to

those found here among Maywood youth (DeSantis, et al. 2007). In that study, mean waking levels were 0.44 μg/dL, which are somewhat higher than those found among Maywood youth and are closer to their peak morning levels. Mean bed time cortisol levels in that study were 0.10 μg/dL, which are consistent with, but somewhat lower than, the bedtime values found here.

Table 7.6. Raw Cortisol Values (μg/dL) for Phase 3 Participants, (Mean (SD), Minimum and Maximum for each sampling day and averaged across days)

Day 1	**Mean (SD)**	**Minimum**	**Maximum**
Wake	0.36 (0.42)	0.03	2.90
Wake + 30 min.	0.47 (0.37)	0.03	2.00
Bed	0.14 (0.19)	0.00	1.07
Day 2			
Wake	0.30 (0.22)	0.03	1.05
Wake + 30 min.	0.44 (0.34)	0.03	2.17
Bed	0.18 (0.21)	0.00	0.96
Mean for both days			
Wake	0.34 (0.26)	0.05	1.62
Wake + 30 min.	0.46 (0.34)	0.07	2.09
Bed	0.16 (0.19)	0.00	1.01
Mean across all times	0.32 (0.21)	0.104	1.36
N	53		

Diurnal cortisol slopes for this adolescent sample were relatively flat. Table 7.7 presents mean values for the cortisol awakening response (calculated as 'wake + 30' – 'wake') and the slope of decline over the course of the day (calculated as 'bed' – 'wake'). Maywood adolescents exhibited a relatively modest mean cortisol awakening response of 0.13 μg/dL (SD = 0.23). The slope of decline in cortisol values over the day was also relatively small, with a mean decline of -0.19 μg/dL (SD = 0.28) from waking to bedtime levels. Figure 7.1 illustrates this relatively minimal diurnal variation and shows the predicted trend line for cortisol values across the day

based on linear regression analysis. While some individuals show marked variation over the day, in general diurnal cortisol slopes for this sample are quite flat.

Table 7.7. Raw Cortisol Awakening Response Magnitude and Slope of Decline over the Day, Means (SD), Minimum and Maximum

	Mean (SD)	Minimum	Maximum
Awakening Response	0.13 (0.23)	-0.53	0.74
Decline	-0.19 (0.28)	+0.27	-1.26

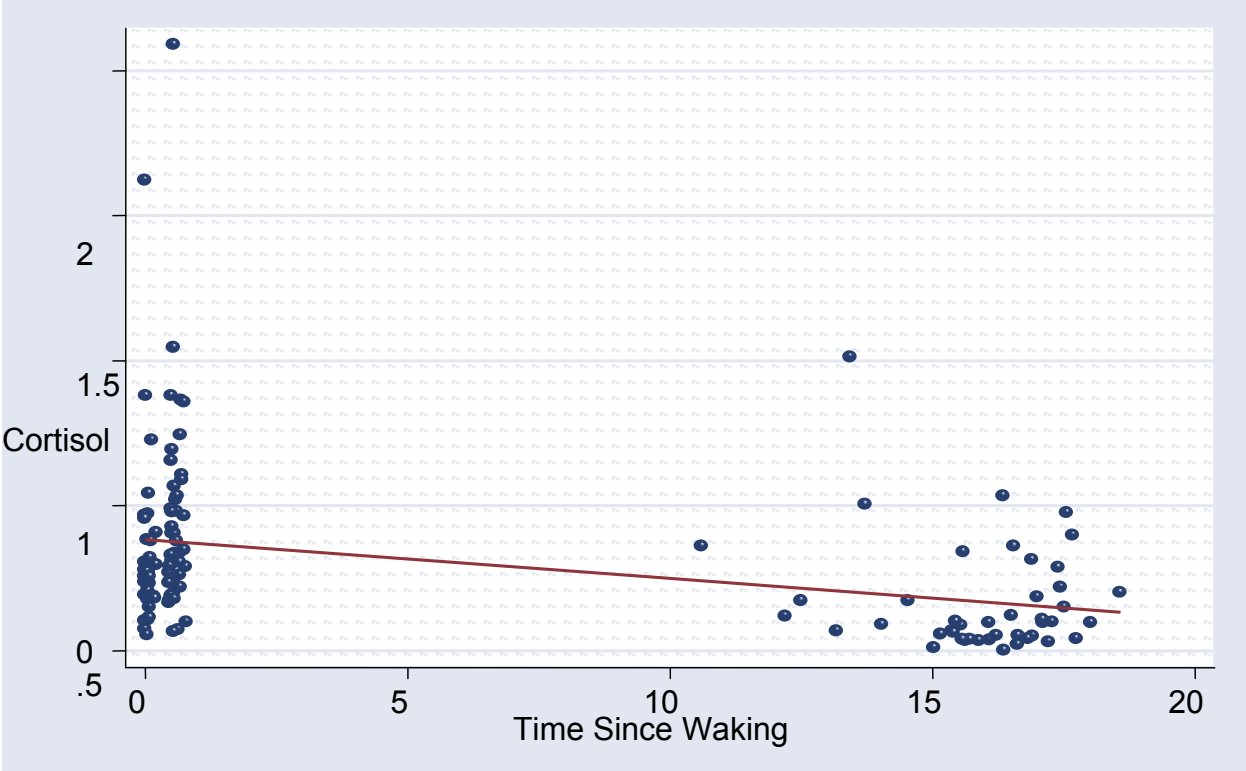


Figure 7.1. Scatterplot and Linear Prediction Line for Cortisol Values across the Day

Regression Results

Log-transformed cortisol parameters (overall mean, waking, morning peak, and bedtime levels) were each considered separately as dependent variables in linear regression analyses. Table 7.8 summarizes regression results for those independent variables found to be significant

predictors of cortisol parameters. Smoking status was modestly and positively associated with bedtime cortisol levels in this sample (B=0.89, p=0.06). Other potential covariates, including body mass, age, gender, prescription medication usage, and parental occupational status were not significantly associated with waking, morning peak, or bedtime cortisol levels.

Cognitive/emotional factors showed modest associations with cortisol parameters in regression analyses. Higher reported depressive symptoms were associated with higher morning peak cortisol levels (B=0.09, p=0.04). Anxiety and perceived stress scores showed no associations with cortisol parameters.

Several aspects of cultural consonance (CC) in stress were associated with cortisol parameters. Higher overall cultural consonance in stressors, or a higher overall burden of culturally salient stressors, was significantly associated with higher morning peak cortisol levels (B=0.03, p=0.03). A higher burden of school-related stressors, in particular, was associated with higher morning peak levels (B=0.09, p=0.06) and higher overall mean cortisol levels (B=0.08, p=0.03). A higher burden of culturally salient general life stressors was also marginally associated with higher overall mean cortisol levels (B=0.05, p=0.08), and higher waking cortisol (B=0.06, p=0.06).

Aspects of social status were also predictive of some cortisol parameters. Higher scores on the ‘general status’ cultural consonance factor were negatively associated with waking cortisol levels (B=-0.19, p=0.05). Similarly, higher scores on the ‘popular’ cultural consonance factor were modestly associated with lower bedtime cortisol levels (B=-0.26, p=0.08). Participants who reported higher perceived social status within their school on the MacArthur Subjective Social Standing scale had modestly higher morning peak cortisol levels (B=0.10, p=0.07).

Table 7.8. Summary of Linear Regression Results Predicting Cortisol Parameters (β (SE) and p-values)

	β (SE)	p-value
Predicting waking levels		
'General Status' CC Factor	-0.19 (0.10)	0.05
CC General Life Stressors	0.06 (0.03)	0.06
Predicting morning peak levels (wake+30)		
CC Stressors	0.03 (0.01)	0.03
CC School-related stressors	0.09 (0.04)	0.06
Depression	0.09 (0.05)	0.04
Subjective Social Standing in School	0.10 (0.05)	0.07
Predicting bedtime levels		
'Popular' CC Factor	-0.26 (0.14)	0.08
Smoking	0.89 (0.46)	0.06
Predicting Mean Cortisol		
CC School-related Stressors	0.08 (0.04)	0.03
CC General Life Stressors	0.05 (0.03)	0.08

While some of the findings described above are somewhat difficult to interpret, in general the associations found between various aspects of psychosocial stress and cortisol in this study are consistent with expectations. With the exception of the MacArthur SSS scale, measures of higher social status in this adolescent sample are associated with more favorable cortisol parameters, namely lower basal (both waking and bedtime) levels. Exposures to stressors, by contrast, are more often associated with signs of HPA dysregulation, including higher basal and overall mean cortisol levels.

Hierarchical Linear Models

Hierarchical linear modeling of log-transformed cortisol values was performed to simultaneously examine within- and between-individual variation in cortisol diurnal curves.

Variation at level-1 was predicted by both a linear (time since waking) and a quadratic (time since waking squared) time of day variable to account for the curvilinearity expected in cortisol diurnal rhythms. Since cortisol samples for both days were included in the outcome variable, a day of sampling variable was included at level-1 to account for any between-day variation. A dummy variable for the cortisol awakening response sample (wake + 30) was also included, and the intercept for that variable represents the average cortisol awakening response in this sample. To explore the associations of demographic and cultural consonance variables to cortisol curves, each level-2 predictor variable was first entered into an HLM model separately. To preserve degrees of freedom, only those predictors that were significant for a given parameter in individual models, or that were needed for comparison, were included in the full model. Results for the full HLM model are presented in Table 7.9.

The linear and quadratic terms for time since waking explained 36.6% of the variance in cortisol curves. With a coefficient of -0.205, cortisol levels in this sample decline, on average, 18% for each hour since waking ($B_{\%change} = [\exp(B_{raw})]-1$; see (Adam 2006)). With the addition of the cortisol awakening response and day of sampling variables, the level-1 predictors explained a total of 40.3% of the variance in cortisol curves. On average cortisol levels were 46% higher 30 minutes after waking than immediately upon waking. Cortisol values were not significantly different across sampling days.

Smoking status was found to be a significant predictor of inter-individual differences in the slope of the cortisol diurnal curve (time since waking). In particular, cortisol slopes were 5.3% flatter among participants who were smokers ($p = 0.001$). No other demographic variable was significantly associated with cortisol parameters.

Several aspects of cultural consonance were found to be associated with cortisol parameters in HLM analyses. A higher burden of culturally relevant stressors (higher cultural consonance in stressors) was associated with significantly more elevated cortisol curves. Specifically, cortisol levels (centered at midday) were 2.4% higher for every unit increase in stress burden. At the highest level of stress burden seen in this adolescent sample (36.34), cortisol levels were thus on average 87.2% higher, representing a significant elevation in overall cortisol levels among these youth. By contrast, perceived stress scores were not significantly associated with cortisol levels ($p = 0.26$). Higher scores on the "K-Swiss" and "general status" factors of cultural consonance in social status were both associated with significantly flatter diurnal cortisol curves ($p \leq 0.02$ for both). By contrast, scores on the MacArthur Subjective Social Standing peer-comparison subscale were not significantly associated with cortisol curves ($p = 0.18$).

Finally, higher depressive symptoms on the HADS depression subscale were associated with an 11% higher cortisol awakening response for each unit increase in reported depressive symptoms. To facilitate interpretation, the depression variable was centered at its mean before it was entered into the final model. Thus, the intercept for the cortisol awakening response in Table 8 represents the average CAR of participants with a mean depression score.

Table 7.8. Hierarchical Linear Model of associations between diurnal cortisol curves, cultural consonance, demographic, and covariate variables

Fixed Effect	Coefficient	SE	df	t-ratio	p-value	interpretation
Cortisol Intercept (midday)						
Intercept	-1.91	0.18	43	-10.21	0.00	0.15 µg/dL at midday
CC Stress	0.024	0.01	43	2.27	0.03	+2.4% per unit incr.
PSS	-0.011	0.01	43	-1.14	0.26	n.s.
Time since waking						
Intercept	-0.205	0.08	41	-2.50	0.02	-18% per hour
Smoking	0.052	0.02	41	2.21	0.03	+5.3% if smoker
MacArthur SSS	-0.006	0.00	41	-1.34	0.18	n.s
CC K-Swiss	0.016	0.01	41	2.48	0.02	+1.6% per unit incr.
CC general status	0.026	0.01	41	3.56	0.00	+2.6% per unit incr.
Time since waking^2						
Intercept	0.009	0.00	45	1.76	0.09	+0.01% per hour^2
Awakening Response						
Intercept	0.378	0.10	44	3.73	0.00	+46% at wake+30
Depression	0.108	0.04	44	2.63	0.01	+11% per unit incr.
Sampling Day						
Intercept	0.101	0.09	45	1.08	0.29	n.s.
Random Effect	**Variance Component**	**SD**	**df**	**chi^2**	**p-value**	**Variance explained**
Intercept	0.92	0.96	22	68.80	0.00	
Time since waking	0.11	0.33	20	61.02	0.00	
Time since waking^2	0.00	0.02	24	58.75	0.00	
Awakening Response	0.09	0.31	23	45.29	0.00	
Sampling Day	0.14	0.38	24	45.16	0.01	

Discussion

The findings described in this chapter demonstrate the striking utility of culturally-derived measures for understanding urban adolescent experiences of stress and their impact on early health risk. Several aspects of cultural consonance in stressor exposures, social status, and social support were highly predictive of adverse psychological symptoms in this sample.

Measures of cultural consonance were also associated with diurnal cortisol parameters, and were better predictors of those parameters than conventional cognitive/emotional and perceived measures.

As would be expected, a higher burden of culturally-relevant stressors was found to be significantly associated with higher subjectively perceived stress scores on the Cohen Perceived Stress Scale. This association was also found for all participant-derived subscales of culturally-relevant stressors - home-related stressors, peer-related stressors, general life stressors, and school-related stressors. These findings indicate that adolescents who are exposed to more of the most salient sources of stress in their community have a stronger subjective experience of stress. These higher perceived feelings of stress could be important indicators of current or future emotional and physical health.

However, only the culturally-derived measures of stressors, and not perceived stress, were found to be associated with salivary cortisol in this adolescent sample. Specifically, HLM analysis showed that a higher burden of culturally-relevant stressors was significantly associated with more elevated overall cortisol curves. This suggests an increased overall activation of the HPA axis in adolescents with a higher burden of stressors. This elevated HPA activation is a risk factor for dysregulated basal HPA activity and stress responsivity later in life, and suggests that these youth may be at greater risk for developing adult chronic cardiovascular conditions. Despite the fact that a higher burden of culturally-relevant stressors is also strongly associated with perceptions of stress, these findings indicate that the pathway through which stress influences biology is not via its subjective perception. For these youth, being exposed to stressors in their community and everyday lives is predictive of emergent health risk, whether they perceive themselves as being ‘stressed out’ or not.

A higher burden of culturally salient stressors was also found to be associated with significantly greater symptoms of anxiety and depression as measured by the Hospital Anxiety and Depression Scale. Similar associations were also found for several subscales of cultural consonance in stressors. Anxiety and, in particular, depression are both well established as important risk factors for the development of clinical emotional disorders and chronic cardiovascular disease. The findings of this study thus suggest that exposure to culturally-relevant stressors is an important pathway through which these health risk factors emerge in adolescents.

The findings of this study also underscore the importance of depression as a health risk factor for youth. HLM analyses showed that higher depressive symptoms were associated with a significantly higher cortisol awakening response (CAR) in this sample. Both clinical depression and depressive symptoms have shown strong but somewhat inconsistent associations with cortisol diurnal rhythms. The findings of this study are consistent with those that have found symptoms of depression to be associated with a higher CAR in adults (Bhagwagar, et al. 2005; Clow, et al. 2004; Pruessner, et al. 2003). But several other studies have found depression, particularly in the clinical range, to be associated with more blunted awakening responses (Huber, et al. 2006; Kuehner, et al. 2007; Stetler and Miller 2005). Some of these inconsistencies make sense in light of an allostatic load model, which suggests that a dampening of appropriate HPA responsivity may result from long-term overactivation of the stress system - the beginnings of which could be indicated by the higher awakening responses of depressed adolescents in this sample.

Importantly, adding or removing depression from the HLM model presented in Table 7.8 does not affect the influence of cultural consonance variables on other cortisol parameters. This

finding highlights both the independence of the cortisol awakening response from general diurnal cortisol variation (Clow, et al. 2004), as well as the strength of cultural variables as predictors in this model. Despite the strong association of culturally-relevant stressors with higher depressive symptoms in this study, the influence of culturally derived measures on biology appears to be independent of this psychological risk factor.

Higher scores on two of the factor-derived subscales of cultural consonance in social status were found in HLM analysis to be associated with significantly flatter cortisol slopes. A flatter cortisol slope over the day generally suggests a more dysregulated HPA axis, and is often due to higher bedtime levels which suggest an inability of the stress system to return cortisol levels to an appropriate baseline low. Thus, at first these findings seem contrary to the expected benefits of higher social status. However, consideration of the specific social status subscales under question helps to clarify the observed relationship. The "K-Swiss" social status subscale, which was found here to be associated with flatter cortisol slopes, was also found to be a significant predictor of higher diastolic blood pressure in this adolescent sample (see Chapter 6). As was described in previous chapters, this subscale is strongly associated with wearing K-Swiss shoes - one of the most contested and problematic status items to emerge from the ethnographic phases of this study. This particular subscale may thus represent conformity with a model of social status that is not universally highly valued among youth in the community. As a result, a strong identification with this model of status may in fact be a source of stress, or even stigma, rather than status or popularity.

The association of higher scores on the "general status" subscale with flatter cortisol slopes is less clearly interpreted. However, in simple regression analyses, this subscale was associated with significantly lower waking cortisol levels. This suggests that the flatter slopes

associated with this subscale may be due to lower, rather than higher, basal cortisol levels and thus may indicate a more favorable cortisol profile.

In general, the findings of this study demonstrate the importance of using culturally-relevant measures in adolescent stress research. In addition to being strong predictors of emotional symptoms, ethnographically-derived measures were the strongest predictors of salivary cortisol in this study. Cultural consonance with both sources of stress and social status were significant predictors of cortisol parameters, while perceived stress and perceived social status were not. These findings suggest that, for Maywood youth, being exposed to prevalent stressors in their community and conforming to social status norms are both important factors in determining their emergent cardiovascular health risk.

Chapter 8

Embodiment, Development and the Dialectic: A Biocultural Perspective on Racial Health Inequality

> Anthropology is at the nexus of the biological and social, a biocultural synthesis spanning an enormous range of comparative, historical, and dynamic material.
> Richard Levins and Richard Lewontin
> Forward, *Building a New Biocultural Synthesis*

In the early 20th century, Franz Boas offered the first truly biocultural approach to understanding the human condition. By examining the ways in which social and nutritional developmental environments influenced bodily form, Boas (Boas 1912) demonstrated that human biology can be best studied through the lens of social, cultural and historical context. While more one-dimensional approaches within the respective cultural and biological subfields have been more common, integrative biocultural research has persisted throughout the history of anthropology and has gained new momentum in the past 20 years (Goodman and Leatherman 1998). Today, as deterministic gene-based theories of racial health inequality are bringing a resurgence of debate over the race concept, biocultural anthropology, with its emphasis on the interface of cultural context with individual biology, stands poised to make significant contributions to this important discourse. As the findings of this dissertation project illustrate, biocultural approaches and techniques can help to elucidate the pathways through which the social experience of race becomes embodied in disease risk and health inequality.

Rather than constituting a particular theoretical orientation or formula for determining health and biology outcomes, the biocultural approach can be best understood as a set of general tenets meant to guide good research practice. These tenets include 1) an appreciation for the inter-relatedness of biology and health with social and cultural context, and the need to develop

methods that can operationalize and link these multiple levels of analysis, 2) an understanding that the social and cultural environments that influence health are historically contingent and embedded in political economic fabrics that structure power and inequality, and 3) consideration of the complex and dynamic dialectical relationship between context and health, whereby the physiological embodiment of social environments and inequalities transforms the interface at which those biologies and contexts relate in the future. Each of these tenets, and their relation to the present study of stress and health risk among African American youth, will be discussed in this chapter.

Inter-relatedness in concept and method: linking levels of analysis

While recognizing the connection between culture and health is relatively straight forward, operationalizing those elements in a way that allows them to be linked in epidemiological analysis poses a significant challenge. The ethnographic methods typically used to capture the richness of social and cultural contexts yield qualitative, and often narrative or textual, data that are difficult to meaningfully quantify. The cultural consensus/consonance technique, described in detail in Chapter 4, offers one mechanism for addressing this challenge, and has been used in biocultural research to connect cultural with biological dimensions of health. In Brazil and the Southeastern United States, Dressler (Dressler, et al. 1997; Dressler, et al. 1998a; Dressler, et al. 2005; Dressler, et al. 1998b; Dressler and Bindon 2000) has used the consensus/consonance approach to show how cultural norms of material status and social support map onto adult cardiovascular risk. In Puerto Rico Gravlee (Gravlee and Dressler 2005; Gravlee, et al. 2005) used the approach to demonstrate the relationship of cultural dimensions of skin color to blood pressure variation. In these studies, the innovative methodological approach

allowed the complex interrelations among social contextual and individual biological factors to be quantitatively explored and modeled.

In the present dissertation study, use of the consensus/consonance approach allowed for a richer understanding of the everyday of experiences of Maywood youth around stress and social position among their peers. This in turn provided for the development of more meaningful and locally relevant quantitative measures of stress exposures (stressors) and social status. These culturally salient measures were strongly associated with adolescent psychological symptomatology, as well as biological health outcomes, including both systolic and diastolic blood pressure and diurnal cortisol levels. These measures were also stronger predictors of biological parameters than the more conventional subjective index of perceived stress. The highest burden of culturally salient stressors, for instance, was associated with 87% higher midday cortisol levels, while subjective perceptions of stress had no significant relationship with adolescent cortisol.

Allan Young has suggested that neglecting the cultural production of meaning in psychosocial stress research relegates the human subject to "a desocialized and amorphous environment" (pg. 133). By using innovative biocultural methods, this study was able to operationalize the psychosocial experiences of individual adolescents while still locating them within the complex and multi-dimensional social contexts of their everyday lives. By effectively incorporating quantitative measures of cultural context, this study not only acknowledges the interconnections between social and biological dimensions, but helps to clarify the pathways through which social environments influence health.

Historical context and political economy: the health consequences of social inequality

Biocultural anthropology has been strongly concerned, particularly during the past 20 years, with recognizing the impact of historical and political economic forces on health (Goodman and Leatherman 1998; Roseberry 1998). Everyday life, and its influence on biology, is embedded within local historically contingent contexts, which in turn are articulated with broader political and economic fields of power and inequality (Polier and Roseberry 1989; Singer 1998). Recognizing these contingencies allows for a more complete and nuanced understanding of specific social and cultural influences on health in particular community and national contexts. Several biocultural researchers, for example, have explored how broad political economic shifts have structured local economies and relations of power and labor in the Peruvian Andes (Leatherman, et al. 1995), lowland Bolivia (Godoy, et al. 2006), and Siberia (Sorensen, et al. 2005), with subsequent consequences for unequal patterning of health risk and disease. Other work in the political economy of health has focused more specifically on "the biology of poverty" (Thomas 1998), exploring how unequally distributed resources affect child nutritional status in the United States (Crooks 1998), women's nutritional health in Colombia (Dufour, et al. 1997), and growth and health status among children in Nepal (Panter-Brick, et al. 1996). These examples represent only a small portion of work in biocultural anthropology helping to elucidate the historical and political economic contexts of health variation.

In Maywood, historical racial demographic shifts, paralleling those of many northern industrial cities during the great northern migration, have been accompanied by declines in local economic resources. As the proportional African American population in Maywood increased during the "white flight" of the 1960s and 1970s, major industrial and retail employers abandoned the community, creating stark economic inequalities between Maywood and

neighboring affluent neighborhoods such as Oak Park and River Forest. In interviews with Maywood teens, it was apparent that the relative economic deprivation of the community was felt by youth in their anxieties over accessing money, finding employment, and establishing successful futures after high school. These issues were also related to participants' concerns over school performance, as many teens viewed academic success as a primary vehicle for advancement in society and movement out of the community. The health impact of these stressors was illustrated in their association with adolescents' blood pressure, diurnal cortisol variation, and indices of adverse psychological symptoms.

The health impacts of structural inequalities in Maywood were also evident in the complex relationships among adolescent material consumption and family economic resources. Elizabeth Chin has described the ways in which the consumer cultures of black urban youth reflect the influence of social-structural inequalities and act as a medium through which issues of power and unequal social relations are confronted (Chin 2001). In Maywood, teens' cultural constructions of peer-based social status are highly concerned with consumption of material status goods. The relationship of these material ideals to social and economic inequalities are complex; teens' consumption norms represent both acts of agency as an attempt to attain and display status in the face of low economic resources, as well as reflections of corporate power, as many of the status items youth consume – cell phone and clothing brands – are the subjects of race- and class-oriented niche marketing. For youth in this community, these complex relationships play out in ways that have real consequences for their health and well-being. In particular, adolescents who consume especially high priced status items but whose parental economic status is not consistent with that level of material status exhibit adversely stressed biology, as evidenced in higher systolic and diastolic blood pressure. Consistent with a status

incongruity model of health employed in other biocultural research (Dressler 1988; McDade 2002), this pattern suggests some of the complex ways in which political economic contexts and associated social inequalities can structure variation in health in local communities.

The Dialectic: development, change, and the lifecourse

Most closely associated with the philosophy of Marx and, especially, Engels, the concept of the dialectic is centrally concerned with processes of change. As Kolakowski (2005) describes, "Dialectics, as understood by Engels, are the study of all forms of motion or activity in nature, in human history, and in thought" (pg. 317). When applied to human biology, a dialectical perspective emphasizes the dynamic, fluid, and reciprocal interconnections between social-cultural context and health. Historically the most famous application of a dialectical approach to biology occurred in the early 20th century with scientific dialectical materialism in the Stalinist Soviet Union (Kolakowski 2005; Levins and Lewontin 1985). This approach, while ideologically bound and ultimately unsuccessful as state-sponsored science, advocated in its least extreme form for a grounded and useful materialist perspective on biology. Namely, "diamat" scientists emphasized the importance of environmental exposures in influencing trajectories of heredity and development and exercised a healthy skepticism of overly deterministic theories of genetic inheritance.

Later 20th century approaches to a dialectical biology (Levins and Lewontin 1985) have recognized the importance of change, dynamic motion, and development in biological process and evolution – concepts that are central to the biocultural perspective on health. The bioanthropological emphasis on phenotypic plasticity – physical, biological, and developmental change in response to environments – is inherently dialectical in nature. In particular, the idea

that developmental trajectories can be altered in response to social and physical environmental circumstances, a perspective with long historical weight in biocultural anthropology and gaining rapidly wider currency in health inequalities research, suggests a dynamic dialectical relationship between environment and biology. As physiologies change in response to social contextual forces, the biological, or phenotypic, substrate with which future environments will interact is transformed, thereby altering the trajectories of those interactive relationships across the lifecourse. In this way, interconnections between context and biology, socio-cultural factors and health, are best understood as processes in motion; failing to consider change over time and historical contexts – not only of communities and nations, but of individuals as well – will yield an incomplete understanding of human health.

In this dissertation, the everyday life of Maywood adolescents was chosen as the subject of study not only because of the significance of the psychosocial environment for teens' current health and well-being, but because of the long-term implications of experiencing stress burden as youth. The higher blood pressures and elevated cortisol rhythms of adolescents with greater burdens of stressors are signs of dysregulated stress response systems and suggest that future psychosocial environments may be experienced under conditions of already sensitive or vulnerable biologies. In the context of racial health inequalities, understanding how social contexts and inequalities influence health risk at developmentally sensitive periods, such as adolescence, helps to elucidate the complex lifecourse processes whereby racially disparate adult disease rates emerge.

Significance and Limitations of this Biocultural Study

In the current racial health disparities discourse, psychosocial determinants of health inequality are often approximated with superficial measures of adult socioeconomic status or subjective perceptions that are presumed to represent a somewhat homogenous African American experience. This trend has the unfortunate effect of replacing reductionist racial-genetic determinism with an equally problematic cultural form of determinism, whereby "inherent" and vague behavioral and economic attributes are ascribed to the black American population and deemed to underlie their disproportionate burden of chronic disease. The present study draws on biocultural research methods and the long history of anthropological study of race to help yield a more complex, meaningful and dialectical picture of how early social environments contribute to racial health inequality.

The stress experience of Maywood youth, contrary to the assumptions of much urban minority adolescent stress research, is highly varied and includes aspects of academic pressures, social peer relationships, home life, and economic concerns, in addition to the more stereotypical stressors of neighborhood violence and exposure to gang activity. For these teens, it is the cumulative burden of these stressors - the unique strain of experiencing family, peer, and school-based stress within the additional everyday context of poor neighborhood quality - that matters for their emotional health and emergent cardiovascular risk. Stressors related to home life and parental relationships are particularly salient for adolescent blood pressure, highlighting the critical importance of long-term developmental psychosocial exposures for youth health risk. Teen's cultural constructions of peer-based social status are also associated with health in complex ways, and demonstrate that measures of subjective social position and parental SES are alone not adequate to capture the relationship between status and adolescent health.

In addition to the significance of these findings, however, the present study also has several limitations. Most notably, the samples of participants for all three phases of the study were not necessarily representative of youth in Maywood as a whole, or of other urban minority youth populations. With participants for the first two phases of the study recruited primarily from a local after-school arts program, representation of teens in the community less engaged in academic and extracurricular activities was quite low. As discussed earlier, given the lack of formal attendance policies in the school district, this sample was likely comparable to the school-based sample of participants in the third phase of the study. However, teens who do not attend school or participate in after-school programs are likely to have cultural models of stress and social position that differ from the ones found in this study, and exploring the health impacts of those different social experiences is an important area for future research.

In addition to issues of general representativeness, samples for all three phases of this study were biased towards females. While data were checked for gender differences at all stages of the study, numbers of male participants were generally too low to expect to find meaningful results. It is very likely that the totality of stressful social experience for boys in Maywood was not captured in the ethnographic phases of the study. In future work, it will be important to further explore the health-related social experiences of boys in Maywood and potential gender differences in these dynamics, especially given the striking gender disparity in systolic blood pressure seen in this sample. Likewise, it will be important in future research to explore other aspects of emergent cardiovascular risk for this population that were not addressed in this study. Dietary quality, for instance, is likely a significant health risk factor in this community given the general lack of large supermarkets and fresh produce vendors in Maywood. Similarly, restricted physical activity due to lack of neighborhood safety and recreational facilities may be and

important health risk factor for many youth in the community and should be explored further in future research.

Conclusion

The findings of this study – that ethnographically derived and culturally salient measures of everyday experience predict adolescent health risk, while conventional subjective measures do not - speak to the value of biocultural approaches that meaningfully operationalize social and cultural contexts in relation to health. Rather than rely on decontextualized measures of psychosocial environments, this study explored the specific ways in which race and class play out in the everyday worlds of urban adolescents and how they manifest as variation in health risk; what Kaplan and Lynch have described as an "epidemiology of everyday life" (Kaplan and Lynch 1997). In particular, these findings show how cultural meanings shape individual experiences of stress and their influence on biology and health, and as such offer new ways of understanding the biosocial processes underlying racial health inequality. At a moment when essentialist theories of race are resurging in scientific discourse, this work contributes to a needed anthropological voice in health disparities research. Drawing on anthropological understandings of race as socially constructed, this study helps to illustrate the literality of embodiment; how social and cultural environments become inscribed in health risk for African American youth, and the pathways through which these exposures may result in racially disproportionate disease burden among adults.

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Appendix A

Phase 2 Survey Instrument

***Return this completed survey AND the signed adolescent assent, signed parent consent, and brief parent survey to either Elizabeth or Crystal to receive a $5 gift certificate for McDonald's.*

Part 1. How important are each of the following things for indicating high status or popularity at your school? For each item, please mark ONE box – either "very important", "somewhat important", or "not important".

	Very Important	Somewhat Important	Not Important
Playing a sport			
Being on the basketball team			
Being on the football team			
Being a cheerleader			
Being in a dance troupe			
Participating/ Being involved in activities			
Being in a gang			
Being on the track team			
Talking about other people			
Being friends with everyone/ Having lots of friends			
Being in a popular clique			
Hanging with popular people			
Having a good attitude or good personality			
Being outgoing or talkative			
Being yourself/ Being unique			
Being a Senior or Junior			
Getting good grades/ Being smart			
Having a popular or athletic boyfriend/ girlfriend			
Name brand clothes			
Rocawear			
Apple Bottoms			
Baby Phat			
Girbaud			

Enyce or Lady Enyce			
Louis Vuitton			
Ecko brand			
Akademiks			
Lot 29			
Juicy			
	Very Important	**Somewhat Important**	**Not Important**
Wearing color coordinated or matching clothes			
Not wearing the same thing too often			
Dressing nice or wearing cute clothes			
Name brand shoes			
Air Force Ones			
Jordans			
K-Swiss			
Unlisted			
Timberland			
Nike gym shoes			
Fresh shoes/ Not having raggedy or dirty shoes			
Buying new shoes often			
Not wearing K-Swiss			
Not wearing Reebok			
Being up to date/ Having the latest stuff			
Having nice hairstyle/ hair done, not raggedy			
Looking good/ Having nice appearance			
Not being too skinny or overweight			
Having Money			
Acting/ Looking like you have money			
Having a car			
Having a nice car (Lexus, BMW, etc)			
Having a big truck (like Escalade)			
Having a cell phone			
Having the latest cell phone			
Having a RAZR phone			
Having a Nextel phone			
Having a T-Mobile phone			
Having Bluetooth			
Having an iPod			

Having a Sidekick			
Having a laptop			
Going to house parties on weekends			
Going to the bowling alley			
Going to a friend's house			
Going to the club Nitro			
Playing laser tag on weekends			
Going to a restaurant with friends			

<u>Part 2</u>. How stressful are each of the following things for teenagers your age? For each thing, please mark ONE box – either "very stressful", "somewhat stressful", or "not stressful".

	Very Stressful	Somewhat Stressful	Not Stressful
Homework, Getting good grades			
Getting talked about			
Boys or Girls			
Money			
Keeping up with looks and clothes			
Meeting parent's expectations			
Trying to fit in at school			
Peer pressure			
Appearance or weight issues			
Conflicts among friends			
Bad home life			
Pressure to have sex			
Trying to be or stay popular			
Controlling or overprotective parents			
Parents in general			
Divorced parents			
Time management, Getting stuff done			
Gaining independence from parents			
Parent passed away			
Having rumors about sex spread about you			
Thinking about college and the future			
Finding a job			
Teachers being down on you			

Trying to please others			
Violence and gangs			
Girls at school acting bougie			
Being stereotyped			
Being discriminated against (racism)			

<u>Part 3a</u>. Please rank the following in terms of who <u>people your age</u> would go to first (1), second (3), third (3), etc if they had a <u>*PERSONAL PROBLEM*</u>.

	Ranking
Mom	
Dad	
Sister or Brother	
Grandma	
Best Friend	
Other Friend	
Cousin	
Aunt or Uncle	
Teacher	

<u>Part 3b</u>. Please rank the following in terms of who <u>people your age</u> would go to first (1), second (3), third (3), etc if they <u>*NEEDED MONEY*</u> or something like that.

	Ranking
Mom	
Dad	
Grandma	
Friends	
Job	
Boyfriend or Girlfriend	
Aunt	
Cousin	
Brother or sister	

<u>Part 3c</u>. Please rank the following in terms of who <u>people your age</u> would go to first (1), second (2), third (3), etc if they wanted to have <u>*FUN*</u>.

	Ranking

Best friend	
Other Friends	
Mom	
Cousin	
Sister or Brother	

Appendix B

Phase 3 Survey

Survey

Please return this completed survey AND the signed adolescent assent, signed parent consent, and brief parent survey to Elizabeth to receive McDonald's gift certificates.

Part 1. Please tell me HOW MANY items from each of the following categories you personally have. If you do not have any from a category, put 0.

	How many do you have?
1) How many Ecko brand items do you have?	
2) How many Juicy Couture brand items do you have?	
3) How many pairs of KSwiss brand shoes do you have?	
4) How many pairs of Unlisted shoes do you have?	

5) On average, how important is it to you to have the above items?

☐ **Very Important** ☐ **Somewhat Important** ☐ **Not at all Important**

Part 2. Please tell me whether you HAVE or DO NOT HAVE each of the following:

	HAVE	DO NOT HAVE
1) A nice car (BMW, Lexus, etc…)		
2) A big truck (Escalade, Expedition, etc…)		
3) A RAZR phone		
4) A Nextel phone		
5) A T-Mobile phone		
6) Bluetooth		
7) An iPod		
8) A Sidekick		
9) A laptop computer		

10) On average, how important is it to you to have the above items?

☐ ☐ ☐

Very Important **Somewhat Important** **Not at all Important**

<u>Part 3.</u> Please answer YES or NO to each of the following things:

	YES	NO
1) Are you on the basketball team?		
2) Are you on the football team?		
3) Are you a cheerleader?		
4) Are you in a dance troupe?		
5) Are you on the track team?		
6) Are you in a gang?		
7) Do you feel that you are too skinny or overweight?		
8) Do you talk about people at school?		
9) Do you go to house parties often?		
10) Do you have money?		
11) Do you act like you have money?		
12) Do you hang out at your friends' houses?		
13) Are you a Senior or Junior?		
14) Do you go to the club Nitro?		
15) Do you go bowling?		
16) Do you play laser tag?		
17) Do you go to restaurants with your friends often?		
18) Are you involved in school activities?		

19) On average, how important is it to you to do the above things?

☐ ☐ ☐

Very Important **Somewhat Important** **Not at all Important**

Part 4. **Please answer YES or NO to each of the following:**

	YES	NO
1) Do you get good grades in school?		
2) Do boys (or girls, if you are a boy) stress you out?		
3) Do you have trouble getting money?		
4) Is it hard to meet your parents' expectations?		
5) Would you describe your home life as "bad"?		
6) Are your parents controlling or overprotective?		
	YES	**NO**
7) Are you able to manage your time, or get everything done?		
8) Do you feel you have independence from your parents?		
9) Have you had a parent pass away?		
10) Have you had rumors about sex spread about you?		
11) Do you think a lot about college and the future?		
12) Have you had trouble finding a job?		
13) Do you think that your teachers are down on you?		
14) Is there conflict among your friends?		
15) Do you experience peer pressure?		
16) Do you experience racism?		
17) Do you think people stereotype you?		
18) Do you experience violence or gang activity?		
19) Do you try to be popular?		
20) Do you experience pressure to have sex?		
21) Do you keep up with the latest looks and trends?		
22) Do you get talked about at school?		
23) Are you popular?		
24) Do you have close friends or relatives who are in a gang?		

Part 5a. Please rank the following in terms of who you personally would go to first (1), second (2), third (3), fourth (4), etc if you had a *PERSONAL PROBLEM*.

	Ranking
Mom	
Dad	
Sister or Brother	
Grandma	
Best Friend	
Other Friend	
Cousin	
Aunt or Uncle	
Teacher	

Part 5b. Please rank the following in terms of who you personally would go to first (1), second (2), third (3), fourth (4) etc if you *NEEDED MONEY* or something like that.

	Ranking
Mom	
Dad	
Grandma	
Friends	
Job	
Boyfriend or Girlfriend	
Aunt	
Cousin	
Brother or sister	

Part 5c. Please rank the following in terms of who you personally would go to first (1), second (2), third (3), fourth (4) etc if you wanted to have *FUN*.

	Ranking
Best friend	
Other Friends	
Mom	
Cousin	
Sister or Brother	

Part 6. **Use this definition to answer the following 2 questions:**

Physical Activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, playing with friends, or walking to school. Some examples of physical activity are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball, football, and surfing.

1) Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?

☐	☐	☐	☐	☐	☐	☐	☐
0 days	1	2	3	4	5	6	7 days

2) Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day?

☐	☐	☐	☐	☐	☐	☐	☐
0 days	1	2	3	4	5	6	7 days

Part 7. **Read each item and place an X in the box which comes closest to how you have been feeling in the past week.**

1) I feel tense, or "wound up":

☐	☐	☐	☐
Most of the time	**A lot of the time**	**Time to time, Occasionally**	**Not at all**

2) I still enjoy the things I used to enjoy:

☐	☐	☐	☐
Definitely as much	**Not quite so much**	**Only a little**	**Not at all**

3) I get a sort of frightened feeling, like something awful is about to happen:

☐	☐	☐	☐
Yes, definitely and quite badly	**Yes, but not too badly**	**A little, but it doesn't worry me**	**Not at all**

4) I can laugh and see the funny side of things:

☐	☐	☐	☐
As much as I always could	**Not quite so much now**	**Definitely not so much now**	**Not at all**

5) Worrying thoughts go through my mind:

☐	☐	☐	☐
A great deal of the time	**A lot of the time**	**From time to time but not too often**	**Only occasionally**

6) I feel cheerful:

☐	☐	☐	☐
Most of the time	**Sometimes**	**Not often**	**Not at all**

7) I can sit at ease and feel relaxed:

☐	☐	☐	☐
Definitely	**Usually**	**Not often**	**Not at all**

8) I feel as if I am slowed down:

☐	☐	☐	☐
Nearly all of the time	**Very often**	**Sometimes**	**Not at all**

9) I get a sort of frightened feeling, like “butterflies in the stomach”:

☐	☐	☐	☐
Very often	**Quite often**	**Occasionally**	**Not at all**

10) I have lost interest in my appearance:

☐	☐	☐	☐
Definitely	**I don’t take as much care as I should**	**I may not take quite as much care**	**I take just as much care as ever**

11) I feel restless as if I have to be on the move:

☐	☐	☐	☐
Very much indeed	**Quite a lot**	**Not very much**	**Not at all**

12) I look forward with enjoyment to things:

☐	☐	☐	☐
As much as I ever did	**Rather less than I used to**	**Definitely less than I used to**	**Hardly at all**

13) I get sudden feelings of panic:

☐	☐	☐	☐
Very often indeed	**Quite often**	**Not very often**	**Not at all**

14) I can enjoy a good book or radio or TV program:

☐	☐	☐	☐
Often	**Sometimes**	**Not often**	**Very Seldom**

<u>Part 8.</u> These questions ask about your feelings and thoughts during the past month. In each case, please indicate how often you felt or thought a certain way.

1) In the last month, how often have you been upset about something that happened unexpectedly?

☐ ☐ ☐ ☐ ☐
Never **Almost never** **Sometimes** **Fairly often** **Very often**

2) In the last month, how often have you felt that you were unable to control the important things in your life?

☐ ☐ ☐ ☐ ☐
Never **Almost never** **Sometimes** **Fairly often** **Very often**

3) In the last month, how often have you felt nervous and 'stressed'?

☐ ☐ ☐ ☐ ☐
Never **Almost never** **Sometimes** **Fairly often** **Very often**

4) In the last month, how often have you felt confident about your ability to handle your personal problems?

☐ ☐ ☐ ☐ ☐
Never **Almost never** **Sometimes** **Fairly often** **Very often**

5) In the last month, how often have you felt that things were going your way?

☐ ☐ ☐ ☐ ☐
Never **Almost never** **Sometimes** **Fairly often** **Very often**

6) In the last month, how often have you found that you could not cope with all of the things you had to do?

☐ ☐ ☐ ☐ ☐
Never **Almost never** **Sometimes** **Fairly often** **Very often**

7) In the last month, how often have you been able to control irritations in your life?

☐ ☐ ☐ ☐ ☐
Never **Almost never** **Sometimes** **Fairly often** **Very often**

8) In the last month, how often have you felt that you were on top of things?

☐ ☐ ☐ ☐ ☐
Never **Almost never** **Sometimes** **Fairly often** **Very often**

9) In the last month, how often have you been angered by things that were outside of your control?

☐ ☐ ☐ ☐ ☐

Never **Almost never** **Sometimes** **Fairly often** **Very often**

10) In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

☐ ☐ ☐ ☐ ☐

Never **Almost never** **Sometimes** **Fairly often** **Very often**

Part 9. Please answer the following questions:

1) What is your gender (circle one)? Male Female

2) Do you smoke cigarettes regularly (circle one)? Yes No

3) How old are you? _____ years old

4) What grade are you in at school (circle one)? 9th 10th 11th 12th

5) What school do you go to? _____

6) What do your parents do for a living?
Mom? _____

Dad? _____

7) What do you *think* your total family income is? (How much money do you *think* your parents make in a year?)

a. less than 5000
b. 5000 - 11,999
c. 12000 - 15,999
d. 16000 - 24,999
e. 25000 - 34,999
f. 35000 - 49,999
g. 50000 - 74,999
h. 75000 - 99,999
i. 100000 or more