NEIGHBORHOOD, HOUSING AND WOMEN'S HEALTH DISPARITIES

By

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Humans do not exist in a vacuum; as such, health and illness do not occur entirely as the result of individual behaviors. People are intrinsically both social and physical beings and are therefore affected by myriad social factors. Lived experiences vary tremendously depending on the area one inhabits. The environment constitutes different contextual aspects that shape one's daily experiences, the social and physical attributes of neighborhoods and housing are–at the same time–both a product and mediator of larger social, economic, and political forces. Despite the numerous studies that have established a clear relationship among neighborhood disadvantage, housing, and health, the mechanisms by which neighborhoods and housing impact health remain unknown. Furthermore, a more thorough understanding of how Section 8 and public housing environments differ is critical, given that the policy intent behind section 8 housing is to reduce pockets of poverty and its sequelae that have been observed in public housing.

The primary purposes of this study were to examine the relationships among neighborhood characteristics, perceived stress, psychological distress, and salivary cortisol secretion among female heads of household with children of low socioeconomic position (SEP) and to determine the differences in neighborhood characteristics, housing satisfaction, perceived stress, psychological distress, and salivary cortisol levels in low SEP female heads of households with children.

Regression analyses indicate that neighborhood characteristics such as disorder, crime exposure and collective efficacy are associated with increased levels of stress, psychological distress, and general health. However when individual level factors are added to models, neighborhood characteristics no longer have an effect on depression, anxiety, health or salivary cortisol in this group of women. Mann-Whitney U tests showed a significant difference in neighborhood economic disadvantage by housing type. Women living in section 8 housing units were located in more economically advantaged areas ($z = -2.552$, $p<0.05$) than women living in public housing. There were no differences in neighborhood disorder, exposure to crime, nor collective efficacy. Future studies that replicate this one using a much larger random sample are needed to provide a better understanding of the impact of neighborhoods and housing on health.

CHAPTER 1
INTRODUCTION

This chapter introduces the background, theoretical framework, and problem statement. The study purposes and associated hypotheses are stated. Limitations are acknowledged and the significance of the study is presented.

Background and Problem Statement

Women and children comprise the greatest proportion of people living in poverty in the United States (U. S.). As of 2004, the official U. S. poverty rate was 12.7%, which is up from 12.5% in 2003 (U. S. Census Bureau, 2005). In 2004, the poverty rate for families was 10.2% comprising almost 7.9 million families. Female-headed families suffer from poverty disproportionately, with 28.4% (nearly 4 million families) living in poverty compared to 5.5% of married-couple families (3.2 million families) (Institute for Research on Poverty, 2005).

Socioeconomic position (SEP) is defined as " the social and economic factors that influence what position(s) individuals and groups hold within the structure of society" (Lynch, 2000), and low SEP has repeatedly been associated with poor health outcomes. For example, the seminal Whitehall study of British civil servants showed that a gradient in mortality runs across the social hierarchy from the bottom employment grades to the top (Marmot, 2003; Marmot et al., 1991). Disparities in health for chronic conditions are more pronounced among women than men, and a steeper gradient in disparate outcomes exists at the lower end of the economic strata than at the top (Lynch, 2000; Marmot and Wilkinson, 1999). Studies show, for example, that women's SEP is strongly and

inversely related to cardiovascular disease (CVD) mortality (Wilkinson, 1996). Poor women are four to five times as likely to rate their health as fair or poor than women with higher incomes, and middle-aged women in the highest SEP group can expect to live 2.7 to 3.8 years longer than those in the lowest income group (Robert, 1998). Moreover, there is evidence that the SEP-related disparities of chronic diseases with some of the highest prevalence, morbidity, and mortality rates among women have actually widened over the past several years despite efforts to close the gap (Wilkinson, 1997).

Housing costs account for the largest expenditure for most families and serve as an indicator of one's social and economic standing within society. Disparities in housing problems are suffered disproportionately in our society and parallel income-related health disparities. The broad term housing problems can be applied to a wide range of housing conditions considered to be sub-standard among developed nations. As such, housing problems include conditions such as high cost burdens relative to income, overcrowding, poor conditions, and homelessness, among others.

Currently, the U. S. is in the midst of an affordable-housing crisis. Affordable housing is defined as spending 30% or less of one's income on housing (Green and Malpezzi, 2003). However, few U. S. citizens are able to pay such a small amount for housing and many are financially burdened by its high cost. In 2001, one third of the nation (95 million people) had housing problems. Two-thirds of the people with housing problems are low-income as defined by federal policy (household income at or less than 80% of the area median). And poignantly, 32% of the low income people with housing problems were children (Trekson and Pelletiere, 2004).

To put the scope of housing problems on more familiar terrain, the number of people that experience housing problems exceeds those who lack health insurance twofold (Joint Center for Housing Studies of Harvard University, 2004). In addition to unaffordable housing, crowding is on the rise, and nearly 2 million households live in over-crowded units (Joint Center for Housing Studies of Harvard University, 2004). Nationally, 47% of renter households lived in unaffordable housing in 2003, which is a 2% increase from 2002.

Studies are beginning to demonstrate that neighborhood and housing characteristics are independent determinants of health (Kington and Smith, 1997; Steptoe, Lundwall, and Cropley, 2000). An estimated 72% of all households receiving rental housing subsidies—including Section 8 (S8) and public housing (PH)—are headed by women, and many are concentrated in lower socioeconomic areas (Adler and Ostrove, 1999) which have higher rates of chronic stress, anxiety, depression and CVD (Kington and Smith, 1997; Steptoe and Marmot, 2002). Increasingly, studies have shown that chronic stress is associated with the development of chronic illnesses such as insulin resistance, depression, and CVD (Berkman and Kawachi, 2000; Lundberg, 1999). As a result of these studies, researchers now hypothesize that arousal of the hypothalamic-pituitary-adrenal (HPA) axis through chronic exposure to stressors in the social and physical environment (e.g., neighborhood and housing-related stressors) results in “wear and tear” on physiological systems, contributing to the development of chronic diseases (Wilkinson, 1997)

To further study this phenomenon, epidemiologists have begun employing multi-level analyses that include both aggregate- and individual-level variables to examine

determinants of SEP-related health disparities. An ecological-to-biological conceptual framework called for within public health and nursing parallels the conceptual and methodological approaches proposed in this study. Thus, this study examines whether neighborhood characteristics and health outcomes differ by housing subsidy type (i.e., section 8 and public housing) and whether neighborhood characteristics may contribute to SEP-related health disparities among women through chronic stress-physiological mechanisms.

Theoretical Framework

Nancy Krieger's ecosocial theory and Bruce McEwen's allostatic load model guide this research. Ecosocial theory seeks to explore the social – biological interface through which environmental factors affect health (Krieger and Davey-Smith, 2004) and calls for incorporating the use of the concept "embodiment" in order to capture how social influences (e.g., housing and the built environment) become literally embodied into physiological characteristics that influence health. Allostatic load is based on the premise that physical and psychological stressors occur within a social and economic context, and that there is individual variation in the stress appraisal process as well as behavioral and emotional coping mechanisms to the perceived stressor (McEwen, 1999).

Combining these two theories into a socio-biological model allows researchers to simultaneously explore social and biological variables advancing scientific knowledge as it relates to the understanding of the social-biological interface that may be mediating relationships among environments (i.e., neighborhoods), chronic stress, and health. Details on ecosocial theory and allostatic load, and their relevance to this study are presented in Chapter. 3.

Problem Statement

Despite the numerous studies that have established a clear relationship among neighborhood disadvantage, housing, and health, the mechanisms by which neighborhoods impact health remain unknown. Specific to the development of a research trajectory in this area, and adding to the body of knowledge regarding neighborhood effects on health, determining what neighborhood and housing characteristics may most affect low SEP women's health risks must precede both targeted neighborhood/housing aggregate-level interventions and individual-level interventions within the highest risk neighborhoods. More research is needed that incorporates a socio-biological approach in order to determine the mechanisms by which neighborhoods "get under the skin" and contribute to the development of chronic disease.

Purposes of the Study

The specific aims of this study are as follows:

1. To determine the relationships among neighborhood characteristics, perceived stress, unfair treatment psychological distress, and salivary cortisol secretion among low SEP female heads of household with children;

2. To determine the differences in neighborhood characteristics of two subsidy housing types, specifically section 8 and public housing, in which low SEP female heads of households with children live; and

3. To examine the differences in housing satisfaction, perceived stress, unfair treatment psychological distress, and neuroendocrine regulation, specifically cortisol secretion, in low SEP female heads of households with children by housing subsidy type (i.e., section 8 and public housing).

Hypotheses

The following hypotheses are investigated in this dissertation

1. Significantly higher levels of crime rates, neighborhood disorder, neighborhood stress, and neighborhood disadvantage will be positively associated with salivary cortisol.

2. Public housing sites will have significantly more neighborhood disorder, greater levels of neighborhood disadvantage, higher levels of neighborhood stress more perceived crime rates, higher objective crime rates, and lower levels of collective efficacy than S8 sites.

3. Women living in PH will experience significantly lower levels of housing satisfaction, have higher levels of perceived stress, psychological distress, and greater alterations in salivary cortisol secretion than women living in S8.

Limitations

This study has several limitations and therefore the findings should be interpreted with caution. First, non-probability sampling limits the generalizability of this study to other populations. Using a random sample of neighborhoods and a random sample of participants from each neighborhood would improve the generalizability at the population level and is vital to conducting epidemiological studies. Second, the small sample size may account for the lack of significant findings among neighborhood characteristics, psychological distress, health and salivary cortisol. Third, the research design could be strengthened by utilizing a longitudinal design that collects physiological measures over several years as opposed to the cross-sectional repeated measures design used in this study. Finally, most of the measures of neighborhood characteristics were based on perceptions of the study participants. Using more objective measures of crime rates and neighborhood disorder would prove useful in future studies. However, perceptions of one's environment are important factors to consider when investigating behavioral and physiological responses to stressors. The effect of the social environment results from the

fact that the brain and body are constantly communicating via the autonomic nervous system and the endocrine and immune systems (McEwen, 2005) Thus, the regulation of stress-related mediators is dependent upon how a potential stressor is perceived as well as the individual's capacity to cope with that stressor.

Significance

Housing is an important social determinant of health, and housing policy in the U.S. disproportionately affects women living in poverty. An increased understanding of relationships among neighborhood, housing, and health has the potential to significantly improve individual and population health. The data from this study in accordance with other epidemiological studies in this area indicate that neighborhood disorder and exposure to crime are important factors to consider regarding women's health.

In line with both the Healthy People 2010 (U. S. Department of Health and Human Services, 2005) goals and the National Institutes of Nursing Research priorities, nursing has a commitment to reducing health disparities among disadvantaged groups through its scientific investigations. This research is consistent with both of these emphases within the public health arena and nursing. Moreover, there is an emerging interest in the relation between the built environment (i.e., neighborhoods and housing) and health in the field of urban planning, Professionals from this field are partnering with public health practitioners and others to improve neighborhood conditions through multidisciplinary investigations that aim to improve the publics' health by establishing healthy cities through more effective public policy (Northridge, Sclar, and Biswas, 2003).

Future research in women's health disparities must include examination of social and contextual factors that mediate SEP and health in order to develop population-based interventions (Fleury, Keller, and Murdaugh 2000). Specific to the development of a

research trajectory in this area, and adding to the body of knowledge regarding neighborhood effects on health, determining what neighborhood and housing characteristics may most affect low SEP women's health risks must precede both targeted neighborhood/housing aggregate-level interventions and individual-level interventions within the highest risk neighborhoods.

Furthermore, lacking in the literature is knowledge regarding whether the experiences of women living in S8 housing differ from those in public housing, and how neighborhood characteristics associated with each of these programs affect health. Studies that discern whether home environment or neighborhood characteristics of S8 housing differ from public housing in ways relevant to health are needed. A more thorough understanding of how S8 and public housing environments differ is critical, given that the policy intent behind S8 housing is to reduce the concentrated pockets of poverty and its sequelae that have been observed in public housing

Knowledge gained from neighborhood, housing, and health research focusing on subsidized housing (i.e., public and section 8 housing) policies would provide valuable data from which to evaluate the impact of housing voucher and mobility programs on health. In addition, such knowledge can assist public health practitioners to secure financial resources for improving neighborhood conditions. The inclusion of bio-markers (such as cortisol, blood pressure, and others) to test specific physiological mechanisms may provide more in-depth knowledge about physiological pathways that may be affected by social processes such as housing policies and neighborhood conditions and how they are embodied into physiological processes and thus produces illness (Acevedo-Garcia et al., 2004; Krieger and Davey-Smith, 2004).

CHAPTER 2
LITERATURE REVIEW

This chapter presents a literature review that concentrates on four major areas relevant to the study aims. The discussion begins by presenting relevant studies on the broad topic of the relationships among SEP and chronic disease health disparities, particularly as they relate to women. Then the discussion will become focused at the neighborhood level presenting study findings that indicate how neighborhood characteristics contribute to chronic stress related health disparities. Nested within neighborhood are a variety of housing subsidy types that may also impact health outcomes. This study focuses on federally subsidized Section 8 and public housing, therefore, a brief overview of subsidized housing policy, neighborhood characteristics associated with subsidized housing, and associations between housing and health are presented. Finally this review presents hypothesized physiological mechanisms that may be affected when neighborhoods and housing serve as sources of chronic stress. This part of the discussion focuses on chronic stress effects on physiology, specifically the hypo-thalamic-pituitary-adrenal (HPA) axis and the development of chronic disease. Due to the extensive nature of the literature in the area of socioeconomic position and health, this section of the literature review will focus on studies conducted in the United States and in England.

Socioeconomic Position and Health

In the past 20 years, research that focuses on the relationship between socioeconomic position and health has grown substantially. Some studies compare

morbidity and mortality of different socioeconomic groups within individual countries, while others contrast health experiences across countries, document the extent of inequalities, and explore possible explanations of differential health outcomes (Feinstein, 1993). Most studies of SEP and health have focused on individual-level SEP (i.e., individual income, education, occupation), and the effects on broad health outcomes such as morbidity and mortality (Robert, 1998).

In a review of the literature on SEP and health research published from 1970 to 1990, Feinstein reports findings from early seminal work and critiques the methodology of several studies conducted in the U. S. and England. For example, one study utilized two data sets the 1960 Matched Records Study and the Chicago Area Study. The Chicago Area Study collected information on census tracts and will be discussed in the section on neighborhood SEP and health. The 1960 Matched Records Study linked death certificates with census information on the educational attainment and household income for 340,000 individuals who died during May-August 1960 in the U. S. These findings show a strong inverse relationship among whites and non-whites, females and males aged 25-64, between years of schooling and mortality in 1960. The difference in standardized mortality rates between the least and best educated subgroups was at least 65% for each of the four classes (i.e., white/non-white men and white/non-white females) (Feinstein, 1993). Furthermore, this study elucidates the fact that the effects of education and income are largely independent of one another.

Another important source of evidence supporting the SEP-health relationship comes from the Black Report which was published in 1980. In 1977 Sir Douglas Black and other researchers were appointed by the British Government to assess the evidence

on inequalities in health in the United Kingdom (U. K.). The Black Report assesses inequalities using a classification system of the British population in which the population is divided into six social classes including professional, intermediate, skilled nonmanual, skilled manual, partly skilled, and unskilled. Household status is determined by the occupation of the head of household (Feinstein, 1993). The findings from this study showed that in 1971, substantial mortality differentials existed in the U. K. and had in fact widened since 1930. In 1971, the mortality rate among men in the lowest occupational class (unskilled) was 9.88 per 1,000 as opposed to men in the highest class which was significantly lower at 3.98 per 1,000. The same trend was found among women as well. Women in the highest (i.e., professional) occupational class had a mortality rate of 2.15 per 1,000 while those in the lowest occupational class had a mortality rate of 5.31 per 1,000 (Feinstein, 1993).

There are several problematic methodological issues that have been identified in this area of research. First, the socioeconomic indicators used in these early studies, particularly income, do not adequately account for the possibility that poor health causes reduced income rather than low income resulting in poor health. In addition, many early studies use household income measures which – for married households –are generally the male's income and therefore do not accurately reflect the woman's income or access to the household income. Thus, the income and health argument holds more validity when applied to men than when applied to women (Feinstein, 1993). Furthermore, these studies do not account for the impact of unpaid labor (i.e., household duties in addition to work) on women's health. Lastly, many researchers in this area believe wealth as opposed to income to be the superior indicator because the problem of reverse causality is

less likely to affect household wealth, than household income measures, primarily because household wealth accumulates over time and consequently is less affected by a single episode of illness (Berkman and Kawachi, 2000; Feinstein, 1993).

After The Black Report was published an explosion of research in health inequalities followed. Much of the work expanded upon the approach used in The Black Report to include alternative datasets for more recent years. For example, Whitehead reviewed evidence from the 1979-83 decennial supplement that showed inequality in mortality rates across social classes was the same as, or slightly larger than before thus supporting evidence from the Black Report even after circumventing some of the methodological weaknesses in previous studies (Feinstein, 1993). In a similar study, utilizing the same data, the researchers merged the social classes into two different groups – manual and nonmanual—and found similar results that indicate a wide inequality in heart disease and lung cancer rates between the two groups (Marmot and McDowall, 1986).

The more recent Whitehall I and II Studies of British civil servants conducted by Michael Marmot and colleagues provide further supporting evidence for the social inequality and health relationship (Williams and Collins, 1995). The Whitehall I Study examined mortality rates over 10 years among males aged 20-64. An inverse association between grade (level) of employment and mortality from coronary heart disease (CHD) and a range of other causes was observed. Men in the lowest grade (i.e., messengers, doorkeepers, etc.) had three times the mortality rate than men in the highest grade (i.e., administrators) (Marmot, Shipley, and Rose, 1984). After controlling for standard risk factors such as hypertension, smoking, obesity, and physical inactivity, the lowest grade

worker still had a relative risk of 2.1 for CHD mortality compared to the highest grade worker (Marmot and Wilkinson, 1999).

The Whitehall II study was designed to assess the effects of the social environment on health and the causes of social inequalities in health. More specifically, it investigates the role of stress on health and the extent to which stress might be involved in the social inequalities in health (Marmot, 2004). The study began in 1985 and included 10,308 male and female civil servants. Findings were consistent with the first Whitehall study. Clear employment grade differences in health risk behaviors including smoking, diet, and exercise, economic and social circumstances, and monotonous work characterized by low control and low satisfaction were present in both men and women (Marmot et al., 1991). Furthermore employment grade differences were also associated with CHD (Marmot, Bosma, Hemingway, Brunner, and Stansfeld, 1997), metabolic syndrome and central obesity (Brunner, 2000).

In addition to the well known Whitehall Studies described above, numerous studies, such as the Multiple Risk Factor Intervention Trial, (Wilkinson, 1996) demonstrate that individual-level SEP disparities exist for many chronic diseases (Fleury, Keller, and Murdaugh, 2000; Kington and Smith, 1997; Marmot and Wilkinson, 1999). To date, much of the epidemiological research in the area of individual-level SEP relationships to chronic disease has focused on CHD (Steptoe and Marmot, 2002). However, a consistent inverse relationship exists between SEP and multiple health indicators, such as CVD, diabetes, metabolic syndrome, arthritis, tuberculosis, chronic respiratory illness, malignant melanoma. (Adler and Ostrove, 1999), and lung and gastrointestinal cancers (Feinstein, 1993).

Socioeconomic Position and Chronic Disease Health Disparities

Socioeconomic position (SEP) has multiple dimensions that are associated with health. In virtually every dimension of mental and physical health, people in lower-socioeconomic groups have poorer health than those in the middle- or upper-income groups (Dalaker, 2001). Regardless of the SEP indicator used, (such as education, occupation, housing tenure, income), those who are worse off socioeconomically have worse health (Marmot and Wilkinson, 1999; Smith, Wentworth, Stamler, and Stamler, 1996). The gradient in morbidity and mortality by SEP for several chronic disease states has been documented for hundreds of years, observed consistently across studies, within and across countries and cultures, and persists and is actually increasing today (Lynch, 2000; Marmot and Wilkinson, 1999). For example, in a study that examined the extent of socioeconomic gradients in all-cause and cardiovascular disease (CVD) mortality among U. S. men and women aged 25-63 years from 1969 to 1998, the researchers found that area socioeconomic gradients in all cause and CVD mortality increased significantly over the last three decades (Singh and Siahpush, 2002). The researchers also found that rates of all-cause and CVD mortality among men in the lowest area socio-economic group were 42% and 30% greater in 1969-1970 and 73% and 79% greater in 1997-1998 respectively than those in the highest socioeconomic group. Women in the lowest area socioeconomic group had rates of all-cause and CVD mortality that were 29% and 49% greater in 1969-1970 and 53% and 94% greater in 1997-1998 respectively than women in the highest area socioeconomic group. It is important to note, however, that health disparities are not observed solely at the extreme ends of the socioeconomic spectrum. Morbidity and mortality risks increase along each incremental decrease in SEP (Wilkinson, 1996).

The Matched Records Study conducted by Kitagawa & Houser and published in 1975 as previously mentioned shows a persistent inverse relationship between educational attainment and mortality from heart disease for both men and women and this relationship is stronger for both sexes aged 25 to 64 (Feinstein, 1993). However, the relationship between educational attainment and cancers is more complex. Cancers directly related to smoking such as lung cancer, as well as, stomach, intestinal, and rectal cancers show a strong inverse relationship to education where other cancers (i.e., prostate and breast) do not (Feinstein, 1993).

SEP and Women's Health Disparities

Very little research has been conducted that specifically addresses women's SEP and health. Most research in the area of SEP and health has focused on middle-aged males or have included both males and females utilizing a cross-sectional descriptive methodology (Beebee-Dimmer, Lynch, Turrell, Lustgarten, Raghunathan, and Kaplan, 2004). One of the reasons that the relationship between women's SEP and health has not received much attention is because of the difficulty in conceptualizing and measuring the class position of those without direct labor market ties (McDonough, Walters, and Strohschein, 2002).

Studies that have focused on women's health in relation to SEP have typically been limited to the quality of social roles, major institutionalized roles, and unequal distribution of resources while the socioeconomic dimensions of women's lives remain relatively unexplored (McDonough et al., 2002). Furthermore, a paucity of SEP and health related research has been conducted among women residing in the United States (U. S.). Many of the studies reviewed on individual-SEP and women's health originated in other industrialized countries such as Canada (McDonough et al., 2002), Britain

(Arber, 1997; Cooper, 2002; Martikainen, Lahelma, Marmot, Sekine, Nishi, and Kagamimori, 2004; Stafford, Bartley, Mitchell, and Marmot, 2001) , Spain (Artazcoz, Borrell, Benach, Cortes, and Rohlfs, 2004) and Finland and Japan (Martikainen et al., 2004).

Despite the lack of research that focuses specifically on women's SEP and health, studies in the U. S. have consistently shown that women of lower SEP have a higher prevalence of diabetes (Centers for Disease Control, 2000), report higher levels of social stress such as recent life events, major events, and death events (Turner and Avison, 2003), and have significantly poorer mental health (especially lone mothers with children) (Macran, Clarke, and Joshi, 1996). In addition, studies that have explored family demands, employment and health in women have found that among women workers of low educational level, family demands showed a negative effect on health and health related behaviors (Artazcoz et al., 2004).

As evidenced by this review, the relationship between SEP and health is well known. What is missing from the literature is research on the mechanisms by which SEP affects women's health. While the precise mechanisms that mediate individual-level SEP and health are unknown, studies indicate it is not only access to material resources that are important, but that psychosocial factors contribute to health disparities, as well. For example, there is an interaction among high psychological demand/low control environments, an increased risk of psychological strain, and physical illness (Berkman and Kawachi, 2000; Lundberg, 1999; Marco, 2000). Thus, in terms of individual-level measures of SEP, the pathways through which SEP exerts its influence are not only through access to material resources (e.g., income or health care services), but may also

operate via psychosocial mechanisms, as more fully described later in the literature review (see section on Hypothalamic-Pituitary-Adrenal (HPA) axis Physiology and its Role in Chronic Disease Development). Furthermore, the area in which one lives may also have a significant impact on health. As will be shown in the following sections, more research is being conducted that explores the relationship between neighborhoods and housing and their impact on health, which can account for some of the influence of SEP on health.

Neighborhood SEP and Health

In addition to research on individual-level SEP and health, epidemiologists are now exploring the SEP-health relationship from an aggregate level. Several studies have found residents of disadvantaged neighborhoods have worse self-reported health and more chronic health problems than persons living in higher SEP neighborhoods (Ross and Mirowsky, 2001). Studies are finding that neighborhood-level SEP indicators have a significant effect on health independent of individual-level SEP (Bosma, Dike van de Mheen, Borsboom, and Mackenbach, 2001; Roy, Kerschbaum, and Steptoe, 2001). For example, in a study of 235 residents of 19 lower SEP neighborhoods, researchers found that neighborhood problems constitute sources of chronic stress that may increase the risk of poor health (Steptoe and Feldman, 2001).

One of the problems in this area of research is the diversity of indicators used to measure neighborhood level SEP. Some researchers have aggregated random samples of individual SEP indicators (i.e., income, education, and occupation to the neighborhood level) (Bosma et al., 2001). Others have used indicators such as percent unemployed, percent on public assistance, poverty rates, and percent households headed by females at the census tract level to determine the neighborhood SEP level (Boardman, Finch,

Ellison, Williams, and Jackson, 2001; Ross and Mirowsky, 2001). Krieger and colleagues found that among eight studies, four used differently categorized measures of neighborhood social class composition, education, poverty level, and unemployment rate, two used measures of average annual family income and two used data on median family income and educational level (Krieger et al. 2003). Despite the SEP measure used, the SEP-health disparities relationship persists above and beyond individual socioeconomic and behavioral factors and therefore warrant further investigation (Steptoe and Feldman, 2001).

Neighborhoods and Health

The Concept of Neighborhood

Neighborhood is a concept that has myriad definitions depending on the context in which it is used. A variety of criteria can be used to define neighborhood, including historical criteria, geographical criteria, resident's perceptions, and administrative boundaries (Diez Roux, 2003). In addition, the size and definition of the geographic area may differ based on the outcome being studied.

Neighborhood has been defined as a place where people can easily walk over and interact with each other and as a social organization of people who reside within a geographical boundary (Galster, 2001). Kearns and Parkinson (2001) describe neighborhood as existing at three different levels. These include the home area (a 5-10 minute walk from one's home), locality, and urban district or region. The predominant function associated with each level of neighborhood is different. For example, the home area is where the psychosocial purposes of neighborhood is strongest with the main functions being, relaxation, connecting with others and fostering attachment and belonging. Localities or sub-districts (e.g., a public or section 8 housing complex)

function as sites for residential activities and positioning oneself within social networks. Regional aspects or the larger urban districts of neighborhood (e.g., cities or towns) provide social and economic opportunities. Importantly, Kearns and Parkinson also note that at the second level of neighborhood (localities), public or low-income housing can be subject to social exclusion and discrimination imposed upon them by the larger urban district.

The attributes comprising neighborhood are dynamic and are the result of past and current flows of households and resources into and out of a defined geographic space (Kearns and Parkinson, 2001). For the purpose of this study, neighborhood will be defined according to Galster's (2001) definition that states, "Neighborhood is the bundle of spatially based attributes associated with clusters of residences, sometimes in conjunction with other land uses" (p. 2112). This definition accommodates the structural, class status, environmental, and social inter-active characteristics of a neighborhood. Structural aspects include the type, state of repair, density, and landscaping of residential and non-residential buildings and the presence of sidewalks. Class status characteristics include income, occupation, and educational composition. The degree of noise pollution, land pollution, and the amount of litter are included in the environmental characteristics of neighborhood. Finally, social-interactive characteristics include local and family networks, degree of inter-household familiarity, type and quality of interpersonal associations, participation in local organizations, and strength of informal social control (Galster, 2001).

Extant literature in this area of research has generally defined neighborhood using geographical or administrative boundaries. For example, studies conducted addressing

neighborhood SEP and health outcomes typically identify neighborhood by census tract area (Boardman et al., 2001; Ross and Mirowsky, 2001) or combine census tracts into "neighborhood clusters" that are ecologically meaningful and internally homogeneous (Sampson and Raudenbush, 1997). According to the U. S. Census Bureau, census tracts are small homogeneous areas in which similar population characteristics, economic status and living conditions are found (The Public Health Disparities Geocoding Project, 2004).

As evidenced by this review, neighborhood can be defined in a variety of ways. Therefore, it is important to carefully consider the appropriate spatial scale in regards to the research questions and variables to be studied (Macintyre, Ellaway, and Cummins, 2002). Neighborhood disadvantage is one example of a variable that is appropriately measured at the census tract level. On the other hand, social networks may not be bounded by geographical boundaries and may either be much broader spatially or narrowly confined.

Neighborhood Disadvantage, Disorder and Health

Neighborhood disadvantage is a term used to describe socioeconomic position of a locality. Typically measured at the census tract level, neighborhood disadvantage is most frequently operationalized by developing an index of various indicators such as family poverty, male unemployed, educational level, public assistance and female-headed households. Researchers have used percent poverty level, percent female heads of households, percent male unemployed, percent on public assistance (Boardman et al., 2001; Sampson and Raudenbush, 1997), or prevalence of poverty and mother-only households, college educated residents and homeownership (Ross and Mirowsky, 2001).

Economically disadvantaged neighborhoods are characterized by high poverty rates. Subsidized and other low-income housing units are frequently concentrated in these

high poverty areas. Neighborhood disadvantage has been positively related to higher levels of stress, lower social resources, and higher levels of anxiety and depression (Boardman et al., 2001).

Studies show that neighborhood disadvantage in the U. S. is associated with increased levels of anxiety and depression among adolescents (Aneshensel and Sucoff, 1996), discrimination in the workplace (Kirschenman and Neckerman, 1991), low birthweight (Buka, Brennan, Rich-Edwards, and Raudenbush, 2003; Pearl, Braveman and Abrams, 2001) and heart disease (Diez Roux, Merkin, Arnett, Chambless, Massing, Nieto, Sorlie, Szklo, Tyroler, and Watson, 2001; Sundquist, Malmstrom, and Johansson, 1999). Furthermore, people living in economically disadvantaged neighborhoods have reported more frequent experiences of unfair treatment (Schulz, Williams, Israel, Becker, Parker, Sherman, and Jackson, 2000), higher levels of substance abuse (Boardman et al., 2001), and higher levels of neighborhood disorder (Ross and Mirowsky, 2001).

Neighborhood disorder is a concept that includes both the physical and social aspects of a neighborhood. Visible signs of physical disorder include high levels of noise, dirtiness, abandoned and run-down buildings. Vandalism and graffiti are common in these areas. Social disorder includes higher crime rates and signs such as fights and trouble among neighbors, the presence of people hanging out on the streets, drinking and taking drugs (Ross and Mirowsky, 1999).

Neighborhood disorder can be seen as a chronic stressor among urban communities that can potentially affect health in a variety of ways. For example, perceptions of higher neighborhood disorder have been linked to greater depressive symptoms after controlling for baseline depressive symptoms (Latkin and Curry, 2003). Ross and Mirowsky (2001)

found that people living in disadvantaged neighborhoods with high levels of perceived disorder have higher levels of fear, report more chronic conditions and worse health and physical functioning.

These studies do not include physiological biomarkers that would illuminate the mechanisms by which neighborhood stressors impact mental and physical health. Fear stimulates the release of epinephrine and norepinephrine, followed by the release of cortisol (Ross and Mirowsky, 2001). Chronic release and exposure to these hormones have been associated with a variety of illnesses such as hypertension (HTN), hypercholesterolemia, atherosclerosis, and hyperglycemia (McEwen, 2000). Furthermore, little is known on how neighborhood social cohesion and social networks may mediate the impact of neighborhood disadvantage and disorder on health.

Neighborhood Social Cohesion and Health

Social cohesion is a new construct in public health research believed to mediate the relationship between neighborhood SEP and health. It has been studied predominantly as an important neighborhood characteristic and has been clearly differentiated from individual social support in that it represents trust among people with some geographically defined boundary where one lives. Kawachi and colleagues (1997) found social cohesion explained 58% of the variance of all-cause age- and SEP-adjusted mortality, and for 15%-20% of the variance in other CVD mortality. Thus, the role of neighborhood social cohesion in modulating chronic stress-physiological mechanisms believed to contribute to health disparities among women deserves further study.

However, the concept of social cohesion is wrought with multiple and confusing definitions. Authors frequently define social capital and social cohesion in much the same way (Kawachi, Kennedy, and Prothrow-Stith, 1997). For example, Kawachi has used the

same indicators of social capital to define and measure social cohesion in different studies (Kawachi, Kennedy, Gupta, and Prothrow-Stith, 1999). Both social cohesion and social capital have been defined as the level of trust between citizens of a community, norms of reciprocity and participation in civic organizations that cooperate for mutual benefit (Kawachi, Kennedy, and Glass, 1999). Forrest and Kelly (2001) describe social cohesion as being "about getting by and getting on at the more mundane level of everyday life" (p. 2127).

While social phenomenon within neighborhoods such as those represented by social cohesion are potentially relevant areas for intervention to improve health, nurse scholars (Drevdahl, Kneipp, Canales, and Dorcy, 2001) and others (Buka et al., 2003; O'Campo, 2003) have urged caution in assuming increasing social cohesion is a simplistic or complete remedy for reducing the health disparities observed to occur among neighborhoods with 'more' or 'less' cohesion. Nonetheless, when considering one (of several) contributing factors relevant for examining mechanisms underlying health disparities, the consistency and magnitude of associations observed to date deem it a worthwhile concept to investigate. For the purposes of this study a socially cohesive neighborhood is defined as the extent of trust and social interaction within the neighborhood (Beauvais and Jenson, 2002; Buka et al., 2003; Sampson and Raudenbush, 1997).

Neighborhood Aspects of Subsidized Housing: Implications for Women's Health

Nested within neighborhoods are a variety of housing types such as single-family and multi-family units, owned versus rental housing as well as subsidized housing. High poverty neighborhoods tend to have more low-income subsidized rental housing units such as public and section 8 housing (Pendall, 2000). Public housing (PH) consists of

housing units owned and operated by the government and typically houses very low-income families. PH residents pay rent based on income with a minimum of $25.00 to $50.00 up to 30% of their monthly income (less deductions allowed by regulations) (U. S. Department of Housing and Urban Development, 2003b). Section 8 housing is a voucher program in which recipients look for rental housing in the private market. Recipients of S8 contribute approximately 30% of their monthly income toward housing costs with S8 programs paying the remainder of a defined payment standard (U. S. Department of Housing and Urban Development, 2003a). Nationally, only 14.8% of S8 voucher recipients live in high poverty neighborhoods (Turner, Popkin, and Cunningham, 1999), however, while 53.6% of PH residents live in high poverty neighborhoods.

In the United States, more than 5 million families are living in substandard housing (Bashir, 2002). Despite often-deplorable conditions, housing is often the highest expenditure for poor families. Increases in fair market rent (gross rent estimates for a specified area that include shelter cost and utilities except telephones) are far exceeding increases in income, particularly among low-income families. When families are forced to spend most of their income on housing, other important needs such as food, clothing, health care, and emotional stability suffer (Bashir, 2002).

Approximately 4.8 million subsidized housing units are available in the U.S., with 2.4 million households participating in the Section 8 program, 1.3 million households living in public housing units, and the remaining 1.1 million units comprised of other types of housing assistance (U. S. Department of Housing and Urban Development, 2002). Of all available subsidized units in the U.S., 96% are occupied. The occupied units are comprised of 58% minority households and 70% female-headed households such as

single-mother households and elderly women living alone (U. S. Department of Housing and Urban Development, 1998).

Housing and Health

Decent, affordable housing not only impacts individual and family health; it is also the building block of healthy neighborhoods, shaping the quality of life in communities. Improved housing can lead to better outcomes for individuals and society at large. The relationship between housing and health has been a long-standing issue in the field of public health. As early as 1872 in a series of essays entitled "The Housing Question", Freidrich Engels discussed the relationship between housing conditions and poor health. He argued that the conditions of the poor, working class areas in cities – viewed as breeding grounds for epidemics – could not be ignored without impunity. While the conditions creating the kind of infectious epidemics Engels addressed have been brought under control in today's industrialized countries and cities, the spatial concentration of socioeconomic groups is still observable (Dunn, 2000).

Extant research on housing and health has been mainly concentrated in four areas: 1) the disadvantage of individuals who are already in poor health in the housing market and their self-selection into substandard housing conditions, which may in turn account for any observed association between poor housing and poor health; 2) health status and access to health care for homeless persons; 3) pathological aspects of dwellings as the presumed cause of both physical and mental health outcomes, and 4) studies that specifically examine the stresses associated with unaffordable and/or inadequate housing (Dunn, 2000).

Regarding physical health, the literature provides evidence on associations among overcrowding, dampness and mold, indoor pollutants, infestations, and inadequate

heating and infectious respiratory diseases, asthma, rhinitis, eczema, and heart disease (Marsh, Gordon, Heslop, and Pantazis, 2000). Other studies have shown relationships between stress, mental health, and housing. For example, in a study on housing stressors, social supports and psychological distress, researchers revealed that housing stressors are significantly associated with psychological distress and that living in substandard housing is an independent and added source of stress to the lives of people with lower incomes (Smith, Smith, Kearns, and Abbot, 1993). Missing from the literature is research on the mechanisms by which housing affects physical and mental health.

Housing and Women's Health

Inequalities in women's health that parallel income inequalities are related to housing conditions in which women live. The negative effects of poverty or near-poverty on health are often mediated or reinforced by substandard housing. In one case study, a single mother living in public housing described the physical manifestations and social consequences of substandard housing that she believed contributed to poor physical and mental health in women (Welch, 1997) Although there are inherent limitations to single-case studies, other studies with samples of over 300 women living in public housing substantiate this finding (Edin and Lein, 1997; Rollins, Saris, and Johnston-Robledo, 2001; Wasylishyn and Johnson, 1998). Interviews of women living in public housing conducted by Rollins and colleagues (2001) highlighted problems such as structural damage and safety issues. Nicolas and JeanBaptiste (2001) used focus group sessions to learn about the experiences and perceptions of women who receive public assistance (including public housing subsidies). Some of the major themes that emerged included feelings of shame and disrespect, an insecure future, and a sadness regarding life's outcomes (Nicolas and JeanBaptiste, 2001). Similar themes were identified through

interviews with 13 pregnant women living in PH by McAllister and Boyle (1998), including discontent, struggling to make ends meet and loneliness. These three core themes depict the consequences of poverty and living in low-income housing. The women in this study also viewed housing assistance as degrading and stigmatizing, and notably, were much more concerned about the violence in their neighborhood than they were about their current pregnancy (McAllister and Boyle, 1998).

These four studies provided excellent descriptions of the experiences and perceptions of living in public housing. However, these studies do not address whether the experiences of women living in S8 housing might differ from those in PH and how neighborhood characteristics affect health. Whether home environment or neighborhood characteristics of S8 housing differ from PH in ways relevant to health remain unknown. A more thorough understanding of how S8 and PH environments differ is critical, given that the policy intent behind S8 housing is to reduce the concentrated pockets of poverty and its consequences that have been observed in PH. In addition, few studies have incorporated an approach that examines the physiological mechanisms by which neighborhoods and housing may impact health and either exacerbate or attenuate SEP-related health disparities among women. Nurse researchers, however, are essentially silent in this domain, even though public health nurses have an extensive history of addressing neighborhood-related concerns in relation to health (Lundy and Janes, 2001).

Housing Policy and Health

Home ownership is the American dream. Viewed as part of the transition to adulthood, owning one's home is a common goal for many young men and women. Thus, the majority of housing assistance policies and programs have focused on homeownership. Unfortunately, due to a combination of factors such as the lack of

affordable housing and an inadequate living wage, many Americans are unable to become homeowners. Many low-income workers, particularly single-women with children, are unable to own their own homes and must not only rent, but also rent utilizing federal housing subsidies. Moreover, minorities and poor women who must depend on housing subsidies to maintain shelter are often stereotyped as lazy, ignorant, unkempt or destructive, and thus marginalized, discriminated against and located apart from the main stream community and its higher level resources (Hays, 1995).

Since the emergence of federal housing policies in the 1930s and the passage of the Wagner-Steagall Housing Act in 1937, low-income housing has been characterized by many factors leading to stigmatization and marginalization. By 1942, the United States Housing Authority (USHA) had built over 100,000 units in over 140 cities (Von Hoffman, 1996). The construction of public housing utilizing minimal design elements reflective of the moderns style contributed to the distinctive yet negative image that came to be associated with public housing. Functional yet austere looking designs and the placement of high density multi-family housing complexes in super-blocks also contributed to the distinctive image of public housing Therefore, a sharp contrast to the types of residences - detached single-family homes - that most Americans occupied emerged that in time would stigmatize public housing (Von Hoffman, 1996).

Further investigations of past housing policies reveal blatant discriminatory language and practice. The 1934 Housing Act, focused on homeownership, guaranteeing loans for mortgages through government appropriations. However the funds for these loans were restricted to the production of new and existing homes for a single owner.

Tragically, during this time period, discrimination was prominent and many lenders practiced red lining, refusing to loan in certain areas of town based on race and ethnicity.

Redlining was supported by the Federal Housing Administration (FHA). The FHA manuals used by lenders instructed them to avoid areas where discordant racial groups resided. In addition, the FHA encouraged developers to establish deed restrictions prohibiting black owners and residents. Discrimination in the housing market became prevalent. Consequently, property values of minority neighborhoods plummeted, and neighborhood segregation by race and income was perpetuated (Orlebeke, 2000).

Further alienation and marginalization of low-income and minority persons was inadvertently propelled by the design of new public housing units. Unfortunately, high-rise buildings turned into PH disasters due to lack of funding for building design, basic amenities and maintenance, isolation and alienation from surrounding neighborhoods and the lack of public space (e.g., parks) (Orlebeke, 2000). Moreover, during the 1950s and 1960s inner city neighborhoods, now termed ghettos, continued to carry a negative stigma. Burdened with cycles of poverty, lack of formal education, lack of economic stability, inadequate housing and a major reduction in federal funding, life in these areas become unsafe and unhealthy (Von Hoffman, 1996).

Current trends in housing policy paint a bleak picture for housing subsidy programs. In 1971 members of Congress argued that high cost, shoddy construction, poor administration, failure to help low-income families and lack of planning on a metropolitan scale were only a few reasons for serious restructuring and reformation of housing subsidy policies and programs. In 1973, President Nixon called for a moratorium on subsidized housing production. Since then the development of three different program

types – vouchers, block grants and tax credits—have become the primary means of providing support for rental housing.

In the early seventies, the Nixon administration introduced the Section 8 voucher program which gave the recipient the option of choosing a unit costing more than the FMR and paying the difference out of his/her own pocket (Hays, 1995). Voucher programs result in increased mobility of recipients to better neighborhoods that are less socially and economically distressed with greater employment opportunities. One study showed that only 14.8 % of certificate and voucher recipients live in high-poverty neighborhoods (more than 30% poor), compared with 53.6 % of public housing residents (Newman and Schnare, 1997). Furthermore, they have lower rent burdens enabling them to use more of their income on food, clothing and health care needs (Newman and Schnare, 1997).

Debates regarding the best use of scarce federal housing dollars often focus on arguments between housing production and rental assistance through voucher type programs. The original purpose of public housing programs was to provide housing for poor working families in urban inner city areas as a means of improving slums. However, several issues associated with public housing (such as, housing design, poor maintenance, residential segregation, and placement of low-income housing in economically distressed areas) have contributed to social inequalities. The economic and racial segregation of poor families to the poorer less desirable areas of cities associated with federal housing policies and programs beginning in the 1930s unfortunately persist to this day. The social inequalities associated with housing subsidy have significant implications for the health of women and the neighborhoods where they live. Marginalization, discrimination,

substandard housing, and housing located in disadvantaged neighborhoods may serve as chronic stressors that catalyze a cascade of events that in time may lead to poor physical and mental health.

What We Know and Gaps in Knowledge and Research

While research in this area has found consistent associations between housing, poverty, and health, the pathways and mechanisms by which the social aspects of these phenomena produce physiological alterations are not well known (Dunn, 2000). Few studies have incorporated an approach that examines the physiological mechanisms by which neighborhoods and housing may impact health and either exacerbate or attenuate SES-related health disparities among women. Lacking in the literature is knowledge regarding whether home environment or neighborhood characteristics of various subsidized housing types differ and whether the experiences of women living in various subsidized housing types differ in ways relevant to health. A more thorough understanding of how subsidized housing (S8 and PH) environments differ is critical, given that the policy intent behind S8 housing is to reduce the concentrated pockets of poverty and its sequelae that have been observed in PH. Furthermore, very little research explores housing as a factor in the social production of health inequalities. Population health studies are needed that explore the relationships among housing, social capital, social cohesion, income/wealth inequalities and women's health from a life course perspective (Berkman and Kawachi, 2000; Dunn, 2000). Studies should address the social-biological interface, thus sorting out the mechanisms by which the social aspects of housing are embodied into physiological characteristics that impact health (Acevedo-Garcia et al., 2004).

SES and Chronic Stress: The Role of the Hypothalamic-Pituitary-Adrenal (HPA) Axis in Chronic Disease

This section of the literature review highlights two areas: the first provides a brief overview of normal hypothalamic-pituitary-adrenal (HPA) axis function and its hypothesized role in chronic disease development and the second reviews literature specific to changes in normal HPA axis function by SEP and chronic stress exposure. Human studies have established relationships between psychosocial stressors and physiologic stress involving the HPA axis (Linden, Rutledge, and Con, 1998) Furthermore, there is increasing evidence that characteristics of lower socioeconomic environments are associated with excessive HPA activation (Seeman and McEwen, 1996) that may lead to the development of chronic conditions that have high morbidity and mortality rates (Rosmond and Bjorntorp, 2000). Responses of the HPA to stress allow organisms to achieve allostasis, the ability to obtain stability through change, which is required for survival (McEwen, 1998). McEwen and others (Seeman, Singer, Rowe, Horwitz, and McEwen, 1997) have proposed the cumulative effects of adapting to stressors (predominantly through pronounced HPA activation) may be quantifiable using the concept of allostatic load as an index of wear and tear on the body over time.

Accumulation of allostatic load is hypothesized to play a role in the pathogenesis of chronic diseases and is a useful concept for considering the relationships among socioeconomic status, the psychosocial stressors of single-mothers, physiologic stress arousal patterns, and related disparities in health (McEwen, 1998). Animal studies have been particularly useful in determining neuroendocrine pathways of the chronic stress and health relationship due to the ability to eliminate selection bias (Kneipp and Drevdahl, 2003). Nonhuman primate studies indicate that dominant social status in a

stable environment is associated with less HPA activation (Sapolsky and Mott, 1987), higher HDL levels (Sapolsky, 1989), and less coronary atherosclerosis in both males and females (Kaplan, Manuck, Clarkson, Lusso, and Taub, 1982). Reciprocally, animals that are socially subordinate, socially isolated, or in other socially-stressful situations consistently demonstrate greater HPA activity (Kalin and Carnes, 1984). In the immediate postpartum period, for example, Bahr, and colleagues (Bahr, Pryce, Dobeli, and Martin, 1998) found female gorillas living under more stressful environments in captivity (e.g., being harassed by other adult and juvenile gorillas) had higher urine cortisol levels and less physical contact with their infants, suggesting the social environment affects parenting behavior and infant bonding via stress-related mechanisms. Several rat studies (Gelsema, Schoemaker, Ruzicka, and Copeland, 1994; Roy et al., 2001) support a relationship between chronically stressful environments, psychological distress, and CVD.

The SEP of women's lives in relation to chronic stressors and disease outcomes has received little attention, even though there is increasing evidence from human studies that chronic stress and HPA axis alteration independent of behavioral or lifestyle factors exists (Julius and Nesbitt, 1996). Other studies show that characteristics of lower SEP environments are associated with altered HPA activity believed to be involved in the development of chronic conditions that have, at the ecological level, been associated with lower SEP (e.g., CVD, DM, and asthma) (Bjorntorp, Holm, and Rosmond, 1999; Wamala, Lynch, and Kaplan, 2001). In a study of diurnal cortisol patterns in healthy mothers of toddlers, investigators found that individual differences in cortisol secretion

patterns could be predicted from medical, demographic, contextual (home and work demands), and psychological variables (Adam and Gunnar, 2001).

While many studies have consistently found chronic stress effects on cortisol patterns, others have not found a relationship (Smyth, Margit, Ockenfels, Gorin, Porter, Kerschbaum, Hellhammer, and Stone, 1997). One reason for this may be that research done in this area has focused on two types of cortisol secretion in response to stressors: (1) those that are short-lived and occur immediately in response to acute, laboratory stressors and (2) those that reflect changes in diurnal secretion patterns in response to chronic, or ongoing, stress exposures. Since the specific aims of this research are to examine chronic stressors in relation to neighborhood context and health, the focus of this discussion will be on alterations in the HPA axis from chronic stress.

HPA Axis Physiology and its Role in Chronic Disease Development

A complex system, the HPA axis regulates the release of many different hormones. These hormones have either a stimulatory or inhibitory effect on many body functions. The following discussion focuses specifically on the release of the glucocorticoid, cortisol in response to stimulation of the HPA axis. When stimulated, the parvocellular neurons within the paraventricular nuclei of the hypothalamus release corticotropin-releasing hormone (CRH), AVP, and other factors. The portal system transports these factors to the anterior pituitary, activates corticotrophs and stimulates the secretion of adrenocorticotropin hormone (ACTH). The systemic blood system transports ACTH to the adrenal glands. The adrenal cortex then synthesizes and secretes glucocorticoids (Campeau, Day, Helmreich, Kollack-Walker, and Watson, 1998). Most importantly researchers hypothesize that exposures to stressors initiate this cascade of events and is one of the hypothesized mechanisms involved in mediating the SEP-health relationship.

Glucocorticoids are known to have metabolic, immunologic, anti-inflammatory, and growth inhibitory effects on the body. They also influence levels of awareness and sleep patterns (McCance and Huether, 1998). However, the main function of glucocorticoids is to promote conditions that assist the body to adapt to adverse situations. Therefore, glucocorticoid receptors are widely dispersed. The most potent glucocorticoid is cortisol. Cortisol supports increased energy requirements during periods of stress by facilitating the mobilization of free fatty acids (FFA) found in adipose tissue in the form of triglycerides. The increase in FFA inhibits utilization of glucose in the peripheral tissues. Cortisol stimulates the release of gluconeogenic enzymes, specifically phosphoenolpyruvate carboxykinase, which regulates the rate of gluconeogenesis. In addition, cortisol also functions to mobilize amino acids from proteins in skeletal muscle (Kacsoh, 2000).

The main function of glucocorticoids is to promote conditions that assist the body systems to adapt to adverse situations. There is evidence to indicate changes in cortisol play a pivotal role in the development of diabetes and CVD. One function of cortisol is to support increased energy requirements during periods of stress by facilitating the mobilization of FFA found in adipose tissue, which may contribute to the development of insulin resistance and, ultimately, Type 2 Diabetes Mellitus (Bjorntorp et al., 1999). Cortisol is perhaps most widely known for its immunosuppressive effects, and evidence now suggests inflammatory processes modulated by cortisol output may play a role in the development of atherosclerosis and CVD (Yudkin, Kumari, Humphries, and Mohamed-Ali, 2000).

Normal cortisol has a diurnal rhythm with a peak occurring in the early morning and a nadir in the early evening. Under periods of stress, cortisol is released acutely to assist the body to adapt to its external and internal demands. Exposure to chronic stressors, however, results in alterations in cortisol secretion that persist over time. It is this change in pattern of cortisol secretion that has been most associated with SEP, chronic psychosocial distress, and the eventual development of select chronic diseases (Lovallo and Thomas, 2000; Raber, 1998). Changes in HPA response and, specifically, the normal diurnal pattern of cortisol secretion to stress, may result in pathological changes that lead to the development of select chronic diseases (McEwen, 1998; Raber, 1998). For example, Plat and coworkers describe how prolonged hypothalamic stimulation from a stressor might result in abnormally high levels of cortisol secretion in the early evening. In addition they found that evening elevations in cortisol were associated with delayed hyperglycemic effects, stimulation of lipolysis and increased concentrations of free fatty acids that have been associated with CVD (Plat, Leproult, L'Hermite-Baleriaux, Fery, Mockel, Polonsky, and Van Cauter, 1999). In another study, researchers found that a stress-related cortisol secretion pattern with a flattened curve—depicting a loss of adaptability to stimuli—was strongly correlated with elevated body mass index, waist-hip ratios, blood pressure, heart rate, triglycerides, total and low-density lipoproteins, insulin, glucose, and visceral fat mass (Bjorntorp et al., 1999). Therefore, they postulate that stress-related cortisol secretion along with an impaired regulation of the HPA axis, are connected to physiologic alterations associated with chronic disease development.

Relationships Among Neighborhood Characteristics, Housing, Chronic Stress, and Health

Studies have demonstrated that neighborhood characteristics play a significant role in determining the type and intensity of daily stress experienced and therefore are important social determinants of health (Boardman et al., 2001; Wasylishyn and Johnson, 1998). Adjusted for individual-level SEP, living in high poverty neighborhoods has been associated with increased daily stressors such as increased exposure to drugs (Boardman et al., 2001) and violent crime (Sampson and Raudenbush, 1997). Studies indicate lower-income women view the stress in their lives as major determinants of not only overall health status but also of other chronic diseases. For example, focus groups conducted by researchers with low-income African-American women to examine their awareness of and concern for CVD found they considered CVD to be associated with stress and low SEP (Behera, Winkleby, and Collins, 2001). Similarly another study found that low-income women with mental health problems were most interested in stress management strategies indicating that they view stress as an important aspect of psychological health (Alvidrez and Azocar, 1999).

Additional qualitative studies with women living in low SES neighborhoods in Detroit highlighted that women linked stressors directly related to neighborhood characteristics (Schulz, Parker, Israel, and Fisher, 2001). Furthermore, the cumulative effect of chronic stressors such as safety issues and unfair treatment was strongly associated with symptoms of depression, while financial and family stress showed the strongest relationships with poorer self-reported health status (Schulz et al., 2001). A recent study conducted by Buka et. al. (2003) examined neighborhood economic disadvantage, neighborhood support, and infant birth weight in 343 neighborhoods. They

found neighborhood economic disadvantage alone accounted for 80.8% of the between neighborhood variance infant birth weight for African-American mothers and 76.3% for White mothers while controlling for individual risk factors (including maternal age, education, smoking during pregnancy, and receipt of prenatal care). When neighborhood social support was added to the model, the addition of this explanatory variable to economic disadvantage accounted for 90.9% of the between neighborhood variance in infant birth weight for Whites.

These results indicate that stressors produced as a consequence of living in economically disadvantaged neighborhoods have significant implications for health, regardless of individual behavioral factors. What remains, unknown, however, is whether and how chronically stressful environments of low-income housing have physiological consequences that contribute to chronic disease development, and whether the environments of PH and S8 differ in ways that are relevant for health (Buka et al., 2003).

Summary

As described in this literature review, neighborhood-level characteristics have a significant effect on health above and beyond individual-level factors. Studies have shown that neighborhood-level factors can produce environments that promote chronic stress and poor health. However, we do not have a clear understanding of the social-biological interface that can provide evidence of the physiological mechanisms by which environments (i. e., neighborhoods) contribute to poor health and chronic illness. The study of social and biological variables at the same time is intrinsically valuable because we are as humans, both social and biological (Brunner, 2000). More research is needed in order to understand what constitutes an unhealthy environment and how it “gets under the

skin" to produce illness (Taylor, Repetti, and Seeman, 1999). This study aims to contribute to this body of research by investigating social and biological variables simultaneously, by beginning to explain the social-biological processes by which neighborhoods and housing impact women's health disparities.

CHAPTER 3
METHODOLOGY

Theoretical Framework

As stated in Chapter 1, this study is guided by a combination of an ecosocial paradigm and the allostatic load model. Together, they allow for exploration of the social – biological interface through which environmental factors affect health. Krieger's ecosocial theory and McEwen's allostatic load model guide the development of the conceptual framework used in this study (Krieger and Davey-Smith, 2004). Krieger and Davey-Smith (2004) call for incorporating the concept "embodiment" in order to capture how social influences (i.e., housing and the built environment) become literally embodied into physiological characteristics that influence health. The concept of "embodiment" simultaneously embraces biologic and social processes while avoiding the trap of equating "biologic' with "innate" and without assuming the soma is governed exclusively by the psyche. In addition, as Krieger and Davey-Smith state, "this new scholarship emphasizes how actualization and suppression of people's agency, that is, their ability to act within their bodies, intimately depends on socially structured opportunities for, and threats to, their well-being" (pg. 95). Thus keeping the concept of embodiment in mind, the conceptual framework developed for this study draws from multiple disciplines such as public health, sociology, and medicine.

The second theoretical model used to derive the socio-biological conceptual framework is McEwen's Allostatic Load model (McEwen, 1998). This model is based on the premise that physical and psychological stressors occur within a social and economic

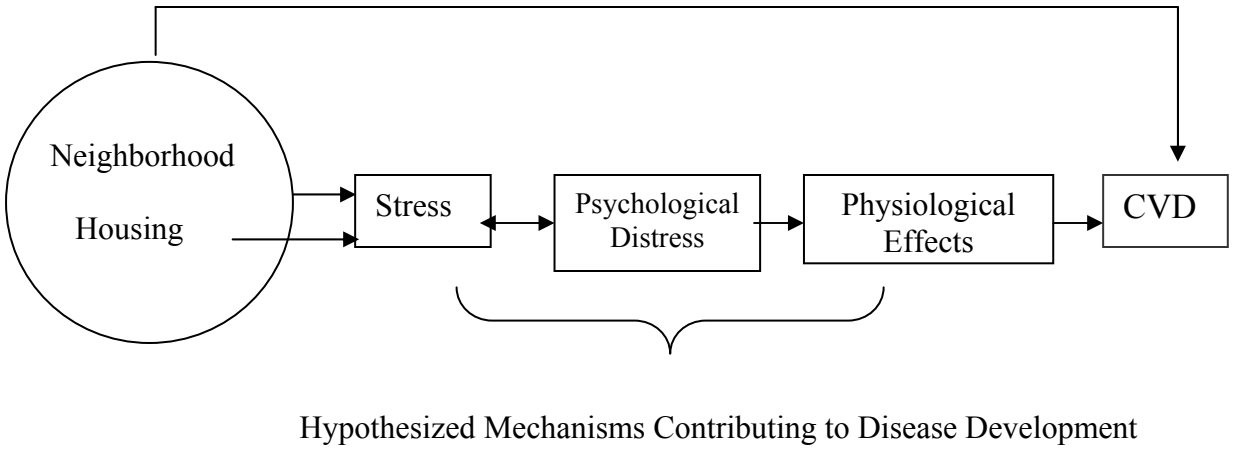
context and that there is individual variation in the stress appraisal process as well as behavioral and emotional coping mechanisms to the perceived stressor (McEwen, 1999). McEwen describes four key propositions of his allostatic load model. First, the brain is the integrative center for coordinating the behavioral and neuroendocrine responses (hormonal, autonomic) to challenges. Second, there are considerable differences in coping with challenges based on interacting genetic, developmental, and experiential factors that predisposes persons to react differently physiologically and behaviorally to events throughout life. Third, inherent within the neuroendocrine and behavioral responses to challenge is the capacity to adapt (allostasis). However, while these physiological processes are protective in the short term, inefficiency or alterations in the ability of the neuroendocrine system to turn on and off responses leads to cumulative negative effects over time. Fourth, allostasis has a price – defined as allostatic load –that reflects the cumulative negative effects or the wear and tear on bodily systems from being forced to constantly adapt to various psychosocial challenges and adverse environments (i.e., disadvantaged neighborhoods).

Accumulation of allostatic load is hypothesized to play a role in the pathogenesis of select chronic diseases, such as insulin resistance, atherosclerosis, increased susceptibility to infections and memory loss (Bjorntorp, Holm, and Rosmond, 1999; McEwen, 1998; McEwen, 2000). Since this model addresses the fact that daily stressors occur within a social and economic context, it is a useful framework for considering the relationships among SEP, the psychosocial stressors of single mothers, physiologic stress arousal patterns, and their noted disparities in health (McEwen, 1999). As such, the impetus in this model is to move from the individual back to populations and consider the average

properties of groups of individuals classified according to measures of SEP attending to not only the social and cultural factors that influence health, but the potential physiological mediators found in these relationships. However, McEwen's model lacks detail regarding the socio-economic aspects of neighborhood and health.

Combining Krieger's ecosocial theory and McEwen's allostatic load model enables the researcher to simultaneously explore social and biological variables. This allows for advancing scientific knowledge as it relates to the understanding of the social-biological interface that may be mediating relationships among environments (i.e., neighborhoods), chronic stress, and health. Relationships among environment, social, psychological, and physiologic factors relevant to this study in relation to the Allostatic Load Model are illustrated in Figure 3-1. Key constructs and concepts and methods of operationalization are explained in the section on major study variables below. The final outcome (CVD) is in grey because it was not explored in the present study. It is only an example of one possible outcome that could be explored using this framework.

Figure 3-1: Socio-biological Model



Research Design

This study utilized a cross-sectional design in which physiological measures were obtained six times a day for 2 days in a sample of 84 women. Of the 84 who participated, complete data were available for only 67 participants – 23 from PH and 43 from S8 housing. The relationships among housing type, neighborhood characteristics, stress, psychological distress and salivary cortisol are examined by specific aim 1. To meet specific aims 2 and 3, differences in neighborhood characteristics, stress, psychological distress and salivary cortisol between women living in S8 and PH are explored.

Population and Sample

The population investigated in this study includes 18 to 45 year old women who are heads of households and have at least one child 18 years-old or less living with them. This age group was selected because it is representative of the target population to be studied. Based on data from the department of Housing and Urban Development, almost two-thirds of those living in subsidized housing are between the ages of 18 and 62 (U. S. Department of Housing and Urban Development, 1998). A subcategory of female children (as defined by NIH) – those who are18 to 21 years of age and are mothers --, are included in this study. While considered by many as children, young (18- to 21- years-old) mothers often live in disadvantaged neighborhoods and poor housing environments. Having the same adult responsibilities as any parent, they experience many daily stressors, associated with adult responsibilities in maintaining family safety and stability. The specific aims of this study are to examine the potential of chronic disease development as a result of cumulative stress associated with adult family responsibilities and being female heads of households within a neighborhood context.

The sample was selected based on their exposure to either S8 or PH environments. Research participants were recruited from the area in cooperation with the Gainesville Housing Authority and S8 housing managers. In Gainesville, Florida and within a 10 mile perimeter of the city limits, there are 1,062 S8 housing "slots". Approximately 400 people per year attend S8 housing orientation provided by the Gainesville Housing Authority. Ten to fifteen percent of people who move into S8 housing move from PH units (Dolder, C. personal communication, June 26, 2002). During a typical application process, of the 400 interested people, 150 applications are processed and reviewed; approximately 5% to 10% are able to move into S8 housing.

The sample was recruited by posting flyers at the local housing agencies, rental units participating in housing subsidy programs, the university, health science center, local hospitals and primary care offices, social service agencies, and churches. In addition, the principal investigator (PI) attended community meetings such as the Black on Black Crime Task Force, and tenant/neighborhood associations in neighborhoods where the sample was located and informed them of the research and recruited interested persons. Addresses were obtained from the Gainesville and Alachua County Housing Authority and letters were disseminated to1500 section 8 and public housing addresses. Most of the public housing participants were recruited by going door to door.

Sample size determination was based on a power analysis to ensure a power of 0.80 is achieved. A sample size of 49 subjects per housing type was needed to detect a difference of .40 in the outcome measures (i.e., salivary cortisol, chronic stress, and psychological distress). For multiple regression analyses a total of 107 women were needed. Power for this study was not achieved due to an inadequate sample size.

A total of 84 women participated in this study. The original sample size of 107 women was not attained due to several issues. Despite compensation with a $30.00 gift certificate to Wal-mart, recruitment of women living in public housing was difficult. Though data was not collected as to why women chose not to participate, based on their comments, fear of getting in trouble with the local housing authority is one possible reason many women did not participate in the study. Also, many of the women refused to collect saliva. Some were repulsed by the idea of collecting saliva, while others voiced concern about what would happen to it after the study was over. Fear and mistrust despite efforts to assure women that their privacy and confidentiality would be maintained was believed to be a major factor in not achieving the desired sample size. Also the study was limited to participants who lived within a 10-mile radius of Gainesville, thus limiting participants geographically.

Of the 84 women who participated, 14 did not have usable cortisol data (defined as missing more that 2 time points in one day). These cases were deleted. Survey and cortisol data were imputed for the 70 participants remaining. Three participants failed to answer over 50% of the questions from one measure leaving a final sample size of 67 women. It was decided a priori that if a participant failed to answer more than 30% of the items in a measure, she would be excluded from data analysis. Up to 10% missing data on a measure may be considered small, while 40% missing data is considered to be high (Musil, Warner, Yobas, and Jones, 2002). Recommendations for handling missing data in nursing research are limited. Decisions regarding the appropriate methods to deal with missing data are based on the pattern, level (subject or item) and amount of data that are missing (Kneipp and McIntosh, 2001; Patrician, 2002). The robustness of certain

imputation techniques is often dependent on extent and amount of missing data. Therefore, these factors should be considered in order to minimize estimation error and response bias (Fox-Wasylyshyn and El-Masri, 2005). Imputation methods used in this study are described in detail later in this chapter.

Setting

The study was conducted in a naturalistic setting (i.e., community of residence). The PI or her research assistant met with participants in their homes or other settings as preferred by the participants.

Human Subjects Protection

Approval for this study was obtained from the University of Florida Health Science Center Institutional Review Board prior to any subject recruitment or data collection. All subjects signed an informed consent form and were given a copy prior to enrollment in the study. Data collection took place in the participant's residential neighborhood. Confidentiality was maintained by use of a code for each subject. All files were kept in a locked file cabinet in the researcher's office. Saliva samples were also coded and stored in a freezer in the college of nursing wet lab, which is locked at all times and has limited access by select faculty, staff, and research assistants.

Inclusion and Exclusion Criteria

Inclusion criteria include:

a) Living in public or section 8 housing for at least 1 month,
b) Able to speak and read English,
c) Between the ages of 18 and 45 years old,
d) A mother who is head of the household with a child living in the same household who is 18 years old or less.

Exclusion criteria include:

a) Age greater than 45 years old,
b) Diagnosis of an autoimmune disorder,
c) Pregnant or breastfeeding,
d) Taking antidepressant, anxiolytic, or steroid-based medications.
e) Working the night shift (from the hours of 11:00 pm to 7:00 am).

The inclusion criteria were selected because this study focuses on women living in section 8 and public housing units and how these areas may serve as stressor for women responsible for maintaining family safety and stability. Women living in an area for at least one month have had time to assess their neighborhood regarding crime, disorder and other characteristics. Women 18 years-old up to 45 years-old are representative of most of those who live in subsidized housing as previously described. The study was limited to participants who could read and speak English due to financial constraints related to hiring a translator.

These exclusion criteria were selected because they are known to alter cortisol levels and may alter responses to stress, depression and anxiety measures. Studies have produced controversial results regarding differences in salivary cortisol based on age group. Studies have demonstrated systematic differences are present in early morning salivary cortisol in which decreasing cortisol concentrations are positively correlated with age (Kirschbaum and Hellhammer, 1992). The lowest mean value of 11.6 nmol/l was found in the age group between 59 and 64 years. The effect of pregnancy on salivary cortisol is controversial. Some studies have shown increases in salivary cortisol secretion while others have not (Kirschbaum and Hellhammer, 1992). In addition, the sample upper age limit of 45 years old will reduce confounding effects of menopause and chronic disease development on physiological measures.

As previously described in the literature review, cortisol has a diurnal pattern with a peak 45 minutes to one hour after awakening and a nadir just before bedtime. Alterations in sleep quality and quanity and working the night shift have been shown to affect the HPA axis and therefore alter cortisol secretion patterns (Leproult, Copinschi, Buxton, and Van Cauter, 1997; Spiegel, Leproult, and Van Cauter, 1999).

In addition to altering salivary cortisol levels, antidepressants and anti-anxiety agents may influence how a particpant responds to questions regarding stress, depression and anxiety leading to underestimation and response bias. Therefore persons taking anti-depressant or anti-anxiety agents were exluded from the study.

Research Variables and Instruments

A demographic data sheet was used to collect information such as age, marital status, race, household type, number and ages of children, individual income, education, and occupation, chronic diseases diagnoses, medication use, height, and weight. In addition information was obtained on current address, living situation (i.e., living with others or others living with them), housing type, length of time in current dwelling, rent assistance per month, public assistance, receipt of food stamps and other sources of income via public assistance resources, such as child care and transportation. Additional data regarding smoking history, alcohol intake, and menstrual cycle phase and regularity were obtained, as well.

Major Study Variables

This section provides detailed information on the measures used in this study. A quick overview of each of the dependent and explanatory variables is provided in the table in the Appendix.

Neighborhood Characteristics

Neighborhood is defined according to Galster's (2001) definition that states, "Neighborhood is the bundle of spatially based attributes associated with clusters of residences, sometimes in conjunction with other land uses" (p. 2112). This definition is broad and quite abstract. It includes several aspects of neighborhood such as the structural, class status, environmental, and social inter-active characteristics of neighborhood.

For the purposes of this study, the term neighborhood characteristics include information on neighborhood economic disadvantage (measured at the census tract level), perceived neighborhood disorder, exposure to crime, and neighborhood cohesion. Each of these measures is described more fully below.

Neighborhood Economic Disadvantage

Neighborhood economic disadvantage was obtained using census tract level data from the 2000 census. Census tracts are designed to be demographically homogenous with stable boundaries over time and generally contain between 3000 and 8000 resident (Boardman, et. al., 2001). Extensive research by Krieger and colleagues has shown that socioeconomic data obtained at the census tract level performs better at detecting economic gradients expected than measures at the county or state level (Krieger et al., 2003).

For the purposes of this study, neighborhood economic disadvantage is an index measure of percent family poverty, percent of female headed households, male unemployment rate, and percent of families receiving public assistance. The four values were summed to create the neighborhood disadvantage measure in which higher numbers indicate greater disadvantage, with scores ranging from 0 to 12. This measure has been

used in studies that investigated the relationship between neighborhood disadvantage and health in adult samples much like the sample in this study (Boardman et al., 2001; Sampson and Raudenbush, 1997). Prior research by Sampson & Raudenbush (1997) demonstrated that these characteristics are highly interrelated and load on one single factor that can be described as neighborhood disadvantage (α= 0.97).

Neighborhood Disorder

The concept of perceived neighborhood disorder includes both social and physical signs indicating a lack of order in the neighborhood. Areas with high levels of disorder are characterized by deviance, noise, vandalism, drug use, crime, trouble with neighbors and other incivilities (Ross and Mirowsky, 1999). This study measured perceived neighborhood disorder using an index that measures physical signs of disorder such as graffiti, vandalism, noise, and abandoned buildings, and social signs such as crime, people hanging out on the street, and people drinking or using drugs. It also includes reverse-coded signs of neighborhood order such as safety, people taking care of their houses and apartments or watching out for each other. The perceived neighborhood disorder scale consists of 15 items on a four point Likert scale that ranges from order on the low end (15) to disorder on the high end (60) of the continuum. This scale has an alpha reliability of .915 (Ross and Mirowsky, 2001).

Neighborhood Stress: Crime Exposure

Neighborhood Stress is defined as exposure to a range of events and conditions in one's proximal environment that are capable of eliciting stressful emotions (e.g., fear, anger, depression) and that may exacerbate disease processes or undermine health (Ewart, 2002). The City Stress Index (CSI) was developed by Ewart (2002) and is used as a self-report measure to assess perceived neighborhood disorder and exposure to crime.

The CSI is an 18-item measure with scores ranging from 18 to 72. Low scores indicate lower levels of neighborhood stressors. This measure can be completed by persons with an eighth grade reading-level. It has good validity and reliability with the neighborhood disorder and exposure to violence portions of the scale having a Chronbach's alpha of .88 and .85 respectively (Ewart, 2002). The recent development of the tool limits the data on use in other populations such as adults, but the reading level and use in urban dwelling adolescents make it a useful measure for this study. Permission to use this measure was obtained from Craig Ewart, a professor in the Center for Health and Behavior at Syracuse University (C. Ewart, personal communication, December 7, 2004).

Neighborhood Social Cohesion

Social cohesion refers to the level of trust, extent of connectedness and solidarity among groups in society (Kawachi and Berkman, 2000; Sampson and Raudenbush, 1997). For some, the neighborhood may become an extension of home for social purposes and becomes important in identity terms possibly leading to a high degree of interaction among community members (Forrest and Kearns, 2001). Neighborhood social cohesion was measured using a using 5 conceptually related items that ask participants whether or not people in the neighborhood willing to help others, get along with each other, share the same values, can be trusted, and whether or not they agreed they lived in a close-knit neighborhood (Sampson and Raudenbush, 1997). The items were scored on a 5-point Likert scale. Scores may range from 0 to 25 with higher scores indicating greater levels of cohesion. The reliability with which neighborhoods can be distinguished on neighborhood social cohesion ranges between 0.80 to 0.91 (Sampson and Raudenbush, 1997).

Housing

Nested within neighborhoods is the construct of housing. Without further definition, housing can refer to several different types of housing such as high or low-income housing, public or section 8 (government subsidized housing), or rental versus owned housing. For use in this study, housing will be further defined as subsidized rental housing (public and section 8 housing).

Housing Satisfaction (Perceived Housing Quality)

Satisfaction with one's housing was measured using one item from HUD's Customer Service and Satisfaction Survey (U. S. Department of Housing and Urban Development, 2003c). The Customer Service and Satisfaction Survey was developed in consultation with housing industry representatives and public housing resident leadership groups. This survey consists of 20 items in addition to six optional demographic questions that were not used in this study. This survey is designed to be both an assessment of current resident opinions regarding their housing quality and a management tool to identify areas of concern (U. S. Department of Housing and Urban Development, 2004). Housing satisfaction was determined by asking participants, "How satisfied are you with your unit/home?" Responses to these questions are based on a 5-point Likert Scale and ranged from, "Does not apply, very dissatisfied, dissatisfied, satisfied to very satisfied." Higher scores are indicative of more satisfaction. This measure has not been used in research, thus, validity and reliability has not been reported.

Stress

The term stress has many definitions depending on the context in which it is used. Hans Selye, a pioneer in the development of stress theory, developed the concept of stress using a response-based orientation (Lyon, 2000). For some stress is good in that it

produces excitement, anticipation, and challenge; for others, the same stressor is bad, producing an undesirable state characterized by worry, frustration, chronic fatigue, and inability to cope (McEwen, 2005). Stress is defined in this study as an undesirable state based on one's perceptions of situations and events such as neighborhood crime and disorder, or unfair treatment which evokes certain emotional, behavioral, and nonspecific physiologic responses.

Perceived Stress

Perceived Stress was measured using Cohen's (1983) Perceived Stress Scale. This scale measures the degree to which situations in one's life are appraised as stressful. The Perceived Stress Scale is a widely used and accepted measure with good validity and reliability. Responses to these questions are based on a 5 point Likert scale asking participants to respond to their feelings and thoughts over the last month. It has good internal consistency with a Chronbach's alpha of .84 – .86. Scores range from 0 to 56 with lower scores indicating less stress (Cohen, Kamarck, and Mermelstein, 1983).

Unfair Treatment and Discrimination

Unfair treatment was assessed using The Interpersonal Mistreatment Scale developed by Williams and colleagues (1997). These items were developed to assess how often in their day-to- day lives persons experience a variety of forms of interpersonal mistreatment. The framework consisted of poor interpersonal treatment and made no reference to race, prejudice, or discrimination (Guyll, Matthews, and Bromberger, 2001; Williams, Yu, Jackson, and Anderson, 1997). The Interpersonal Mistreatment Scale consists of 10 items on a 4-point Likert scale. Scores range from 10 to 40 with higher scores corresponding to more frequent experiences of mistreatment. This measure has

demonstrated good internal consistency with a Cronbach's alpha of .76 to .86 (Guyll et al., 2001; Williams et al., 1997).

Chronic Stress

Chronic stress, the cumulative load of minor, everyday stressors, can have long-term consequences (McEwen, 1998). The effects of chronic stress may be exacerbated by unhealthy behaviors such as lack of physical activity, high calorie, high fat diets, smoking and alcohol use. Chronic Stress was measured in this study using the Trier Inventory for the Assessment of Chronic Stress (TIC-S) (Schlotz and Schulz, 2004). This measure is a comprehensive measure of chronic stress that comprises nine dimensions including work overload, social overload, overextended at work, lack of social recognition, work discontent, social tension, performance pressure at work, performance pressure in social interactions, social isolation, and worry propensity. This measure is included in this study in addition to the perceived stress scale because in addition to being more comprehensive, it asks people to answer questions based on their experiences for the last 3 months. Stressors experienced for this amount of time have more of a chronic component than stress experienced for only one month. Furthermore, the TIC-S includes specific dimensions which allow researchers to pinpoint specific areas (work or social life) that may be considered stressful, unlike other measure used in this study. Responses are based on a 5 point Likert scale. The TIC-S has demonstrated good internal consistency with a Cronbach's alpha of .76 to .91 and a split-half reliability of .79 to .89. Permission was obtained from William Schlotz , a professor at the University of Trier, Department of Psychobiology in Johanniterufer Germany to use the short version of the Trier Inventory for the Assessment of Chronic Stress (TICS-S) (Schlotz and Schulz, 2004).

Psychological Distress

Psychological Distress is defined as a discomforting emotional state experienced by an individual in response to one or more stressors or demands that is manifest by a change in baseline stable emotional state to one of anxiety, depression, demotivation, irritability, aggressiveness, or self-depreciation (Ridner, 2004). In this study, psychological distress was measured by using scales that measure depressive symptomology and state anxiety. In addition to serving as independent variables that influence the outcome variable health and salivary cortisol, these variables will also be dependent variables when addressing the impact of neighborhood stressors and mental health.

Depression

The Center for Epidemiological Studies of Depression Scale (CES-D) is a 20-item, self-report scale that measures depressive symptoms in the general population (Weissman, Sholomskas, Pottenger, Prussoff, and Locke, 1977). It includes six major symptom areas: (1) depressed mood; (2) guilt-worthlessness; (3) helplessness/hopelessness; (4) psychomotor retardation; (5) loss of appetite; (6) sleep disturbance. Responses are based on a 4-point Likert scale. Validity and reliability of this scale has been supported in previous studies Internal consistency and reliability using Cronbach's alpha has ranged from 0.85 to 0.91 (McDowell & Newell, 1996).

State-Trait Anxiety

The Speilberger State-Trait Anxiety Inventory for Adults – Form Y (STAI Form Y-1) was used to measure anxiety. The STAI has been used extensively in research and clinical practice. It comprises separate self-report scales for measuring state and trait anxiety. The state portion of the scales consists of 20 statements that evaluate how

respondents feel at the moment they are completing the survey. The trait portion of the scale consists of 20 statements that assess how people generally feel (Spielberger, Gorsuch, Lushene, Vagg, and Jacobs, 1983). Responses are based on a 4-point Likert scale. This measure had demonstrated good internal consistency with a Cronbach's alpha of .86 to .95.

General Health

General Health was measured using one item from the SF-12v2™ survey form (Ware, Kosinski, and Keller, 1996). Participants were asked, "In general would you say your health is poor, fair, good, very good, or excellent?" Answers were based on a four-week recall. Scores ranged from 1 to 5 respectively. These scores were transformed to a 0 to 100 scale and compared with national norms for women of the same age group (Ware, Kosinski, Turner-Bowker, and Gandek, 2002). Cronbach's alpha for the SF-12v2™ survey ranges from 0.73 – 0.77 in the general population of women ages 18 to 44 years old (Ware et al., 1996).

Salivary Cortisol (SC)

SC is a widely accepted method for measuring physiological responses to acute laboratory induced stress and perceived chronic stress. It highly correlates with serum (blood) and urine cortisol levels and offers stress-free, non-invasive sampling, easy collection and storage (Kirschbaum and Hellhammer, 1994). However, cortisol levels are affected by a variety of factors such as an acute stressor, smoking, drugs (such as steroid-based medications, contraceptives, anti-depressants and anxiolytics), a high protein meal, lack of sleep and the luteal phase of the menstrual cycle (Kirschbaum and Hellhammer, 1992). These factors were controlled for in the exclusion criteria and saliva collection protocol, or by incorporating them as covariates in statistical models. Samples were

analyzed using the HS-Cortisol High Sensitivity Salivary Cortisol Enzyme Immunoassay Kit. This kit requires minimal saliva volume (25 µl), detects < 0.012 to 3.0 µl of cortisol, has a serum-saliva correlation of $r = .94$, $p < .0001$ (Salimetrics, 2005). It was designed as a superior alternative to resolve problems associated with serum-based radioimmunoassay and other salivary immunoassays (Schwartz, Granger, Susman, Gunnar, and Laird, 1998).

Participants provided 12 cortisol samples consisting of 6 samples per day for 2 days. Specimens were collected over 2 days based on expert recommendations from the John D. and Catherine T. MacArthur Research Network on Socioeconomic Status and Health. Though somewhat controversial, the more measurements in a day for a greater number of days (at least 3 to 4) allows for a more reliable measurement of "trait" daily concentration of cortisol (AUC). The advantage of using multiple days is that it helps to control the unreliability of one day's data, which can underestimate the cortisol relationship to outcomes (Stewart and Seeman, 1999).

A period of 2 days was decided upon for several reasons. First, prior research experience with a similar population suggested that data collection for a period of time longer than two days would be unrealistic. The day to day turmoil experienced by many in this population precludes prolonged daily data collection. Furthermore, daily data collection for 4 to 6 days places a significant burden on the participants in addition to their daily routines and responsibilities. Finally, biological specimen collection and analysis is costly. Materials and supplies for collection and analyses of biological specimens can be quite expensive, and participants should be compensated appropriately

for the time commitment and burden placed upon them as study participants. Therefore, financial constraints also prevented more frequent or prolonged data collection.

Specimen collection was timed based on each participant's time of awakening with the first sample to be collected upon awakening (T1). The remaining 5 samples were collected at 30 minutes 1 hour, 4, 9, and 11 hours after waking (T2-T6). This method of salivary cortisol collection is preferred since the time of cortisol peak is not dependent upon the absolute time nor is it influenced by daylight; it is dependent on wake-up timing of each individual (Immuno-Biological Laboratories, 2004; Stewart and Seeman, 2000).

The total area under the curve (AUCg) with respect to ground as described by Pressner and colleagues (2003) was examined in terms of its relationship to the independent variables in this study. The formula used for the AUCg is derived from the trapezoid formula (Pressner, Kirschbaum, Meinlschmid, and Hellhammer, 2003). The formula used to calculate AUCg is presented below in Equation 3-1.

Equation 3-1

AUCg =
(SC2+SC1)/2*t1+(SC3+SC2)/2*t2+(SC4+SC3)/2*t3+(SC5+SC4)/2*t4+(SC6+SC5)/2*t5

This AUCg calculation takes into account change over time of each measurement and the distance of the measures from zero (the level at which the changes over time occur and results in a measure that is more related to total hormonal output (Pressner et al., 2003). Researchers at the MacArthur Research Network on Socioeconomic Status and Health agree that AUC is the most widely accepted measure whereas diurnal rhythm, or diurnal 'pattern' analysis is more controversial (Stewart and Seeman, 2000).

However, AUCg is not without limitations. Though AUCg is a summarized index for repeated measures over time, it is not sensitive to fluctuations of repeated measures. For example, if two persons have completely different patterns of cortisol levels relative to time, they may get the same AUCg. In addition, the AUCg approach does not take into account the correlations among repeated outcome measures within a specific person. Given these limitations, generalized estimating equations (GEEs) will additionally be used to examine the relationships among the independent variables and salivary cortisol.

GEEs provide a general framework for the analyses of continuous, ordinal, polychotomous, dichotomous, and count-dependent data, and relax several assumptions of traditional regression models. GEEs represent an extension of the generalized linear model (GLMs) to accommodate correlated data. GLMs assume that the dependent variable can be expressed as a linear function of the independent variables. It also assumes that the variance of the dependent variables is a known function of its expectation (thus allowing relaxation of the homoscedasticity assumption). Other assumptions of the GEE method include: (1) the number of clusters be relatively high (a rule of thumb is no fewer than 10, possibly more than 30, and (2) the observations in different clusters be independent, although within-cluster observations may correlate. Hence, GLMs do not require the specification of the form of the distribution, but only the relationship between the outcome mean and the explanatory variables and between the mean and the variance (Ghisletta and Spini, 2004).

GEE is a marginal (or population averaged) as opposed to a cluster-specific (or subject-specific, conditional) method. Population average models model the average response over the subpopulation that shares a common value of the predictors as a

function of such predictors. Population average parameters represent the averaged effect of a unit change in the predictors for the whole population. The GEE approach specifies a working correlation matrix for the vector of repeated measures from each participant to account for the dependency among the repeated measures. The working correlation can be assumed to be the same for all participants, reflecting average dependence among the repeated measures over participants. Several working correlation structures can also be specified, including independent, exchangeable, autoregressive, and unstructured correlation. The standard errors are derived from what is called the sandwich estimator of the covariance matrix of the regression coefficients. The main advantage of GEEs is that the calculation of the standard errors for the regression coefficients is robust even if the specifications of the correlation structure is incorrect or if the strength of the correlation between repeated outcomes varies somewhat from person to person. Although the use of robust standard errors ensures that regression inferences are consistent regardless which correlation structure is chosen, however, there is no straightforward way in GEE models to truly determine the best correlation structure to use (Ghisletta and Spini, 2004).

GEE is not without limitations. First the technique is asymptotic, hence requiring large total sample sizes for unbiased and consistent estimation. Second, in applications to empirical data, sensitivity analyses of different specifications of the intracluster correlation matrix are advised. Finally, GEE methodology assumes missing completely at random data, because GEEs do not specify the full conditional likelihood. However, GEEs do no yield a great deal of bias with missing at random data (Ghisletta and Spini, 2004).

Given the limitations of AUCg and the advantages of GEE methods, GEE will also be used to examine the relationships among neighborhood characteristics, psychological distress, stress, and salivary cortisol.

Individual Social Support

Individual social support is considered a covariate in this study. The amount and type of individual social support one has may possibly offset the lack of support that may exist in the area in which one lives. Therefore, it is important to control for the amount of individual social support when examining the effects of neighborhood social cohesion on health. Individual-level social support was measured in this study using the International Support Evaluation List – General Population Form (ISEL-GP) (Cohen, Mermelstein, Kamarck, and Hoberman, 1985). ISEL-GP consists of 40 items designed to assess the perceived availability of four separate functions of individual social support (tangible, appraisal, self-esteem, and belonging). Responses are measured on a 4-point Likert scale. In other studies Cronbach's alpha has been reported as 0.88 and 0.90 and test-retest reliability coefficients = 0.87 (Cohen et al., 1985).

Study Protocol

Participants were screened for inclusion in the study. For those who met inclusion and exclusion criteria and agreed to participate, a time and place was agreed upon for the participant to meet with the PI. At this initial meeting, the consent to participate in research was reviewed with the participant, who then signed the informed consent form approved by the Institutional Review Board Human Subjects Committee at the University of Florida. At this point, the PI or research assistant covered the requirements of the study in detail. The PI or research assistant left the Salivettes for saliva collection and the questionnaire and scheduled a time to pick up the saliva and completed questionnaire.

To provide a sample, participants were given 12 tubes called Salivettes® (The Sarstedt Group, 2003). Six tubes for each day of collection were provided in separate plastic bags. Saliva collection times were based on the time of awakening and were collected 30 minutes, 1, 4, 9, and 11 hours after waking. Participants were instructed to collect the first saliva specimen (upon awakening) before rising and getting out of bed. Upright positions may significantly increase salivary cortisol concentrations (Hennig et al., 2000). They were also instructed to place a cotton roll in their mouths, chew on it until it became saturated, and place it in the salivette. Participants were instructed not to brush their teeth, smoke, eat, or drink anything at least two hours prior to collection because the factors have been shown to alter salivary cortisol concentrations (Kirschbaum, Read, and Hellhammer, 1992). They were also instructed to place the salivette tubes in the freezer at the end of each day. After being collected by the researcher or research assistant, samples were centrifuged and stored frozen (-20º C). Before analysis samples were thawed and mucins were precipitated from the specimens at 3000 rpm for 15 minutes. Cortisol was measured by using Expanded Range High Sensitivity Salivary Cortisol Enzyme Immunoassay Kit (Salimetrics, 2005). All analyses were conducted according to the manufacturer's directions. Samples with greater than 30% coefficient of variation (CV) were rerun. Inter- and intra-assay CV% was less than 15%. Inter-assay CV is based on the high and low controls of 28 plates. Intra-assay CV was based on eight high and eight low control duplicate samples.

Participation in this study required a commitment of completing a survey that took approximately 1 to 1.5 hours to complete and completing saliva collection for 2 days. Each saliva collection was estimated to take a maximum of 5 minutes which would entail

an additional 1 hour of the participant's time. Given the time burden placed on the participants, a $30.00 gift certificate to Wal-mart was given to each participant that completed data collection. A $30.00 gift certificate was used as opposed to cash so it would not be counted as income, placing the participants at risk for loosing food stamp supplements, housing subsidy or other financial assistance through the Temporary Assistance for Needy Families program, if they were receiving these supports.

Statistical Analyses

Data were analyzed using Stata 9.0 statistical software. Two-tailed tests were used in all cases and an alpha level of .05 was selected a priori to determine significance. Descriptive statistics were tabulated for all variables.

Statistical Analysis Approach

Before any analyses were conducted, the primary outcome variables (general health, state anxiety, depression and SC-AUCg) were examined for normality. Skewness and kurtosis tests for normality were used to examine the distribution of all study variables (see table 3-1 below). General health was transformed to a 0 to 100 scale. General health and SC-AUCg were both positively skewed; therefore, log transformations were conducted based on the ladder of powers (Hamilton, 2006). Depression was also positively skewed, but was transformed using square root transformation. Choosing a transformation method for each outcome variable was based on analyses using ladder of powers. This test combines the ladder of powers with tests of normality (specifically the skewness/kurtosis test in Stata) and reports whether the result is significantly non-normal (Hamilton, 2006). The transformation with the lowest Chi square and a normal distribution was chosen because most statistical procedures work best when applied to variables that follow a normal distribution.

Table 3-1 Skewness and Kurtosis for Study Variables

Neighborhood Characteristics	Skewness	Kurtosis	Adj chi^2	Prob>chi^2
Neighborhood Economic Disadvantage	0.000	0.089	13.76	0.0010
Neighborhood Disorder	0.305	0.456	1.67	0.434
Neighborhood Stress	0.039	0.515	4.69	0.096
Neighborhood Social Cohesion	0.474	.669	0.71	0.6999
Individual-level Variables				
Housing Satisfaction	0.001	0.184	10.63	0.005
Unfair Treatment	0.212	0.210	3.26	0.195
Perceived Stress	0.780	0.527	0.49	0.784
Chronic Stress	0.732	0.629	0.35	0.8375
ISEL – social support	0.501	.556	0.82	0.2413
Anxiety	0.130	0.510	2.84	0.6637
Depression	0.645	0.007	6.76	0.034
General Health	0.001	0.357	10.05	0.0066
Salivary Cortisol (SC) AUCg_ug/dl	0.000	0.001	26.33	0.0000

Specific Aim 1

The first aim of this study was to determine the relationships among neighborhood characteristics, perceived stress, psychological distress, and salivary cortisol levels among low SEP female heads of households with children living in either section 8 or public housing. More specifically, this research sought to examine whether neighborhood characteristics had an independent effect on the outcome variables

Bivariate correlation and multiple regression analyses were used to determine significant relationships among the study variables. First simple regression analyses were conducted and nonsignificant explanatory variables were not added to subsequent models. Standard multiple regression analyses were utilized to determine associations between neighborhood characteristics, depression, anxiety, health, and SC-AUCg above and beyond individual level predictors. For all multiple regressions, assumptions were tested by examining normal probability plots of residuals and scatter diagrams of

residuals versus predicted residuals. No violations of normality, linearity, or homoscedasticity were detected. There was no evidence of influential outliers based on stem and leaf plots and studentized residuals. In addition, perceived stress, chronic stress, anxiety and depression were examined for multicollinearity. Finally seemingly unrelated regression is used to compensate for cross-equation error correlation between the anxiety and depression equations (Chen, Ender, Mitchell, and Wells, 2006).

Issues of Multicollinearity

Multicollinearity can occur in multiple regression analysis when independent variables are too highly intercorrelated (Polit, 1996) and is associated with unstable estimated regression coefficients (Chatterjee, Hadi, and Price, 2000). A thorough investigation of multicollinearity will involve examining the value of R^2 that results from regressing each of the predictor variables against all the others. Table 3-2 shows collinearity diagnostics for all possible explanatory variables. The relationship between explanatory variables, R^2_j would be close to 1, and the variance inflation factor (VIF) would be large. Values of VIF greater than 10 is indicative of collinearity problems (Chatterjee et al., 2000). Tolerance defined as 1/VIF is used also used by many researchers to check on the degree of collinearity. A tolerance value lower than 0.1 means that the variable considered is a linear combination of other independent variables (Chen et al., 2006). In addition, a condition number – a commonly used index of global instability – greater than or equal to 10 is an indication of global instability. The condition index number for the variables noted in table 3.2 is 4.66. No problems with collinearity were identified.

Table 3-2 Collinearity Diagnostics for Explanatory Variables

Variable	**VIF**	**Tolerance**	**R^2**	**Condition Index**
Neighborhood Economic Disadvantage	1.13	0.885	0.11	1.0
Neighborhood Disorder	1.45	0.692	0.31	1.75
Neighborhood Stress	1.95	0.514	0.49	2.05
Neighborhood Social Cohesion	1.67	0.599	0.40	2.41
Unfair Treatment	1.51	0.663	0.34	2.65
Perceived Stress	1.67	.0598	0.40	2.78
Chronic Stress	2.27	0.440	0.56	3.22
Social Support	1.99	0.504	0.50	3.41
Depression	2.87	0.350	0.65	3.50
Anxiety	3.16	0.317	0.68	4.66

Seemingly Unrelated Regression

Pairwise correlation of anxiety and depression revealed that these two measures had a strong correlation (r, 0.74; p-value < 0.001). Though problems with collinearity when these variables were used as explanatory variables were not revealed as mentioned above, it was suspected that when anxiety and depression were used as dependent variables in separate equations, the regression errors may be correlated. Correlation of errors in regression models may lead to underestimation of the regression coefficients (Chen, Ender, Mitchell, and Wells, 2005). Seemingly unrelated regression allows researchers to estimate both models simultaneously while accounting for the correlated errors at the same time, leading to more appropriate standard errors (Chen et al., 2005). Unlike traditional multivariate regression, seemingly unrelated regression allows one to estimate equations that do not have the same set of predictors, allowing more flexibility in model estimation approaches. The estimates provided for the individual equations are the same as the ordinary least squares estimates. A Chi- Square test is used to determine the overall fit of the model (Chen et al., 2005). Seemingly unrelated regression was used

instead of multivariate regression because the explanatory variables differed for the two equations.

Multi-level Analysis

Typically, when data are nested as in this study – persons nested within neighborhoods – and the study is examining the contextual effects of neighborhoods on individual health, multi-level analyses are warranted (Diez-Roux, 2000). Multi-level analysis allows researchers to examine neighborhood-level variation in health among populations (Merlo, Chaix, Yang, Lynch, and Rastam, 2005) and to test hypotheses about how variables measured at one level (neighborhoods) affect relations occurring at another (individual) level (Raudenbush and Bryk, 2002). It is intuitive that people living in the same neighborhood or in neighborhoods with similar characteristics will have comparable health characteristics. Therefore, when examining neighborhood contextual effects on individual health, variation in neighborhood characteristics is essential. Given the lack of variation in neighborhood economic disadvantage in this study (as determined in Aim 2), multi-level statistical analyses could not be conducted.

Specific Aim 2

The second aim of the study was to determine the differences in neighborhood characteristics of two subsidized housing types, specifically section 8 and public housing, in which low SEP female heads of households with children live.

Assumptions for using t-tests include random sampling, a normal distribution, and homogeneity of variance. Skewness and kurtosis tests for normality as shown in Table 3.1 were used to examine the distribution of all outcome variables. Variance comparison tests for each of the neighborhood variables by housing subsidy type showed that the homogeneity of variance assumption was not violated. Neighborhood economic

disadvantage was negatively skewed. Group comparison t-tests were used to determine the differences in neighborhood disorder, neighborhood stress, and neighborhood social cohesion by housing type. The Mann-Whitney *U*-test, the non-parametric analogue of the t-test, (Polit, 1996) was used to examine differences neighborhood economic disadvantage by housing subsidy type.

Specific Aim 3

The final aim of the study was to examine the differences in housing satisfaction, perceived stress, psychological distress, and salivary cortisol levels, in low SEP female heads of households with children by housing subsidy type (section 8 and public housing).

Again, assumptions as noted in the previous section were analyzed for violation. General health, housing satisfaction, depression, and SC-AUCg were significantly skewed as shown in Table 3.1. SC-AUCg, general health and depression were transformed as previously described. Group comparison t-tests were performed to detect differences in SC-AUCG, depression, perceived stress, chronic stress, anxiety, social support, and health by housing subsidy type. Variance comparison tests showed no violations in homogeneity of variance by housing subsidy type. Mann-Whitney *U* tests were used to examine the differences in housing satisfaction by housing subsidy type because housing satisfaction was a one-item question measured on an ordinal scale and was not normally distributed.

Missing Data

Missing data were present in several study variables including salivary cortisol. Item non-response occurs when a participant does not respond to a question or questions on a survey, which is the case for the missing data in this study. Several methods to deal

with missing data are available to researchers depending on the pattern of missing data including case mean substitution, sample and group mean substitution, hot-deck imputation, regression and multiple imputation (Fox-Wasylyshyn and El-Masri, 2005; Patrician, 2002). Case-wise single item imputation using multinomial logistic regression analysis was used to impute data in this study. This method was chosen because it uses a respondent's scores on non-missing values within a scale or subscale to predict missing values. This approach takes into account that missing values may differ based on differences in individual characteristics. The outcome variables (item codes) were categorical with more than two categories; polytomous or multinomial logistic regression was preformed to predict the missing value in a subscale. Regression imputation uses knowledge of the available data to predict values of missing data. The underlying principle is that missing data items can be predicted by other items in the measure or subscale, the resulting regression equation can be used to predict missing values (Patrician, 2002). More specific information is provided regarding missing data patterns in the section Handling Missing Survey Data.

Handling Missing Cortisol Data

Of the 84 participants, 14 did not have usable cortisol data (defined as greater than 2 time points missing in one day). These cases were deleted and not used in data analyses. Of the 70 participants remaining, 49 had complete cortisol data on Day 1 and 46 on Day 2. For statistical analyses missing data at Days 1 and 2 T2 were replaced by the average values from the preceding and following samples. For example, from table 3-3 below, one participant was missing cortisol data on Day 1 T2 and T5, and on Day 2 T3. The average of T1 and T3 on Day 1 was used to replace the missing data point.(0.219 + 0.44)/2 = 0.66/2 = 0.33. Therefore, 0.33 was the value used to replace the missing data

point for the Day1 at T2. Equation 3-2 provides a formula for calculating the average for a T2 data point.

Table 3-3: Example of Missing Cortisol Data for One Participant

Time of Day	Day 1	Day 2	Replacement Value
T1 – Awakening	0.219	0.094	--
T2 – 30 min after waking		0.225	0.33
T3 – 60 min after waking	0.44		0.44
T4 – 4 hr after waking	.552	0.272	--
T5 – 9 hr after waking		0.166	0.166
T6 – 11 hr after waking	0.199	0.122	--

Equation 3.2: Formula for Calculated T2 SC for Days 1 and 2

$T2 = T1 + T3/2$

When data were missing at any time other than T2, the value from the same time point on the preceding or following day was taken. For example, from table 3-3 the participant was missing cortisol data on Day 2, T3 this missing data point was replaced with the value at the same time from the preceding day (0.44).These techniques have been utilized in other studies (Odber, Cawood, and Bancroft, 1998). After imputing SC data, a total of 70 participants were retained for data analysis.

Handling Missing Survey Data

Once cases were deleted due to missing cortisol data, missing survey data was imputed. No more than 20% of the data were missing from any study measure. Before imputing data, missing value patterns were determined by dummy coding missing data for each participant with 0 = no missing data and 1 = at least one missing data point. Study participants were grouped on whether or not missing data was present and two-sample t-tests were performed on each study variable. Creating a missing data dummy code and computing t-test comparisons between respondents and non-respondents is

often used to determine if non-responders differ on any of the items in the data set (Wasylyshyn and El-Masri, 2005). A significant difference between respondents and non-respondents indicates an association, and rules out the possibility the data are missing completely at random (MCAR) (Wasylyshyn and El-Masri, 2005). Missing data points are said to be MCAR if the probability of missing data on one variable is not related to the value of that variable or is not related to other variables in the data set (Patrician, 2002). Because the state anxiety was statistically significantly different (t= -1.99, df 70, p=0.05), and the individual social support scale approached significance, (t=-1.88, df, 61. p=0.06), data from this study were determined to be missing at random (MAR). MAR occurs when the probability of a missing data point in one variable is not related to the value of that variable (Patrician, 2002). Each measure used in this study was divided into its appropriate subscales, if present, and multinomial regression analyses were performed for each item missing within a measure based on items present within the subscale.

Case-wise multinomial regression imputation was used to predict missing values. This method ascribes the respondent's predicted score based upon the items that are present within in the missing score subscale for that respondent. The primary advantage of this technique is that it acknowledges differences across cases (respondents) and maximizes any one respondents own data from items in a given subscale. Also, imputing item-level missing data retains the inter-subject variability across summed scores because the majority of information from each participant is retained with measurements and their subscales. Using single value regression to replace missing values is most useful when data are 10% - 40% incomplete (Wasylyshyn and El-Masri, 2005).

After data imputation for each study variable was complete, three additional participants had to be withdrawn from the study due to excessive missing data, leaving a final sample size of 67.

In summary, after imputing missing data, 67 women were included in data analysis. Specific aim 1 was addressed by bivariate analysis, standard multiple and multivariate regressions, and GEE. Specific Aims 2 and 3 are examined by using t-test and the Mann-Whitney *U* test depending on the type of variable under study and whether the normality assumption was met.

CHAPTER 4
RESULTS

The first aim of this study was to examine the relationships among neighborhood characteristics, perceived stress, psychological distress, and salivary cortisol levels among low SEP female heads of households with children. The second aim was to examine the differences in neighborhood characteristics by housing subsidy type (i.e., public and section 8 housing). Finally, this study sought to determine if participants who lived in public versus section 8 housing differed in terms of stress, psychological distress, general health and salivary cortisol levels.

This chapter first presents descriptive results, including means, standard deviations, and frequency data for each variable. The hypotheses posed in Chapter 1 are addressed using parametric and nonparametric tests.

Descriptive Results

Description of the Sample

As described in Chapter 3, data analysis included a final sample size of 67 women. Most of the participants in this study were black, single, had a high school education or less and one to two children. The mean age was 30 years old. Over half of the participants reported their main daily activity as either looking for work or keeping house and raising children. Mean gross income was $486.50/month. Sixty-four percent of the participants lived in section 8 housing and less than one-third were receiving direct financial assistance through the Temporary Assistance for Needy Families Program (TANF). Table 4-1 below provides a detailed description of the sample.

Table 4-1: Sample Demographic Profile: (n=67)

	N	%	Mean (SD)	Range
Age	--	--	30.33 (±8.31)	18-45
Income	--	--	486.50 (±440.71)	$0-$2,100
Race				
White	12	17.91	--	--
Black	54	80.60		
Hispanic/Latino	1	1.49		
Marital Status				
Married	6	9.09	--	--
Single	57	86.36		
Divorced/Separated	3	4.55		
Education				
Less than 9th grade	4	6.15		
Less than 12th grade	21	32.31		
High School Diploma	9	13.85	--	--
General Education Diploma	10	15.38		
Some College/Training	16	24.62		
Associates Degree	5	7.69		
Number of Children				
1-2	44	65.87	--	--
3-4	21	31.34		
5-7	2	2.98		
Daily Activity				
Work Full-time	9	13.43		
Work Part-time	10	14.93		
School Full-time	4	5.97	--	--
School Part-time	4	5.97		
Work and School Part time	6	8.96		
Unemployed	20	25.37		
Keep House/Raise Children	30	25.37		
Housing Type:				
Public Hosing	24	35.82	--	--
Section 8 Housing	43	64.18		
TANF Assistance				
Yes	23	29.03	--	--
No	44	70.97		

Neighborhood Characteristics of the Sample

Two-thirds of the participants lived in neighborhoods with the greatest amount of economic disadvantage that were characterized by high rates of disorder, and exposure to crime. (See figure 4-1).

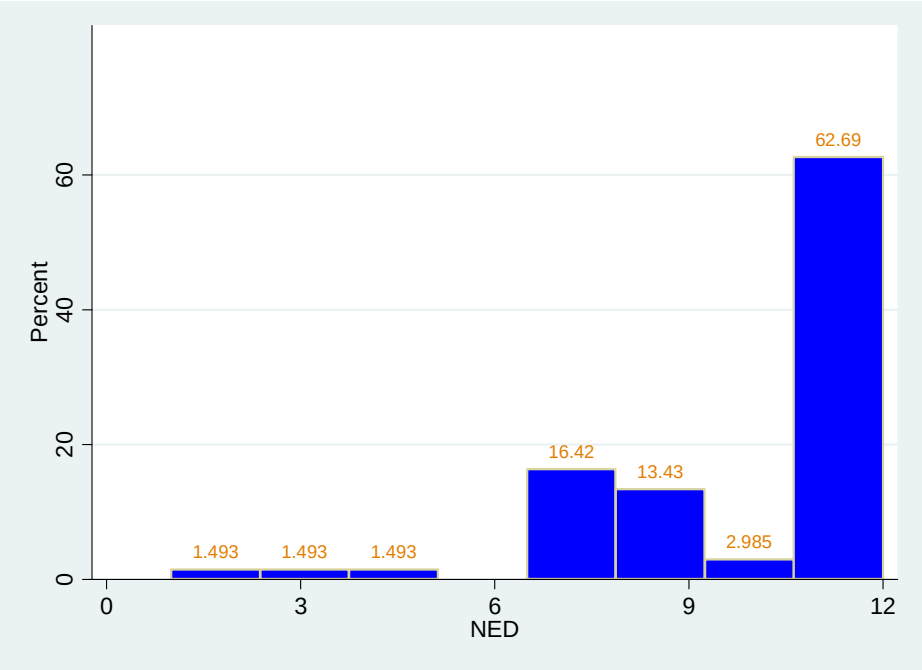


Figure 4-1: Neighborhood Economic Disadvantage (NED) for all Participants

Over 50% of the participants scored above the mean on neighborhood disorder while 25% scored will over the mean of 37.15 on neighborhood stress indicating that they perceived their neighborhoods as areas with high rates of and crime. In addition, these women also reported higher rates of social cohesion which is not surprising given that studies have shown that neighborhood social cohesion may buffer the effects of neighborhood disorder and stress (Ross and Jang, 2000). See Table 4.2 on the following page.

Table 4-2: Sample Description of Neighborhood Characteristics.

Variables	Mean (SD)	Range
Neighborhood Characteristics		
Neighborhood Economic Disadvantage	10.16 (±2.66)	1-12
Neighborhood Disorder	36.52 (±7.98)	16-55
Neighborhood Stress (Crime Exposure)	37.15 (±11.89)	18-72
Neighborhood Social Cohesion	13.31 (±3.86)	5-25

Stress, Psychological Distress, Health, and Salivary Cortisol Sample Characteristics

Table 4-3 provides mean scores and ranges for all individual level psychosocial and stress variables.

Table 4-3: Stress, Psychological Distress, Health and Salivary Cortisol Scores

Variables	Mean (SD)	Range
Unfair Treatment	21.49 (±6.35)	10-36
Perceived Stress	28.64 (±6.87)	12-45
Chronic Stress	52.82 (±21.48)	0-105
Individual Social Support	70.46 (±20.76)	26-117
Depression	24.73 (±11.77)	2-47
State Anxiety	44.67 (±11.95)	20-70
General Health	37.21 (±27.69)	0-100
Salivary Cortisol (AUC) ug/dl	2.84 (±2.19)	0.227-10.71

Salivary cortisol levels vary based on the time at which the sample is taken. The ranges of salivary cortisol in this sample of women are within the ranges for healthy women of the same age group reported by other investigators (Kirschbaum, Read, and Hellhammer, 1992). Table 4-4 provides mean scores and ranges for salivary cortisol measures by day and time.

Table 4-4 Salivary Cortisol Scores by Day and Time

Salivary Cortisol (ug/dl) by Day/Time	**Mean (SD)**	**Range**
Day 1		
Time 1 – awakening	0.315 (.259)	0.02-1.25
Time 2 – 30 minutes after waking	0.328 (0.277)	0.02-1.27
Time 3 – 60 minutes after waking	0.261 (0.256)	0.016-1.48
Time 4 – 4 hours after waking	0.255 (0.241)	0.015-1.08
Time 5 – 9 hours after waking	0.195 (0.235)	0.015-1.17
Time 6 – 11 hours after waking	0.194 (0.227)	0.011-0.91
Day 2		
Time 1 – awakening	0.292 (0.275)	0.013-1.53
Time 2 – 30 minutes after waking	0.332 (0.32)	0.015-1.40
Time 3 – 60 minutes after waking	0.269 (0.237)	0.014-0.91
Time 4 – 4 hours after waking	0.223 (0.236)	0.017-1.10
Time 5 – 9 hours after waking	0.180-(0.201)	0.007-0.84
Time 6 – 11 hours after waking	0.136 (0.172)	0.017-0.83

Overall, this sample of women reported higher levels of anxiety and scored lower on general health compared to national norms (Spielberger, Gorsuch, Lushene, Vagg, and Jacobs, 1983; Ware, Kosinski, Turner-Bowker, and Gandek, 2002; Weissman, Sholomskas, Pottenger, Prussoff, and Locke, 1977) indicating poorer health. (See Table 4-5). They scored well above the cut off of 16 on the CES-D, which indicates depressive symptoms are high enough to suggest clinical depression with a mean of 24.73.

Table 4-5: Mean Psychological Distress and General Health Scores Compared to National Norms

	Sample Mean (SD)	**Norm for females of same age (SD)**		
State Anxiety	44.67 (± 11.95)	35.20 (± 10.61)		
Depression	24.73 (± 11.77)	>16 Suggests clinical depression		
General Health	37.21 (± 27.69	49.84* (± 10.62)	52.11** (± 9.86)	51.01*** (± 8.70)

* National norms for women 18-24 years old
** National norms for women 25-34 years old
*** National norms for women 35-44 years old

Specific Aim 1: Associations among Neighborhood Characteristics, Stress, Psychological Distress, Health and Salivary Cortisol

The first aim of this study was to determine the relationships among neighborhood characteristics, perceived stress, psychological distress, and salivary cortisol levels among low SEP female heads of household with children 18 years old or less. It was hypothesized that higher rates of neighborhood disorder, exposure to crime, and neighborhood economic disadvantage, and elevated levels of stress would be positively associated with depression, state anxiety, and salivary cortisol and negatively associated with general health. More specifically, this research investigated whether neighborhood characteristics had an effect on any of the outcome when individual level factors (perceived stress, unfair treatment, chronic stress, and social support) were added to the model.

Bivariate Analyses of Neighborhood Characteristics, Housing Satisfaction, Stress, Depression, State Anxiety, Health and Salivary Cortisol

Based on bivariate correlations the hypotheses for specific aim 1 are partially supported. Neighborhood disorder (ND), neighborhood stress (NS), and neighborhood social cohesion (NSC) have significant weak to moderate positive associations with depression, chronic stress, and unfair treatment. Only ND and NS were positively associated with perceived stress. NSC had a positive, but weak association with housing satisfaction and a weak negative correlation with chronic stress. Housing satisfaction also had a weak negative association with unfair treatment. (See Table 4-6). Neighborhood economic disadvantage (NED) was not associated with any of the outcome variables in this study. The remainder of this section is ordered based on the outcome variable under study. First, predictors of general health are presented, followed by state anxiety, depression and finally SC-AUCg.

Table 4-6: Correlations between Neighborhood Characteristics, Housing Satisfaction, Psychological Distress, General Health, and Salivary Cortisol

	NED [a]	**ND**	**NS**	**NSC**	**Housing** [a] **Satisfaction**
Housing Satisfaction [a]	-0.033	0.23 (0.06)	-0.20	0.30*	
State Anxiety	-0.12	0.22 (0.06)	0.37**	-0.14	-0.11
Depression (sqrt)	-0.17	0.29*	0.39**	-0.24*	-0.06
General Health (log)	-0.07	-0.09	-0.04	.019	0.057
Unfair Treatment	-0.19	0.41***	0.35**	-0.29*	-0.25*
Perceived Stress	-0.14	0.26*	0.39**	-0.19	-0.02
Chronic Stress	-0.15	0.48***	0.52***	-0.25*	-0.04
Salivary Cortisol (SC) AUCg ug/dl (log)	0.07	-0.09	-0.11	0.13	-0.08

Note: *p < 0.05 **p < 0.01 ***p<0.001; n = 67

General Health, Neighborhood Characteristics, Stress, and Psychological Distress

As previously stated, general health was log transformed to obtain a normal distribution. Bivariate regression analysis revealed that unfair treatment and smoking significantly impacted health in this sample of women. However, the magnitude of the effect of unfair treatment is quite small (adj. $R^2 = 0.05$, F (1,65 = 4.37. p-value <0.05) accounting for only five percent of the variability in general health. Smoking (adj. $R^2 = 0.11$, F (1, 65 = 8.85. p-value <0.01) accounted for 11% of the variation in health. As shown in table 4-7 below, none of the other variables in this study had a significant effect on general health.

Table 4-7: Bivariate Regression Results for General Health

Variable	B	SE	Adj R^2	F	95% CI
Neighborhood Characteristics					
Neighborhood Economic Disadvantage	-0.006	0.021	0.001	0.08	-0.05 – 0.04
Neighborhood Disorder	-0.003	0.007	0.02	0.25	-0.017 – 0.01
Neighborhood Stress	-0.001	0.005	0.004	0.04	-0.01- 0.008
Neighborhood Social Cohesion	0.013	0.008	0.001	2.34	-0.004 – 0.036
Individual Level Factors					
Perceived Stress (PSS)	-0.013	0.008	0.03	2.90	-0.03 – 0.002
Chronic Stress (TCSI)	-0.002	0.003	-0.01	0.45	-0.01 – 0.003
Unfair Treatment	-0.178*	0.008	0.05	4.37	-0.35 – 0.001
State Anxiety	-0.01	0.004	0.01	1.89	-0.01 – 0.002
Depression	-0.007	0.005	0.02	2.18	-0.02 – 0.002
Individual Social Support (ISEL)	0.003	0.003	0.004	1.23	-0.002 – 0.008
Age	-0.008	0.006	0.007	1.49	-0.02 – 0.005
Marital Status	-0.13	0.15	0.01	0.73	-0.43 – 0.17
Number of children	-0.01	0.05	-0.01	0.06	-0.1 – 0.08
Education	0.01	0.04	-0.01	0.08	-0.06 – 0.08
Monthly Income	-0.00	0.00	-0.01	0.17	-0.0003 – 0.00
Smoking	-0.40**	0.14	0.11	8.85	-0.68 - -0.13

Note: *p < 0.05 **p < 0.01 ***p<0.001; df (1, 65); n = 67

Multiple regression analysis of the effects of smoking and unfair treatment on health showed that both variables are significant predictors of health (adj. R^2 = 0.11, F (2, 64 = 6.76. p-value <0.01) (table not shown). Potential confounding variables considered were age, race, marital status, number of children living in the household, income, and smoking. None of these variables (other than smoking) were significantly associated with general health in bivariate regression analyses.

Neighborhood and Individual Level Effects on State Anxiety

Bivariate analyses (see Table 4-8) show that neighborhood stress (disorder plus exposure to crime) significantly affects state anxiety accounting for 13% of the variation (Adj. R^2 0.13, F (1, 65) = 10.56, p-value 0.002). No other neighborhood characteristics had an impact on state anxiety.

Table: 4-8: Bivariate Regression Results for State Anxiety

Variable	B	SE	Adj. R^2	F	95% CI
Neighborhood Characteristics					
Neighborhood Economic Disadvantage	-0.67	0.55	0.023	1.50	-1.77 – 0.42
Neighborhood Disorder	0.33	0.18	0.036	3.43	-0.03-0.70
Neighborhood Stress	0.37**	0.11	0.13	10.56	0.14 – 0.61
Neighborhood Social Cohesion	-0.26	0.23	0.004	1.29	-0.73 – 0.20
Individual Characteristics					
Unfair Treatment	0.38	0.23	0.03	2.78	-0.075 – 0.84
Perceived Stress (PSS)	1.01***	0.18	0 .33	32.94	0.66 – 1.36
Chronic Stress (TCSI)	0.30***	0.06	0.28	27.18	0.19 – 0.42
Individual Social Support	-0.35***	0.06	0.37	39.92	-0.47 - -0.24
Age	-0.04	0.18	-0.01	0.04	-0.40 – 0.32
Race	3.27	2.09	0.02	2.45	-0.90 – 7.45
Education	-1.3	0.10	0.01	1.80	-3.27 – 0.64
Income	-0.005	0.003	0.01	1.90	-0.01 – 0.002
Marital Status	4.6	4.02	0.005	1.30	-3.4 – 12.6
Number of children	-1.7	1.25	0.01	1.85	-4.22 – 0.8

* p <0.05, ** p <0.01, *** p<0.001: df 1, 65 n = 67

The final model for state anxiety included neighborhood stress, perceived stress, chronic stress and individual social support. Covariates considered were, age, marital status, race,

education, income, and number of children living in the household. None of these suspect covariates had a significant impact on state anxiety and were not included in the final model. Neighborhood stress, perceived stress, chronic stress and social support were added to the final model. Once individual level characteristics were added to the model, neighborhood stress no longer had an effect on state anxiety. Together perceived stress and social support accounted for almost 50% of the variation in state anxiety (Adj. $R^2 = 0.49$, F (4, 62) = 17.12, $p < 0.001$). See Table 4-9 below

Table 4-9 Effects of Neighborhood and Individual Level Characteristics on State Anxiety

Variable	B	SE	95% CI
Neighborhood Characteristics			
Neighborhood Stress	-0.13	0.11	-0.22 – 0.20
Individual Level Factors			
Perceived Stress (PSS)	0.60 **	0.18	0.22 – 0.93
Chronic Stress (TCSI)	0.11	0.64	-0.01 – 0.24
Individual Social Support (ISEL)	-0.21***	0.63	-0.33 - -0.08

Note: n = 67 F(4, 62) = 17.12 Adj. $R^2 = 0.49$***
* p <0.05, ** p <0.01, *** p<0.001:

Depression, Neighborhood Characteristics and Stress

Bivariate analyses show that neighborhood disorder (Adj R^2 0.07, F (1, 65) = 6.16, p-value < 0.05), neighborhood stress (Adj. R^2 0.14, F (1, 65) = 11.42, p-value < 0.01) and neighborhood social cohesion (Adj. R^2 0.04, F (1, 65) = 4.04, p-value < 0.05) have mild effects on depression scores in this group of women. See table 4-10.

Individual factors such as perceived stress (Adj. R^2 0.26, F (1,65) = 24.42, p-value < 0.001), chronic stress (Adj. R^2 0.39, F (1,65) = 43.32, p-value < 0.001), unfair treatment (Adj. R^2 0.14, F (1,65) = 11.92, p-value < 0.01), and individual social support (Adj. R^2 0.26, F (1,65) = 24.27, p-value < 0.001) also significantly impact depression.

Due to the small sample size and the large number of variables, significant neighborhood and individual level variables in Table 4-11 were put into separate multiple regression

models. Variables that continued to have a statistically significant effect on depression were put in the final model. Table 4-11 illustrates the first model and shows which neighborhood variables remain significant predictors of depression. When all neighborhood level variables were added to the model, only neighborhood stress remained significant (Adj. R^2 0.13. F (3. 63) = 4.38, p –value < 0.01). Therefore, neighborhood stress was placed in the final model.

Table 4-10: Neighborhood, Psychosocial, and Individual Effects on Depression (CES-D)

Variable	B	SE	Adj. R^2	F	95% CI
Neighborhood Characteristics					
Neighborhood Economic Disadvantage	-0.08	0.06	0.01	1.89	-0.02 – 0.04
Neighborhood Disorder	0.05*	0.02	0.07	6.16	0.01 – 0.09
Neighborhood Stress	0.04**	0.01	0.14	11.42	0.02 – 0.07
Neighborhood Social Cohesion	-0.05*	0.02	0.04	4.04	-0.1 - -0.0003
Individual Level Factors					
Perceived Stress (PSS)	0.1***	0.02	0.26	24.42	0.06 – 0.14
Chronic Stress (TCSI)	0.04***	0.006	0.39	43.32	0.03 – 0.05
Unfair Treatment	0.08**	0.024	0.14	11.92	0.03 – 0.13
Individual Social Support (ISEL)	-0.03***	0.007	0.26	24.27	-0.05 - -0.02
Age	-0.02	0.02	0.005	0.69	-0.05 – 0.02
Marital Status	0.43	0.44	-0.001	0.94	-0.46 – 1.31
Number of children	-0.20	0.14	0.015	2.00	-0.47 – 0.08
Race	0.11	0.24	-0.01	0.23	-0.36 – 0.58
Education	-0.18	0.11	0.03	2.90	-0.40 – 0.03
Income	-0.0007	0.0004	0.04	3.41	-0.002 – 000

Note n = 67 df (1, 65)
* p <0.05, ** p <0.01, *** p<0.001:

The second model consists of significant individual level factors from Table 4-10 above. As shown in Table 4-11, only perceived and chronic stress (Adj. R^2 0.47. F (4. 62) = 15.85, p –value < 0.01) continue to be significant predictors accounting for almost 50% of the variation in depression. In the final model neighborhood stress no longer has a significant effect on depression. For this sample of women, perceived and chronic stressors

(Adj. R^2 0.45, F (3. 63) = 18.85, p –value < 0.001) are more important predictors of depression than neighborhood disorder and exposure to crime.

Table 4-11: Regression Results for Neighborhood and Psychosocial Measures as Predictors of Depression

Variable	B	SE	95% CI
Model 1 – Neighborhood Level Factors			
n = 67, F (3, 63) = 4.38; Adj. R^2 0.13**			
Neighborhood Disorder	0.006	0.25	[-0.45 , 0.06]
Neighborhood Stress	0.45*	0.19	[0.07 , 0.83]
Neighborhood Social Cohesion	-0.03	0.03	[-0.09 , 0.02]
Model 2 – Individual Level Factors			
n = 67, F (4, 62) = 15.85; Adj. R^2 0.47**			
Perceived Stress (PSS)	0.05*	0.02	[0.01 , 0.09]
Chronic Stress (TCSI)	0.02**	0.007	[0.008 , 0.04]
Unfair Treatment	0.25	0.02	[-0.02 , 0.07]
Individual Social Support (ISEL)	-0.01	0.007	[-0.02 , 0.003]
Final Model – Combined			
n = 67, F (3, 63) = 18.85; Adj. R^2 0.45**			
Neighborhood Stress	0.01	0.15	[-0.29 , 0.31]
Perceived Stress (PSS)	0.06**	0.02	[0.02 , 0.09]
Chronic Stress (TCSI)	0.03***	0.007	[0.02 , 0.04]

* p <0.05, ** p <0.01, *** p<0.001:

Seemingly Unrelated Regression Analysis of Anxiety and Depression Regression Equations

The correlation matrix of residuals for anxiety and depression was 0.52. Breusch-Pagan test of independence revealed that the residuals from the two equations above are not independent (Chi Square 18.24, p-value < 0.001). Table 4-12 shows seemingly unrelated regression results for anxiety and depression regression models. Again, with individual level factors added to the model, neighborhood stress is no longer a predictor of anxiety or depression. Both perceived stress and chronic stress remain significant predictors of depression and anxiety. Social support is also a significant predictor of anxiety with lower levels of social support associated with higher levels of anxiety.

Possible confounding variables included weight, smoking, hours of sleep, and presence of an acute stressor, and menstrual cycle phase. None of these factors were significantly associated with SC-AUCg. The only individual level factors associated with SC-AUCg were unfair treatment (Adj. R^2 0.13, F (1. 65) = 11.26, p – value < 0.01) and weight (Adj. R^2 0.04, F (1. 65) = 4.05, p –value < 0.05).

Table 4-12 Seemingly Unrelated Regression Analysis of Anxiety and Depression Equations

Equation	**Obs.**	**Parms.**	**RMSE**	**R^2**	**Chi^2**	**P**
CESD	67	3	0.95	0.47	60.12	0.000
State Anxiety	67	4	8.22	0.52	71.32	0.000
	B	**SE**	**Z**	**p-value**	**95% CI**	
Depression Equation						
Neighborhood Stress	0.002	0.14	0.08	0.94	[-0.27 , 0.30]	
Perceived Stress	0.06	0.02	2.98	0.003	[0.02 , 0.09]	
Chronic Stress	0.03	0.007	4.49	0.000	[0.17 , 0.044]	
Anxiety Equation						
Neighborhood Stress	0.0005	1.25	-0.10	0.92	[-2.59 , 2.34]	
Perceived Stress	0.62	0.17	3.64	0.000	[0.28 , 0.95]	
Chronic Stress	0.13	0.06	2.21	0.03	[-0.26 , -0.06]	
Social Support	-0.16	0.05	-3.08	0.002	[-0.26 , -0.06]	

When these variables were added to a multiple regression model both remained significant predictors of salivary cortisol (Adj. R^2 0.21, F (2. 62) = 9.32, p –value < 0.001) and accounted for 20% of the variability in mean salivary cortisol over the day. See table 4-14. Contrary to the hypothesis that unfair treatment (stress) would be positively associated with SC-AUCg, for each 0.04 point increase in unfair treatment SC-AUCg decreased by one unit (ug/dl).

Given the limitations regarding the lack of sensitivity of SC-AUCg to differences in individual cortisol levels over time and the correlation of repeated salivary cortisol measures within each person as discussed in chapter 3, general estimating equations (GEE)

were also used to examine the relationships among neighborhood characteristics, stress, psychological distress and salivary cortisol.

Table 4-13: Simple Regression SC-AUCg

Variable	B	SE	Adj. R^2	F	95% CI
Neighborhood Characteristics					
Neighborhood Economic Disadvantage	0.02	0.03	-0.01	0.29	-0.05 – 0.08
Neighborhood Disorder	-0.003	0.01	-0.014	0.09	-0.02 – 0.018
Neighborhood Stress	-0.006	0.007	-0.003	0.82	-0.02 – 0.01
Neighborhood Social Cohesion	0.01	0.01	0.003	1.21	-0.01 – 0.05
Individual Characteristics					
Unfair Treatment	-0.04**	0.012	0.13	11.26	-0.06 - -0.02
Perceived Stress	-0.022	0.12	0.04	3.48	-0.04 – 0.002
Chronic Stress	-0.002	0.004	-0.010	0.35	-0.01 – 0.005
Individual Social Support	0.004	0.004	0.0002	1.01	-0.004 – 0.01
Depression	-0.01	0.007	0.016	2.06	-0.02 – 0.004
Anxiety	-0.011	0.007	0.027	2.80	-0.02 – 0.002
Weight	-0.004*	0.002	0.04	9.32	-0.01 - -0.00003
Birth Control	0.18	0.27	-0.009	0.44	-3.65 – 0.73
Menstrual Cycle Phase	-0.09	0.12	-0.007	0.54	-0.33 – 0.15
Smoking	-0.14	0.22	-0.01	0.41	-0.57 – 0.29
Sleep Hrs					
Day 1	-0.17	0.04	-0.01	0.19	-0.09 – 0.06
Day 2	0.04	0.05	-0.003	0.76	-0.5 – 0.13
Acute Stressor					
Day 1	-0.06	0.19	-0.01	0.11	-0.43 – 0.31
Day 2	0.19	0.25	-0.006	0.59	-0.31 – 0.70
Age	0.008	0.01	0.01	0.75	-0.01 – 0.03

* p <0.05, ** p <0.01, *** p<0.001; df 1, 65

Table 4-14: Multiple Regression of Individual Level Characteristics on SC-AUCg

Variable	B	SE	95% CI
Unfair Treatment	-0.045***	0.01	-0.07 - -0.02
Weight	-0.004*	0.002	-0.007 - -0.0008

Note: n = 65 F(2, 62) = 9.32 Adj. R^2 = 0.21***
* p <0.05, ** p <0.01, *** p<0.001:

As stated in chapter 3, in addition to using standard regression, GEE was used to examine the relationship between neighborhood characteristics, stress, and psychological

distress and repeated measures of salivary cortisol. Using GEE methodology, neighborhood characteristics do not have an effect on salivary cortisol. In this sample of women, perceived stress and unfair treatment are negatively associated with salivary cortisol. As seen in the final model, the GEE approach yields more conservative results compared to standard multiple regression using AUCg. For each unit change in unfair treatment and perceived stress salivary cortisol decreases by 0.02 and 0.03 units respectively, after controlling for other potentially confounding psychosocial and physiological stressors ($p < 0.05$). See table 4-15.

Table 4-15: GEE Population Averaged Model of Effects of Neighborhood Characteristics, Stress and Psychological Distress on Salivary Cortisol

Variable	**B**	**SE**	**p**	**95% CI**
Neighborhood Characteristics – Multiple Regression				
Number of observations = 804; number of groups = 67; Wald Chi^2 = 7.02; p = 0.22				
Neighborhood Economic Disadvantage	-0.007	0.03	0.80	-0.066 - 0.50
Neighborhood Disorder	0.09	0.01	0.47	-0.016 - 0.03
Neighborhood Stress	-0.01	0.008	0.18	-0.025 - 0.005
Neighborhood Social Cohesion	0.007	0.02	0.77	-0.040 - 0.053
Individual Level Characteristics – Multiple Regression				
Number of observations = 804; number of groups = 67; Wald Chi^2 = 16.42; p = 0.02				
Unfair Treatment	-0.031	0.013	0.02	-0.06 – 0.005
Perceived Stress	-0.29	0.013	0.04	-0.05 – 0.002
Chronic Stress	0.005	0.005	0.27	-0.004 - 0.014
Individual Social Support	0.0001	0.005	0.98	-0.009 - 0.009
Depression	0.009	0.010	0.41	-0.012 - 0.009
Anxiety	-0.007	0.011	0.53	-0.027 - 0.014
Final Model – Controlling for Individual SES, physiological factors and health behaviors				
Number of observations =768; number of groups = 64; Wald Chi^2 = 19.73; p = 0.01				
Unfair Treatment	-0.02	0.012	0.03	-0.05 - -0.002
Perceived Stress	-0.025	0.011	0.02	-0.05 - -0.003
Monthly Income	-0.0001	0.0002	0.64	-0.0004 – 0.0003
Weight	-0.003	0.002	0.07	-0.006 – 0.0003
Menstrual Cycle Phase	0.06	0.11	0.60	-0.16 – 0.27
Smoking – Packs per day	-0.14	0.19	0.47	-0.52 – 0.24
Number of Children in household	-0.029	0.063	0.65	-0.15 – 0.09

Specific Aim 2: Differences in Neighborhood Characteristics by Housing Subsidy Type

The second aim of this study was to determine the differences in neighborhood characteristics of two subsidized housing types, specifically section 8 and public housing, in which low SEP female heads of households with children live. It was proposed that public housing sites would have significantly more neighborhood disorder, greater levels of neighborhood disadvantage, higher levels of neighborhood stress, higher reports of crime exposure, and lower levels of neighborhood social cohesion than section 8 housing sites. Group comparison T-test and Mann-Whitney *U*-test were used to test whether neighborhoods differed by housing subsidy type.

Eighty percent of the women living in public housing lived in the most economically disadvantaged neighborhoods, while a little over one half of those living in section 8 housing lived in the poorest areas. Figure 4.2 illustrates the differences in neighborhood economic disadvantage by housing subsidy type.

As shown in table 3-1, skewness and kurtosis tests for normality showed that NED is significantly skewed to the left. Therefore, the Mann-Whitney *U* test was used to test whether there were differences in NED by housing subsidy type. The hypotheses were partially supported. Women living in section 8 housing units were located in more economically advantaged areas ($z = -2.552$, $p<0.05$) (table not shown). No differences in neighborhood disorder, exposure to crime, or collective efficacy by housing type were found in this sample of women.

Specific Aim 3: Differences in Stress, Psychological Distress, Health and Salivary Cortisol by Housing Type

The final aim of this study was to examine the differences in housing satisfaction, perceived stress, psychological distress, and salivary cortisol levels, in low SEP female

heads of households with children by housing type. It was purported that women living in public housing would experience significantly lower levels of housing satisfaction, have higher levels of perceived stress, psychological distress, and greater alterations in salivary cortisol secretion than women living in section 8 housing.

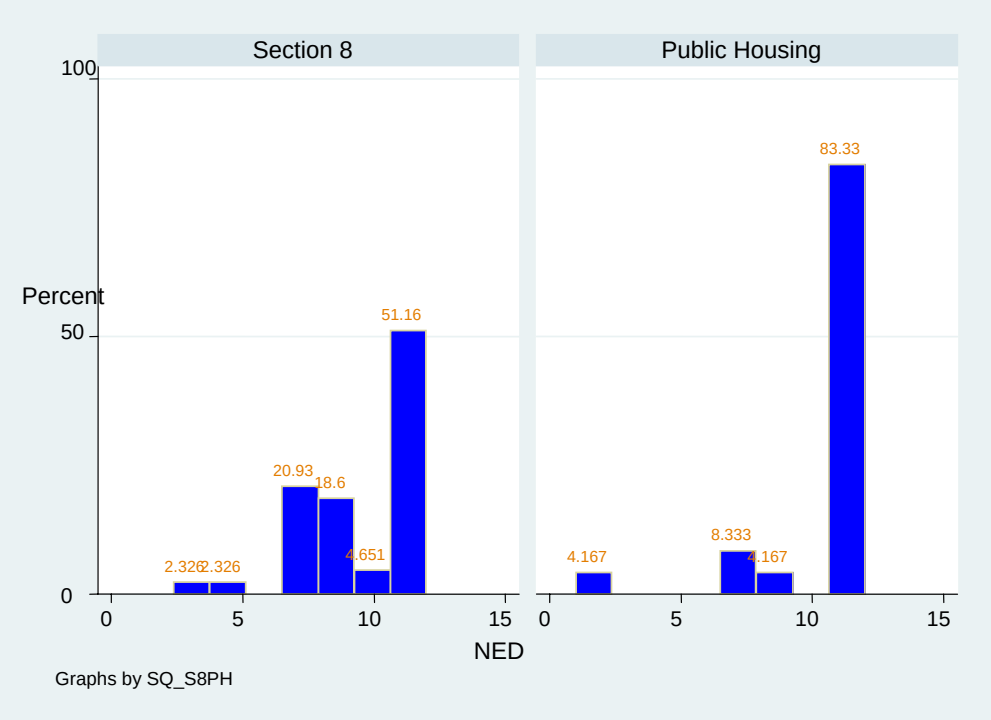


Figure 4.2: Neighborhood Economic Disadvantage (NED) by Housing Subsidy Type

The outcome variables were housing satisfaction, perceived stress, chronic stress, state anxiety, depression and SC-AUCg. Housing satisfaction is an ordinal variable; therefore the Mann-Whitney test was used to examine differences in housing satisfaction by housing type. T-tests were used for all other variables. There were no differences in any of the outcome variables by housing subsidy type. The hypotheses for this specific aim were not supported.

The hypotheses for specific aims one and two were partially supported. Study results did not support specific aim three. The women in this study have higher rates of state anxiety and depression, and lower levels of general health compared to national norms for the same age group. Neighborhood disorder and crime exposure were mildly to moderately associated with increased levels of perceived stress, unfair treatment, chronic stress, depression and anxiety. However, the neighborhood effects on depression and anxiety became statistically insignificant when perceived stress, unfair treatment, chronic stress and other individual level covariates were added to the model. The following chapter provides a detailed discussion on the study results, discusses the limitations of the study and implications for public health nursing research and practice.

CHAPTER 5
DISCUSSION AND RECOMMENDATIONS

This chapter presents major study findings, addresses study limitations and discusses implications for public health nursing research and practice. First, findings regarding sample characteristics are discussed. Then major findings for each specific aim and associated hypotheses are presented. Next study limitations are acknowledged. Finally, implications for public health nursing research and practice are discussed.

Major Findings

This study is unique in its design and attempts to examine the associations among housing type, neighborhood characteristics, stress, psychological distress, health, and the hypothalamic-pituitary-adrenal axis (HPA axis), specifically salivary cortisol. Salivary cortisol samples were collected for two days in women living in section 8 or public housing while in their natural setting going about their daily routine. To date only one study has examined neighborhood characteristics (neighborhood socioeconomic status) in relation to the HPA axis, specifically cortisol levels; however, that study examined cortisol as a response to an acute stressor, as opposed to basal levels in relation to chronic stress exposures. Kapuku, Trieber and Davis (2002) colleagues examined the association between neighborhood socioeconomic status (SES), cardiovascular function, and plasma cortisol in response to laboratory-induced stress in a sample of 24 black males 16 to 25 years old. They found that family SES was related to baseline serum cortisol level (partial $r = .46$, $p<.05$), but the correlation between neighborhood SES was not statistically significant (Kapuku, Treiber, and Davis, 2002). Other studies have examined individual-

level factors such as perceived stress and burnout (Grossi et al., 2005; Zarkovic et al., 2003), depression and anxiety (Takai et al., 2004; Vedhara *et al.*, 2003) and individual-level SES (Cohen, Doyle, and Baum, 2006) in relation to cortisol. However, the present study is the first to examine the associations between other neighborhood characteristics (disorder, crime, and social cohesion and neighborhood economic disadvantage) and salivary cortisol levels in a community setting. In addition, this study sought to determine if any differences are present in neighborhood characteristics, stress, psychological distress, and salivary cortisol by housing subsidy type (section 8 and public housing).

Sample Characteristics

Consistent with national housing data (U. S. Department of Housing and Urban Development, 1998), the majority of women is this study were Black, single female heads of households with one or two children and a high school diploma or GED as the maximum level of education. Their mean annual income was $5, 838.00 which is well below the 2006 poverty guidelines for two, three, and four persons households ($13,200, 16,660, and 20,000 respectively) (United States Department of Health and Human Services, 2006). Despite their low-income, less than 1/3 of the women in this study received financial assistance from the Temporary Assistance for Needy Family programs. Information on food stamp assistance or involvement in the Women, Infant's and Children program was not obtained. Other studies have shown that poor women experience more social stressors (McAllister and Boyle, 1998; Turner and Avison, 2003) and have poorer physical and mental health (Artazcoz, Borrell, Benach, Cortes, and Rohlfs, 2004; Macran, Clarke, and Joshi, 1996).

The women in this study reported higher rates of state anxiety and poorer general health than the national norms. Almost one-half of the sample (49.25%) scored well

above the cut off of 16 (mean 24.73) on the CES-D, suggestive of clinical depression. Other studies have also demonstrated that women living in subsidized housing report poorer mental and physical health (Fauth, Leventhal, and Brooks-Gunn, 2004; Leventhal and Brooks-Gunn, 2003; Welch, 1997).

Similar to these findings, Popkin and colleagues (2002) evaluated residents involved in the HOPE VI program, a major federal initiative to transform distressed public housing nationwide by demolishing distressed developments and replacing them with mixed-income housing. In the baseline report (status before moving), adult public housing residents reported higher rates of depression (60% higher than the national population average) and lower rates of overall health than the national average (29% of adults in public housing older than 50 years of age versus 30% for adults in the same age group nationally) (Popkin et al., 2002).

Specific Aim 1: Relationships between Neighborhood Characteristics Stress, Psychological Distress, Health and Salivary Cortisol

Several hypotheses are associated with specific aim 1 and are divided into neighborhood- and individual-level factors. The final hypothesis relevant to specific aim 1 was that neighborhood characteristics would have an effect on depression, anxiety, general health and SC-AUCg above and beyond individual level stressors.

Neighborhood level hypotheses

Regarding neighborhood-level factors, it was posited that women living in neighborhoods with high levels of neighborhood economic disadvantage, disorder and crime would have higher levels of perceived stress, chronic stress, anxiety, depression SC-AUCg, and lower levels of general health. Higher levels of neighborhood social

cohesion were hypothesized to be associated with lower levels of perceived stress, chronic stress, anxiety, depression, SC-AUCg and better general health.

The hypotheses for specific aim one were partially supported. Findings reveal that neighborhood disorder and crime exposure are mildly to moderately correlated with increased levels of stress and psychological distress, but not general health, SC-AUCg, or repeated time-specific measures of salivary cortisol. These findings are consistent with other studies investigating neighborhood effects on stress, psychological distress, and health (Boardman, 2004; Boardman, Finch, Ellison, Williams, and Jackson, 2001; McAllister and Boyle, 1998; Steptoe and Feldman, 2001).

In the present study, neighborhood economic disadvantage was not associated with stress, psychological distress, general health or SC-AUCg. Other studies investigating the relationships between neighborhood SES and health have revealed inconsistent findings. Some studies have documented an association between neighborhood SES and stress (Boardman et al., 2001; Schulz et al., 2000) and psychological distress and health (Ross and Mirowsky, 2001). In contrast, other studies have not found a significant relationship between neighborhood SES, stress, psychological distress and health (Henderson et al., 2005; Kapuku et al., 2002). Inconsistencies in the neighborhood effects and stress literature are likely due to different indexes used to measure neighborhood effects on health as well as the use of different methods and instruments used to measure stress. More studies are needed using consistent neighborhood measures to better understand the contextual effects of neighborhoods on health.

Neighborhood social cohesion was shown to have weak negative associations with depression, unfair treatment, and chronic stress, but not with anxiety and perceived stress

as hypothesized. Furthermore, neighborhood social cohesion was not associated with general health or SC-AUCg in the present study. Ellaway, Macintyre and Kearns (2001) revealed similar findings in their study on perceptions of place and health in socially contrasting neighborhoods. They found that perceived neighborhood social cohesion was not significantly associated with general self-assessed health, but there was a negative weak association (R^2 -0.149, $p < .05$) with mental health (Ellaway, Macintyre, and Kearns, 2001). However, other studies investigating the relationship between social cohesion and health have found that social cohesion may serve as a buffer between perceived neighborhood disorder and health, especially physical functioning (Feldman and Steptoe, 2004; Ross and Jang, 2000). To date, no studies have examined the relationships among neighborhood disorder, crime exposure and social cohesion on salivary cortisol levels.

Discussion Regarding Individual Level Hypotheses

It was hypothesized that perceived stress, chronic stress and unfair treatment would be positively associated with depression, anxiety and SC-AUCg; and negatively associated with general health. Individual social support would be negatively associated with perceived stress, chronic stress, depression, anxiety and SC-AUCg and positively associated with general health.

Perceived stress and individual social support accounted for almost half of the variation in state anxiety (Adj. $R^2 = 0.49$, F (4, 62 $p < 0.001$). Where as perceived and chronic stress accounted for 45% of the variation in depression scores (Adj. $R^2 – 0.45$, F (3, 63) = 18.85, p-value < 0.01). These findings are consistent with numerous studies that have documented significant associations between perceived stress, chronic stress social

support and psychological distress (anxiety and depression) (Elliot, 2000; Ross, Reynolds, and Geis, 2000; Schulz et al., 2006).

This study did not find a significant association between SC-AUCg perceived stress, chronic stress, depression or anxiety using standard multiple regression methods. However when GEE was used perceived stress and unfair treatment was negatively associated with mean salivary cortisol. These findings are similar to others in the literature. However, inconsistencies in findings are common. For example, Takai and colleagues (2004) did not find a significant association between basal salivary cortisol levels and State Trait Anxiety Inventory scores; where as other researchers have found significant relationships between stress, depression, anxiety and basal salivary cortisol levels (Polk, Cohen, Doyle, Skoner, and Kirschbaum, 2005; van Eck, Berkhof, Nicolson, and Sulon, 1996; Vedhara et al., 2003). However, these studies vary in their methodology which may influence their findings. For example, Polk and colleagues (2005) obtained salivary cortisol samples in a hotel setting prior to viral exposure. In this setting, the change in normal routine as well as anticipatory stress regarding voluntary viral exposure may disrupt the normal cortisol levels in these participants. Vedhara et. al (2003) examined salivary cortisol using both AUC and rate of change in a sample of 54 women attending a diagnostic breast clinic with suspected breast disease. Again, examining salivary cortisol in this type of environment may result in biased results due to the increase in emotional distress due to the possibility of being diagnosed with a serious breast disorder.

Some researchers have found that lower levels of cortisol have been associated with chronic stress, and depression (Burke, Fernald, Gertler, and Adler, 2005; Zarkovic et al.,

2003), while others have demonstrated that stress, anxiety, and depression are associated with higher levels of salivary cortisol (van Eck et al., 1996). These inconsistencies may be the result of the variety of way and methods used to analyze salivary cortisol. Some researchers use morning cortisol levels or morning area under the curve, while other use multi-level analyses to estimate the average cortisol levels over time (Burke et al., 2005; Kirschbaum and Hellhammer, 1994). In addition to differences in statistical methodology, the settings in which salivary cortisol is collected also differ. For example, Burke and colleagues (2005) examined salivary cortisol in response to an acute naturalistic stressor (unexpected arrival of a team of researchers at the participant's homes) with saliva samples collected upon arrival, then 25 and 50 minutes after arrival. In contrast van Eck, Berkhof, Nicolson and Sulon (1996) examined salivary cortisol 10 times a day for five consecutive days in a sample of 87 men during their normal daily activities. In this type of study, researchers are able to get a better idea of cortisol levels and diurnal patterns in a naturalistic setting. However, given the short length of time for which cortisol was evaluated, little can be said about the impact of chronic stress on alterations in salivary cortisol. More research that incorporates comprehensive longitudinal designs, preferably over the life-course, are essential to understanding how chronic exposure to stressful stimuli affect cortisol levels, which may in turn perpetuate chronic illnesses such as hypertension, cardiovascular disease, and type 2 diabetes.

This is the first study to document an association between unfair treatment (a chronic psychosocial stressor) and salivary cortisol (Adj. $R^2 = 0.13$, $p < 0.001$). Higher scores on the interpersonal mistreatment scale were significantly associated with lower mean salivary cortisol levels throughout the day using both standard multiple regression

and GEE. This finding is surprising in that the direction of the relationship between unfair treatment and SC-AUCg is opposite of the hypothesized relationship. Only one study has examined unfair treatment as a factor that may alter physiological responses to stress. Guyll, Matthew, and Bromberger (2001) examined the cardiovascular reactivity of 70 African Americans and 158 Caucasians in response to laboratory induced stressors. They found that after adjusting for covariates, attributing mistreatment to discrimination was positively related to baseline heart rate levels among African American participants [t(95) = 2.08, p<.05, (M_{adj}=72.9vs68.7bpm; f^2=0.046]. Also between-subjects analyses of African American's data showed that participants who experienced discrimination exhibited greater average diastolic blood pressure reactivity than those who did not [t(94) = 2.25, p,.03 (M_{adj} = 9.2 versus 5.5 mmHg; f^2 = 0.054] (Guyll, Matthews, and Bromberger, 2001). To date no published studies have been found that examined unfair treatment or discrimination in relation to salivary cortisol.

The differences noted in associations between perceived stress, unfair treatment and salivary cortisol using AUCg versus repeated measures (GEE) may be due to the fact that GEE adjusts for correlations between repeated time-specific measures of salivary cortisol, but AUCg does not. The correlation adjustment in GEE tends to result in smaller standard errors in the coefficients of standard regression models, leading to smaller p-values (less statistical significance). Inconsistencies in the literature along with the current debates regarding AUC methodology justify further detailed multi-level analyses of time dependent changes in salivary cortisol in relation to unfair treatment before making any conclusions regarding this finding. The time of day in relation to salivary cortisol levels along with AUC (over the entire day) is an important factor in determining

the relationship between salivary cortisol levels and chronic illnesses. Different portions of the diurnal cortisol pattern may be more relevant to a certain illness than other parts of the cortisol cycle. For example, blunted morning cortisol response and morning AUC have been associated with chronic psychological distress and depression (Burke et al., 2005; Zarkovic et al., 2003); where as elevated evening cortisol levels have been associated with cardiovascular disease (Stewart and Seeman, 2000). More research is needed to resolve these methodological issues.

Discussion Regarding Neighborhood Effects on Psychological Distress, Health and Salivary Cortisol

The final hypothesis regarding specific aim 1 was that neighborhood economic disadvantage, disorder, crime and social support would have an effect on psychological distress (anxiety and depression), salivary cortisol and general health above and beyond individual level factors. After controlling for individual level factors (perceived stress, chronic stress and individual social support), neighborhood level factors no longer had an effect on depression, anxiety, health or SC-AUCg. Other studies have similarly found that the effects of adverse neighborhood characteristics on health are mediated by psychosocial and physiological processes (Cattell, 2001; Hill, Ross, and Angel, 2005; Sampson, Morenoff, and Gannon-Rowley, 2002). Others studies, however, have found strong positive associations between perceived neighborhood characteristics and depressive symptoms that are not buffered by individual social support (Latkin and Curry, 2003).

Conclusions

This study did not find an association between any of the neighborhood characteristics examined and health, SC-AUCg, or repeated, time-specific salivary

cortisol levels. Neighborhood effects on mental and physical health reported elsewhere, however, tend to be small (Boardman, 2004; Feldman and Steptoe, 2004; Schulz et al., 2000). Given the small sample size in this study, it is possible that any significant neighborhood effects on the outcome measures were undetectable due to lack of power. However, the significant associations found in this study between neighborhood disorder, crime and social cohesion, and stress and psychological distress indicate that neighborhood characteristics influence perceptions of stress. These findings affirm the importance and necessity of including neighborhood level variables in future studies as important sources of individual stress, particularly in relation to an ecological model.

The association between unfair treatment and SC-AUCg and repeated time-specific salivary cortisol is unexpected and has the potential to add to the literature on psychosocial stressors and health via the HPA axis. More research is needed utilizing a longitudinal design to better understand the relationship between unfair treatment and salivary cortisol.

Specific Aims 2: Differences in Neighborhood Characteristics, Housing Satisfaction, by Housing Subsidy Type

It was hypothesized that women living in public housing would have higher rates of neighborhood economic disadvantage and higher scores on perceived neighborhood disorder, neighborhood stress, and lower scores on perceived neighborhood social cohesion. The hypotheses for specific aim 2 were partially supported. Though there is a significant difference in neighborhood economic disadvantage by housing subsidy type, there were no differences in neighborhood disorder, exposure to crime, nor neighborhood social cohesion. The lack of significant differences in neighborhood disorder, crime exposure and neighborhood social cohesion by housing subsidy type may be explained by

the fact that while located in areas with greater economic advantage, Section 8 housing units may still be located in areas with “pockets” of high crime rates and disorder. However, it should be noted that this study did not differentiate between the types of Section 8 households that participated. Section 8 recipients in this study included those using project-based Section 8, certificates, and vouchers. In project-based Section 8, families live in specifically designated section 8 housing developments or units. The assistance is tied to the unit, not the family, thus mobility to more advantaged areas is limited (Employment Support Institute, 2006). As noted in Chapter 2, historic and recent trends for location of low-income housing units are that they are more often than not located in more economically disadvantaged areas.

Though being phased out, certificate programs remain in effect. The main difference between Section 8 certificate and voucher programs is that the public housing authority or administering agency pays the landlord the difference between 30% of the household’s adjusted income and the unit’s rent and that rent cannot exceed the U. S. Department of Housing and Urban Development (HUD) established fair market rent for the area (U. S. Department of Housing and Urban Development, 2004). In the Section 8 voucher program, the family pays the difference between the actual rent charged by the landlord and the amount subsidized by the program. In other words, if they can afford to do so, the family may rent a unit that exceeds the HUD fair market rent for the area. Though detailed statistics were not kept on the different types of Section 8 recipients in the present study, many of the participants lived in project-based Section 8 units which may attenuate the differences between Section 8 and public housing residents.

There are weaknesses associated with the Section 8 voucher programs that may also impact the ability to differentiate between neighborhood characteristics of public and Section 8 housing. Historically many suburban jurisdictions have used zoning and land use regulations to limit the development of multi-family rental housing in order to maintain their property tax base and ensure social homogeneity. Consequently, the stock of affordable rental housing tends to be concentrated in central cities, older suburbs, and less affluent neighborhoods (Turner, 2003). Furthermore, while the housing voucher program has allowed recipients to live in lower-poverty areas, racial disparities still exist in terms of residential mobility and choice. Studies have shown that 25.2% of African-American recipients and 27.9% of Hispanics live in high-poverty neighborhoods (poverty rates over 30%), compared with only eight percent of whites (Devine, Gray, Rubin, and Taghavi, 2003).

However, at least one study has shown a significant difference in voucher recipients and persons residing in public housing or receiving project-based assistance. Leventhal and Brooks-Gunn (2003) focused on the short term effects of the Moving To Opportunity program (MTO), a randomized housing mobility experiment launched by HUD in 1994. They found that the experimental group (families who received Section 8 vouchers and special assistance to move only to neighborhoods with less than 10% poverty rates) had higher median incomes and reported significantly less physical and social disorder compared to control groups (families who continued to live in public housing or who receive project-based Section 8 assistance).

The section 8 voucher program is the federal government's major program for assisting very low-income households to afford housing in the private market. It also

provides the most portability in terms of selecting into more advantaged neighborhoods. However many barriers remain that limit the success of the Section 8 voucher program to improve neighborhood quality for its recipients. Future research should focus on the differences between the voucher program and other types of housing assistance in terms of neighborhood characteristics, residential segregation, employment opportunities and the impact on health.

Specific Aim 3: Differences in Stress, Psychological Distress, Health and SC-AUCg by Housing Type

It was hypothesized that women living in public housing units would report significantly higher levels of stress, psychological distress, have higher SC-AUCg levels and report poorer health than their counterparts in Section 8 housing. The data did not support the stated hypotheses for specific aim 3. There were no significant differences found in stress, psychological distress, health, or salivary cortisol by housing type. Given the fact that 50% of the women living in Section 8 units also lived in neighborhoods with high levels of economic disadvantage, disorder and crime, it is possible that the women in this study experienced similar environmental stressors as women living in public housing. Only a few studies have assessed the differences in health between public housing and section 8 voucher recipients. The MTO study demonstrated that households who moved to low-poverty neighborhoods (experimental group) reported less mental distress than those who remained in high poverty areas (control group) (Leventhal and Brooks-Gunn, 2003). The HOPE VI resident tracking study revealed that persons returning to revitalized public housing units were less likely to report very good or excellent health than those moving to other areas, even after restricting elderly adults from the analysis (Buron, Popkin, Levy, Harris, and Khadduri, 2002). Though neighborhood and mental

health benefits have been documented regarding recent changes in low-income housing policy, more research is needed to understand the social processes and physiological mechanisms that contribute to disparate health outcomes among low-income women.

Study Limitations

This study has several limitations. Therefore, the findings should be interpreted with caution. First, non-probability sampling limits the generalizability of this study to other populations. Using a random sample of neighborhoods and a random sample of participants from each neighborhood would improve the generalizability at the population level and is vital to conducting epidemiological studies. A larger sample of a variety of neighborhood environments is crucial to detecting neighborhood effects on health. Second, the small sample size may account for the lack of significant findings between neighborhood characteristics, psychological distress, health and salivary cortisol.

Third, the research design could be strengthened by utilizing a longitudinal design that collects physiological measures over several years as opposed to the cross-sectional repeated measures design used in this study. Longitudinal designs, especially in the face of forced relocation due to public housing revitalization efforts, are crucial in determining the effects of these changes on the health and well-being of the mover as well as the recipient communities. Some important research questions might be: what are the recipient community members' perceptions of S8 voucher recipients and how do those perceptions change over time? How do those perceptions impact acceptance into the community and treatment of low-income housing residents?

Fourth, most of the measures of neighborhood characteristics were based on the perceptions of the study participants. Using more objective measures of crime rates and neighborhood disorder would prove useful in future studies. However, perceptions of

one's environment are important factors to consider when investigating behavioral and physiological responses to stressors. The effect of the social environment results from the fact that the brain and body are constantly communicating via the autonomic nervous system and the endocrine and immune systems (McEwen, 2005). Thus, the regulation of stress-related mediators is dependent upon how a potential stressor is perceived as well as the individual's capacity to cope with that stressor.

Fifth, given the natural hierarchical ordering of the data (individuals nested housing – nested within neighborhoods), multi-level analysis techniques in future studies are warranted in order to account for the contextual effect of neighborhoods on individual health outcomes.

Implications for Public Health Nursing Research and Practice

Public health nurses (PHNs) are in an extraordinary position to provide policy makers with accurate accounts of how substandard housing and disadvantaged neighborhoods affect the daily lives of women and their families. Keeping up to date on current policy trends involving housing, welfare, and neighborhood revitalization is an important aspect of understanding the communities served. In addition, PHNs as trusted members of the community are valuable resources for grass roots organizations and local community groups, which strive to improve neighborhood and housing conditions. In this venue, PHNs can educate and empower community members to advocate for themselves and their communities on important policy issues.

Housing is an important social determinant of health, and housing policy in the U.S. disproportionately affects women living in poverty. The negative effects of poverty or near-poverty on health are often mediated or reinforced by substandard housing. An

increased understanding of relationships among neighborhood, housing, and health has the potential to significantly improve individual and population health.

Despite the lack of significant findings in the presence of individual level factors in this study, neighborhood economic disadvantage, disorder and exposure to crime remain important factors to consider regarding women's health. For example, this study found that the majority of low-income housing participants reside in economically disadvantaged areas characterized by high rates of perceived disorder and crime, which has implications for future policy decisions regarding location of low-income housing units. In order to reduce pockets of poverty and high crime areas, understanding the current state of low-income housing in an area is crucial. However, further research with larger sample sizes are needed in order to better understand the contextual effects of neighborhoods and housing on community health. Policies that prevent residential and income segregation and concentration of affordable housing units are crucial to reducing social inequalities and their related disparities in health.

The women in this study reported high rates of unfair treatment, perceived and chronic stress. An examination of local housing and land use policies may identify institutional forms of discrimination leading to important policy changes that could possibly improve women's health. In addition, intervention studies that educate women who live in subsidized housing, as well as providers of social services, on how to constructively deal with stress and confront discriminatory behaviors in a positive manner may prove beneficial. More research in this area could highlight specific mechanisms by which low-income housing participants experience discriminatory treatment that may in turn result in higher levels of overall chronic stress.

Knowledge gained from further neighborhood, housing, and health research focusing on low-income housing policies would provide valuable data from which to evaluate the impact of housing voucher and mobility programs on health. Increased awareness of these issues can possibly assist public health nurses, other public health practitioners, urban planners and local governments to secure financial resources for improving neighborhood and housing conditions. Finally, the inclusion of bio-markers (e.g., cortisol and blood pressure) to test specific mechanisms of housing or neighborhood effects on health over time may provide more in depth knowledge on the pathways by which social processes such as housing policies and neighborhood conditions are embodied into physiological processes and thus produce illness.

APPENDIX
CONSTRUCTS, CONCEPTS, AND OPERATIONAL MECHANISMS

Major Explanatory Variables		
Construct	*Concept & Instruments`*	**Psychometrics**
Neighborhood Characteristics	***1. Neighborhood Economic Disadvantage*** **-** An index of % family poverty, % male unemployed, % female head of household and % on public assistance at the census tract level obtained from the 2000 Census Bureau website. ***2. Neighborhood Disorder*** – perceived neighborhood disorder scale consists of 15 items on a four point Likert scale that ranges from order on the low end (15) to disorder on the high end (60) of the continuum. ***3. City Stress Index*** – a self-report measure to assess perceived neighborhood disorder and exposure to violence. The CSI is an 18 item measure with scores ranging from 18 to 72. Low scores indicate lower levels of neighborhood stressors. ***4. Neighborhood Social Cohesion***– Measures aggregate level trust with neighborhoods. (Sampson and Raudenbush, 1997) 5 items on a 5-point Likert Scale; range 0-25.	1.Chronbach's alpha = 0.97 (Sampson & Raudenbush, 1997). 2. Chronbach's alpha = 0.915, (Ross and Mirowsky, 1999, 2001). 3. Chronbach's alpha of .88 and .85 respectively (Ewart, 2002). 4. Chronbach's alpha ranges from 0.80 to 0.91 (Sampson, Raudenbush, and Earls, 1997). .

Major Explanatory Variables Continued		
Construct	**Concept & Instruments**	Psychometrics
Housing	***Perceived Housing Quality*** - Housing and Urban Development (HUD) Customer Service and Satisfaction Survey 26 item on a 5-point Likert scale that measures the degree to which individuals are satisfied with their current housing situation. Includes areas of overall satisfaction, maintenance and repair, communication with management, safety, services, and housing development appearance (U. S. Department of Housing and Urban Development, 2002).	This instrument was developed in focus group settings with public housing residents by HUD. Chronbach's alpha has not been reported for this instrument.
Stress	***1. Perceived Stress*** - The Perceived Stress Scale (PSS) Measures the degree to which situations in one's life are appraised as stressful. A 14 item measure, the PSS scores range from 0 to 56 with lower scores indicating less stress 2. ***Trier Chronic Stress Inventory*** - a 30-item comprehensive measure of chronic stress that comprises nine dimensions including work overload, social overload, overextended at work, lack of social recognition, work discontent, social tension performance pressure at work, performance pressure in social interactions, social isolation, and worry propensity. ***3. Unfair Treatment*** - consists of 10 items. Scores range from 10 to 40 with higher scores corresponding to more frequent experiences of mistreatment (Guyll, Matthews, and Bromberger, 2001; Williams, Yu, Jackson, and Anderson, 1997).	1. Test-retest: r=0.85 Cronbach's alpha = 0.84-0.86 in women. 2. Cronbach's alpha of .76 to .91 and a split-half reliability of .79 to .89. 3. Cronbach's alpha of .76 to .86.

Major Outcome Variables		
Construct	**Concept & Instruments**	**Psychometrics**
Psychological Distress	***1. State/Trait Anxiety*** - The Speilberger State-Trait Anxiety Inventory for Adults has been used extensively in research and clinical practice. The state portion of the scale consists of 20 statements that evaluate how respondents fell at the moment they are completing the survey. The trait portion of the scale consists of 20 statements that assess how people generally feel (Spielberger, Gorsuch, Lushene, Vagg, and Jacobs, 1983). ***2. CES-D*** - a 20-item self-report scale that measures depressive symptoms in the general population (Weissman, Sholomskas, Pottenger, Prussoff, and Locke, 1977). It includes six major symptom areas: (1) depressed mood; (2) guilt-worthlessness; (3) helplessness/hopelessness; (4) psychomotor retardation; (5) loss of appetite; (6) sleep disturbance.	1. Cronbach's alpha of .86 to .95. 2. Cronbach's alpha has ranged from 0.85 to 0.91 (McDowell & Newell, 1996).
General Health	***SF-12v2 Health Survey*** - Only one item from this instrument is used to evaluate general health. Responses range from 0 to 5 (Ware, Kosinski, Turner-Bower, & Gandek, 2005).	Chronbach's alpha ranges from 0.73 – 0.77 in women ages 18-44 years old.
Physiological Effects	***Salivary Cortisol (SC)*** - SC is a widely accepted method for measuring physiological responses to stress; highly correlates with serum (blood) and urine cortisol levels and offers stress-free, non-invasive sampling, easy collection and storage (Kirschbaum and Hellhammer, 1994). Samples will be analyzed using the Extended Range High Sensitivity Salivary Cortisol Enzyme Immunoassay Kit (Salimetrics, 2005).	Requires minimal saliva volume (25 μl), has a serum-saliva correlation of $r = .94$, $p < .0001$(Salimetrics, 2005; Schwartz, Granger, Susman, Gunnar, and Laird, 1998).

LIST OF REFERENCES

Acevedo-Garcia, D., Osypuk, T. L., Werbel, R. E., Meara, E. R., Cutler, D. M., & Berkman, L. F. (2004). Does housing mobility policy improve health? *Housing Policy Debate, 15*(1), 49-98.

Adam, E. K., & Gunnar, M. R. (2001). Relationship functioning and home and work demands predict individual differences in diurnal cortisol patterns in women. *Psychoneuroendocrinology, 26*, 189-208.

Adler, N., & Ostrove, J. (1999). Socioeconomic status and health: What we know and what we don't. *Annals New York Academy of Sciences, 896*, 3-15.

Alvidrez, J., & Azocar, F. (1999). Distressed women's clinic patients: Preferences for mental health treatments and perceived obstacles. *General Hospital Psychiatry, 21*, 340-347.

Aneshensel, C. S., & Sucoff, C. A. (1996). The neighborhood context of adolescent mental health. *Journal of Health and Social Behavior, 37*(4), 293-310.

Arber, S. (1997). Comparing inequalities in women's and men's health: Britain in the 1990s. *Social Science & Medicine, 44*(6), 773-787.

Artazcoz, L. L., Borrell, C., Benach, J., Cortes, I., & Rohlfs, I. (2004). Women, family demands and health: The importance of employment status and socio-economic position. *Social Science & Medicine, 59*(2), 263-274.

Bahr, N. I., Pryce, C. R., Dobeli, M., & Martin, R. D. (1998). Evidence form urinary cortisol that maternal behavior is related to stress in gorillas. *Physiology and Behavior, 64*(4), 429-437.

Bashir, S. A. (2002). Home is where the harm is: Inadequate housing as a public health crisis. *American Journal of Public Health, 92*(5), 733-738.

Beauvais, C., & Jenson, J. (2002). *Social cohesion: Updating the state of the research.* Ottawa: Canadian Policy Research Networks.

Beebee-Dimmer, J., Lynch, J. W., Turrell, G., Lustgarten, S., Raghunathan, T., & Kaplan, G. A. (2004). Childhood and adult socioeconomic conditions and 31 year mortality risk in women. *American Journal of Epidemiology, 159*(5), 481-490.

Behera, S. K., Winkleby, M. A., & Collins, R. (2001). Low awareness of cardiovascular disease risk among low-income African American women. *American Journal of Health Promotion, 14*(5), 301-305.

Berkman, L. F., & Kawachi, I. (eds.). (2000). *Social epidemiology*. New York: Oxford University Press.

Bjorntorp, P., Holm, G., & Rosmond, R. (1999). Hypothalamic arousal, insulin resistance and type 2 diabetes mellitus. *Diabetic Medicine, 16*, 373-383.

Boardman, J. D., Finch, B. K., Ellison, C. G., Williams, D. R., & Jackson, J. S. (2001). Neighborhood disadvantage, stress, and drug use among adults. *Journal of Health and Social Behavior, 42*, 151-165.

Boardman, J. D. (2004). Stress and physical health: The role of neighborhoods as mediating and moderating mechanisms. *Social Science and Medicine, 58*, 2473-2483

Bosma, J., Dike van de Mheen, H., Borsboom, G. J., & Mackenbach, J. P. (2001). Neighborhood socioeconomic status and all-cause mortality. *American Journal of Epidemiology, 153*(4), 363-371.

Brunner, E. J. (2000). Toward a new social biology. In L. F. Berkman & I. Kawachi (Eds.), *Social epidemiology* (pp. 306-331). Oxford: Oxford University Press, Inc.

Buka, S. L., Brennan, R. T., Rich-Edwards, J. W., & Raudenbush, S. W. (2003). Neighborhood support and the birthweight of urban infants. *American Journal of Epidemiology, 157*(1), 1-8.

Burke, H. M., Fernald, L. C., Gertler, P. J., & Adler, N. E. (2005). Depressive symptoms are associated with blunted cortisol stress responses in very-low income women. *Psychosomatic Medicine, 67*, 211-216.

Buron, L., Popkin, S., Levy, D., Harris, L., & Khadduri, J. (2002). The Hope VI resident tracking study: A snapshot of the current living situation of original residents from eight sites. Retrieved June 2006 from http://www.urban.org/UploadedPDF/410591_HOPEVI_ResTrack.pdf

Campeau, S., Day, H. E., Helmreich, D. L., Kollack-Walker, S., & Watson, S. J. (1998). Principles of psychoneuroendocrinology. *The Psychiatric Clinics of North America, 21*(2), 259-276.

Cattell, V. (2001). Poor people, poor places, and poor health: The mediating role of social networks and social capital. *Social Science & Medicine, 52*, 1501-1516.

Centers for Disease Control. (2000). Socioeconomic status of women with diabetes: United states 2000. *Morbidity and Mortality Weekly Report, 51*(107), 147-148.

Chatterjee, S., Hadi, A. S., & Price, B. (2000). *Regression analysis by example* (3rd ed.). New York: John Wiley & Sons, Inc.

Chen, X., Ender, P. B., Mitchell, M., & Wells, C. (2005). Regression with stata: UCLA Academic Technology Services

Cohen, S., Doyle, W. J., & Baum, A. (2006). Socioeconomic status is associated with stress hormones. *Psychosomatic Medicine, 68*, 414-420.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *journal of Health and Social Behavior, 24*(4), 385-396.

Cohen, S., Mermelstein, E., Kamarck, T., & Hoberman, H. M. (1985). *Measuring the functional components of social support*. The Hague, Holland: Martinus Nijhoff.

Cooper, H. (2002). Investigating socio-economic explanations for gender and ethnic inequalities in health. *Social Science & Medicine, 54*, 693-706.

Dalaker, J. (2001). *Poverty in the united states* (No. Series P60-214). Washington, D. C.: U. S. Government Printing Office.

Devine, D. J., Gray, R. W., Rubin, L., & Taghavi, L. B. (2003). Housing choice voucher location patterns: Implications for participants and neighborhood welfare. Retrieved May 2006, from http://www.novoco.com/Research_Center/Location_Paper.pdf

Diez-Roux, A. V. (2000). Multilevel analysis in public health research. *Annual Reviews in Public Health, 21*, 171-192.

Diez Roux, A. V. (2003). The examination of neighborhood effects on health: Conceptual and methodological issues related to the presence of multiple levels of organization. In I. Kawachi & L. F. Berkman (Eds.), *Neighborhoods and health* (pp. 45-64). Oxford: Oxford University Press.

Diez Roux, A. V., Merkin, S. S., Arnett, D., Chambless, L., Massing, M., Nieto, J., et al. (2001). Neighborhood of residence and incidence of coronary heart disease. *New England Journal of Medicine, 345*(2), 99-106.

Drevdahl, D., Kneipp, S., Canales, M. K., & Dorcy, K. S. (2001). Reinvesting in social justice: A capital idea for public health nursing? *Advances in Nursing Science, 24*(9), 19-31.

Dunn, J. R. (2000). Housing and health inequalities: Review and prospects for research. *Housing Studies, 15*(3), 341-366.

Edin, K., & Lein, L. (1997). *Making ends meet: How single mothers survive welfare and low-wage work*. New York: Russell Sage Foundation.

Ellaway, A., Macintyre, S., & Kearns, A. (2001). Perceptions of place and health in socially contrasting neighborhoods. *Urban Studies, 38*(12), 2299-2316.

Elliot, M. (2000). The stress process in neighborhood context. *Health and Place, 6*, 287-299.

Employment Support Institute. (2006). Tenant-based and project-based vouchers and certificates overview. Retrieved May 2006, from http://www.workworld.org/wwwebhelp/tenant_based_project_based_vouchers_certificates.htm

Ewart, C. K. (2002). Discovering how urban poverty and violence affect health: Development and validation of a neighborhood stress index. *Health Psychology, 31*(3), 254-262.

Fauth, R. C., Leventhal, T., & Brooks-Gunn, J. (2004). Short-term effects of moving from public housing in poor to middle-class neighborhoods on low-income, minority adults' outcomes. *Social Science and Medicine, 59*, 2271-2284.

Feinstein, J. S. (1993). The relationship between socioeconomic status and health: A review of the literature. *The Milbank Quarterly, 71*(2), 279-322.

Feldman, P. J., & Steptoe, A. (2004). How neighborhoods and physical functioning are related: The roles of neighborhood socioeconomic status, perceived neighborhood strain, and individual health risk factors. *Annals of Behavioral Medicine, 27*(2), 92-99.

Fleury, J., Keller, C., & Murdaugh, C. (2000). Social and contextual etiology of coronary heart disease in women. *Journal of Women's Health & Gender-Based Medicine, 9*(9), 967-978.

Forrest, R., & Kearns, A. (2001). Social cohesion, social capital and the neighborhood. *Urban Studies, 38*(12), 2125-2143.

Fox-Wasylyshyn, S., & El-Masri, M. M. (2005). Handling missing data in self-report measures. *Research in Nursing & Health, 28*, 488-495.

Galster, G. (2001). On the nature of neighborhood. *Urban Studies, 38*(12), 2111-2124.

Gelsema, A. J., Schoemaker, R. G., Ruzicka, M., & Copeland, N. E. (1994). Cardiovascular effects of social stress in borderline hypertensive rates. *Journal of Hypertension, 12*(9), 1019-1029.

Ghisletta, P., & Spini, D. (2004). An introduction to generalized estimating equations and an application to assess selectivity effects in a longitudinal study on very old individuals. *journal of Educational and Behavioral Studies, 29*(4), 421-437.

Green, R. K., & Malpezzi, S. (2003). *A primer on u. S. Housing markets and housing policy*. Washington, DC: The Urban Institute Press.

Grossi, G., Perski, A., Ekstedt, M., Johansson, T., Lindstrom, M., & Holm, K. (2005). The morning salivary cortisol response in burnout. *Journal of Psychosomatic Research, 59*(2), 103-111.

Guyll, M., Matthews, A., & Bromberger, J. T. (2001). Discrimination and unfair treatment: Relationship to cardiovascular reactivity among African American and European American women. *Health Psychology, 5*(315-325).

Hamilton, L. C. (2006). *Statistics with stata*. Duxbury: Thomson Brooks/Cole.

Hays, R. A. (1995). *The federal government and urban housing: Ideology and change in public policy* (2nd ed.). Albany: State University of New York Press.

Henderson, C., Diez Roux, A. V., Jacobs Jr., D. R., Kieffe, C. I., West, D., & Williams, D. R. (2005). Neighborhood characteristics, individual level socioeconomic factors, and depressive symptoms in young adults: The CARDIA study. *Journal of Epidemiology and Community Health, 59*, 322-328.

Hennig, J., Friebe, J., Ryl, I., Kramer, b., Bottcher, J., & Netter, P. (2000). Upright posture influences salivary cortisol. *Psychoneuroendocrinology, 25*, 69-83.

Hill, T. D., Ross, C. E., & Angel, R. J. (2005). Neighborhood disorder, psychophysiological distress and health. *Journal of Health and Social Behavior, 46*, 170-186.

Immuno-Biological Laboratories. (2004). Saliva diagnostics. Retrieved April 2006, from http://www.biovit.hr/ibl/saliva/intro_e.pdf

Institute for Research on Poverty. (2005). Who was poor in 2004? Retrieved April 2006, from http://www.irp.wisc.edu/faqs/faq3.htm

Joint Center for Housing Studies of Harvard University. (2004). The state of the nation's housing. Retrieved January 2005, from http://www.jchs.harvard.edu/publications/markets/son2004.pdf

Julius, S., & Nesbitt, S. (1996). Sympathetic overactivity in hypertension: A moving target. *American Journal of Hypertension, 9*, 113S-120S.

Kacsoh, B. (2000). *Endocrine physiology*. New York: McGraw-Hill.

Kalin, N. H., & Carnes, M. (1984). Biological correlates of attachment bond disruption in humans and nonhuman primates. *Progressive Neuropsychopharmacology and Biological Psychiatry, 8*(3), 459-469.

Kaplan, J. R., Manuck, S. B., Clarkson, T. B., Lusso, F. M., & Taub, D. M. (1982). Social status, environment, and atherosclerosis in cynomolgus monkeys. *Arteriosclerosis, 2*(5), 359-368.

Kapuku, G. K., Treiber, F. A., & Davis, H. C. (2002). Relationships among socioeconomic status, stress induced changes in cortisol, and blood pressure in African American males. *Annals of Behavioral Medicine, 24*(4), 320-325.

Kawachi, I., & Berkman, L. F. (2000). Social cohesion, social capital and health. In I. Kawachi & L. F. Berkman (Eds.), *Social epidemiology* (pp. 174-190). Oxford: Oxford University Press.

Kawachi, I., Kennedy, B. P., & Glass, R. (1999). Social capital and self-rated health: A contextual analysis. *American Journal of Public Health, 89*(8), 1187-1193.

Kawachi, I., Kennedy, B. P., Gupta, V., & Prothrow-Stith, D. (1999). Women's status and the health of women and men: A view from the states. *Social Science and Medicine, 48*, 21-32.

Kawachi, I., Kennedy, B. P., & Prothrow-Stith, D. (1997). Social capital, income equality, and mortality. *American Journal of Public Health, 37*, 1491-1498.

Kearns, A., & Parkinson, M. (2001). The significance of neighbourhood. *Urban Studies, 38*(12), 2103-2110.

Kington, R. S., & Smith, J. P. (1997). Socioeconomic status and racial and ethnic differences in functional status associated with chronic diseases. *American Journal of Public Health, 87*(5), 805-811.

Kirschbaum, C., & Hellhammer, D. H. (1992). Methodological aspects of salivary cortisol measurement. In C. Kirschbaum, G. F. Read & D. Hellhammer (Eds.), *Assessment of hormones and drugs in saliva in biobehavioral research* (pp. 19-32). Seattle: Hogrefe & Huber Publishers.

Kirschbaum, C., & Hellhammer, D. H. (1994). Salivary cortisol in psychoneuroendocrine research: Recent developments and applications. *Psychoneuroendocrinology, 19*(4), 313-333.

Kirschbaum, C., Read, F. G., & Hellhammer, D. H. (Eds.). (1992). *Assessment of hormones and drugs in saliva in biobehavioral research*. Seattle: Hogrefe and Huber Publishers.

Kirschenman, J., & Neckerman, K. (1991). We'd love to hire them but...The meaning of race for employers. In C. Jencks & P. Peterson (Eds.), *The urban underclass* (pp. 203-232). New York: Brookings.

Kneipp, S., & Drevdahl, D. (2003). Problems with parsimony in research on the socioeconomic determinants of health. *Advances in Nursing Science, 26*(3), 162-172.

Kneipp, S. M., & McIntosh, M. (2001). Handling missing data in nursing research with multiple imputation. *Nursing Research, 50*(6), 384-389.

Krieger, N., & Davey-Smith, G. (2004). "Bodies count," And body counts: Social epidemiology and embodying inequality. *Epidemiologic Reviews, 26*, 92-103.

Krieger, N., Zierler, S., Hogan, J. W., Waterman, P., Chen, J., Lemieux, K., et al. (2003). Geocoding and measurement of neighborhood socioeconomic position: A u. S. Perspective. In I. Kawachi & L. F. Berkman (Eds.), *Neighborhoods and health* (pp. 147-178). Oxford: Oxford University Press.

Latkin, C. A., & Curry, A. D. (2003). Stressful neighborhoods and depression: A prospective study of the impact of neighborhood disorder. *Journal of Health and Social Behavior, 44*, 34-44.

Leproult, R., Copinschi, G., Buxton, O., & Van Cauter, E. (1997). Sleep loss results in an elevation of cortisol levels the next evening. *Sleep, 20*(10), 865-870.

Leventhal, T., & Brooks-Gunn, J. (2003). Moving to opportunity: An experimental study of neighborhood effects on mental health. *American Journal of Public Health, 93*(9), 1576-1582.

Linden, W., Rutledge, T., & Con, A. (1998). A case for the usefulness of laboratory social stressors. Annals of behavioral medicine. *Annals of Behavioral Medicine, 20*(4), 310-316.

Lovallo, W. R., & Thomas, T. L. (2000). Stress hormones in psychophysiological research: Emotional, behavioral, and cognitive implications. In J. T. Cacioppo, L. G. Tassinary & G. G. Berntson (Eds.), *Handbook of psychophysiology* (2nd ed., pp. 342-350). Cambridge: Cambridge University Press.

Lundberg, U. F., M. (1999). Stress and workload of men and women in high-ranking positions. *Journal of Occupational Health Psychology, 4*(2), 142-151.

Lundy, K., & Janes, S. (2001). *Community health nursing: Caring for the public's health.* Boston: James & Bartlett Publishers.

Lynch, J. K., G.,. (2000). Socioeconomic position. In L. F. K. Berkman, I., (eds.) (Ed.), *Social epidemiology* (pp. 391). New York: Oxford University Press.

Lyon, B. L. (2000). Stress, coping and health. In V. H. Rice (Ed.), *Handbook of stress, coping, and health: Implications for nursing research, theory, and practice* (pp. 3-23). Thousand Oaks: Sage Publications, Inc.

Macintyre, S., Ellaway, A., & Cummins, S. (2002). Place effects on health: How can we conceptualise, operationalise and measure them? *Social Science & Medicine, 55*, 125-139.

Macran, S., Clarke, L., & Joshi, H. (1996). Women's health: Dimensions and differentials. *Social Science & Medicine, 42*(9), 1203-1216.

Marco, C. A., Schwartz, J. E., Neale, J. M., Shiffman, S., & Cately, D. A.,. (2000). Impact of gender and having children in the household on ambulatory blood pressure in work and nonwork settings: A partial replication and new findings. *Annals of Behavioral Medicine, 22*(2), 110-115.

Marmot, M. (2003). Understanding social inequalities in health. *Perspectives in Biology and Medicine, 46*, S9-S23.

Marmot, M. (2004). The stress and health study: Also known as the Whitehall II study. Retrieved June 2004, from http://www.ucl.ac.uk/epidemiology/white/w2homepage.htm

Marmot, M., & McDowall, M. (1986). Mortality decline and widening social inequalities. *Lancet, 2*(8501), 274-276.

Marmot, M., Shipley, M. J., & Rose, G. (1984). Inequalities in death: Specific explanations of a general pattern? *Lancet, 1*, 1003-1006.

Marmot, M., Smith, G. D., Stansfeld, S. A., Patel, C., North, F., Head, J., et al. (1991). Health inequalities among British civil servants: The Whitehall II study. *Lancet, 337*, 1387-1393.

Marmot, M., & Wilkinson, R. G. (Eds.). (1999). *Social determinants of health*. Oxford: Oxford University Press.

Marmot, M. G., Bosma, J., Hemingway, H., Brunner, E., & Stansfeld, S. (1997). Contributions of job control and other risk factors to social variations in coronary heart disease incidence. *Lancet, 350*, 235-239.

Marsh, A., Gordon, D., Heslop, P., & Pantazis, C. (2000). Housing deprivation and health: A longitudinal analysis. *Housing Studies, 15*(4), 411-428.

Martikainen, P., Lahelma, E., Marmot, M., Sekine, M., Nishi, N., & Kagamimori, S. (2004). A comparison of socioeconomic differences in physical functioning and perceived health among male and female employees in Britain, Finland and Japan. *Social Science & Medicine, 59*(6), 1287-1295.

McAllister, L. E., & Boyle, J. S. (1998). Without money, means, or men: African American women receiving prenatal care in a housing project. *Family and Community Health, 21*(3), 67-74.

McCance, L., & Huether, S. (1998). *Pathophysiology: The basis for disease in adults and children* (3 ed.). St. Louis: Mosby.

McDonough, P., Walters, V., & Strohschein, L. (2002). Chronic stress and the social patterning of women's health in Canada. *Social Science & Medicine, 54*(5), 767-782.

McDowell, I., & Newell, C. (1996). *Measuring health: A guide to rating scales and questionnaires* (2nd ed.). New York: Oxford University Press.

McEwen, B. (1998). Protective and damaging effects of stress mediators. *The New England Journal of Medicine, 338*(3), 171-179.

McEwen, B. (1999). Stress, adaptation, and disease. *Annals New York Academy of Sciences, 893*, 33-44.

McEwen, B. (2000). The neurobiology of stress: From serendipity to clinical relevance. *Brain Research, 886*, 172-189.

McEwen, B. S. (2005). Stressed or stressed out: What is the difference? *Journal of Psychiatry and Neuroscience, 30*(5), 315-318.

Merlo, J., Chaix, B., Yang, M., Lynch, J., & Rastam, L. (2005). A brief conceptual tutorial of multilevel analysis in social epidemiology: Linking the statistical concept of clustering to the idea of contextual phenomenon. *Journal of Epidemiology and Community Health, 59*, 443-449.

Musil, C. M., Warner, C. B., Yobas, P. K., & Jones, S. L. (2002). A comparison of imputation techniques for handling missing data. *Western Journal of Nursing Research, 24*(7), 815-829.

Newman, S. J., & Schnare, A. B. (1997). ...And a suitable living environment: The failure of housing programs to deliver on neighborhood quality. *Housing Policy Debate, 8*(4), 703-741.

Nicolas, G., & JeanBaptiste, V. (2001). Experiences of women on public assistance. *Journal of Social Issues, 57*(2), 299-309.

Northridge, M. E., Sclar, E. D., & Biswas, P. (2003). Sorting out the connections between the built environment and health: A conceptual framework for navigating pathways and planning healthy cities. *Journal of Urban Health: Bulletin of the New York Academy of Medicine, 80*(4), 556-568.

O'Campo, P. (2003). Invited commentary: Advancing theory and methods for multilevel models of residential neighborhoods and health. *American Journal of Epidemiology, 157*(1), 9-13.

Odber, J., Cawood, E. H., & Bancroft, J. (1998). Salivary cortisol in women with and without perimenstrual mood changes. *Journal of Psychosomatic Research, 45*(6), 557-568.

Orlebeke, C. J. (2000). The evolution of low-income housing policy, 1949 to 1999. *Housing Policy Debate, 11*(2), 489-520.

Patrician, A. (2002). Multiple imputation for missing data. *Research in Nursing & Health, 25*(1), 76-84.

Pearl, M., Braveman, P., & Abrams, B. (2001). The relationship of neighborhood socioeconomic characteristics to birthweight among 5 ethnic groups in California. *American Journal of Public Health, 91*(11), 1808-1814.

Pendall, R. (2000). Why voucher and certificate users live in distressed neighborhoods. *Housing Policy Debate, 11*(4), 881-910.

Plat, L., Leproult, R., L'Hermite-Baleriaux, M., Fery, F., Mockel, J., Polonsky, K., et al. (1999). Metabolic effects of short-term elevations of plasma cortisol are more pronounced in the evening than in the morning. *The Journal of Clinical Endocrinology & Metabolism, 84*, 3082-3092.

Polit, D. F. (1996). *Data analysis and statistics for nursing research*. Stamford: Appleton & Lange.

Polk, D. E., Cohen, S., Doyle, W. J., Skoner, D. P., & Kirschbaum, C. (2005). State and trait affect as predictors of salivary cortisol in health adults. *Psychoneuroendocrinology, 30*, 261-272.

Popkin, S. J., Levy, D. K., Harris, L. E., Comey, J., Cunningham, M. K., Buron, L., et al. (2002). Hope VI panel study: Baseline report. Retrieved May 2004, from http://www.urban.org/UploadedPDF/410590_HOPEVI_PanelStudy.pdf

Pressner, J. C., Kirschbaum, C., Meinlschmid, G., & Hellhammer, D. H. (2003). Two formulas for computation of the area under the curve represent measures of total hormone concentration versus time-dependent change. *Psychoneuroendocrinology, 28*, 916-931.

The Public Health Disparities Geocoding Project. (2004). Geocoding and monitoring us socioeconomic inequalities in health: An introduction to using area-based socioeconomic measures. *The Public Health Disparities Geocoding Project* Retrieved July 2004, from http://www.hsph.harvard.edu/thegeocodingproject/webpage/monograph/geocoding.htm

Raber, J. (1998). Detrimental effects of chronic hypothalamic-pituitary-adrenal axis activation. From obesity to memory deficits. *Molecular Neurobiology, 18*(1), 1-22.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks: Sage Publications.

Ridner, S. H. (2004). Psychological distress: Concept analysis. *Journal of Advanced Nursing, 45*(5), 536-545.

Robert, S. A. (1998). Community-level socioeconomic status effects on adult health. *Journal of Health and Social Behavior, 39*, 18-37.

Rollins, J. J., Saris, R. N., & Johnston-Robledo, I. (2001). Low-income women speak out about housing: A high stakes game of musical chairs. *Journal of Social Issues, 57*(2), 277-298.

Rosmond, R., & Bjorntorp, P. (2000). The hypothalamic-pituitary-adrenal axis activity as a predictor of cardiovascular disease, type 2 diabetes and stroke. *Journal of Internal Medicine, 247*, 188-197.

Ross, C. E., & Jang, S. J. (2000). Neighborhood disorder, fear, and mistrust: The buffering role of social ties with neighbors. *American Journal of Community Psychiatry, 28*(4), 401-420.

Ross, C. E., & Mirowsky, J. (1999). Disorder and decay: The concept and measurement of perceived neighborhood disorder. *Urban Affairs, 34*(3), 412-432.

Ross, C. E., & Mirowsky, J. (2001). Neighborhood disadvantage, disorder and health. *Journal of Health and Social Behavior, 42*, 258-276.

Ross, C. E., Reynolds, J. R., & Geis, K. J. (2000). The contingent meaning of neighborhood stability for resident's psychological well-being. *American Sociological Review, 65*, 581-597.

Ross, C. E., & Mirowsky, J. (2001). Neighborhood disadvantage, disorder and health. *Journal of Health and Social Behavior, 42*, 258-276.

Roy, M. P., Kerschbaum, C., & Steptoe, A. (2001). Psychological, cardiovascular, and metabolic correlates of individual differences in cortisol stress recovery in young men. *Psychoneuroendocrinology, 26*, 375-391.

Salimetrics. (2005, January 03, 2006). Expanded range high sensitivity salivary cortisol enzyme immunoassay kit. Retrieved April 2006, from http://www.salimetrics.com/ercortisolkitinsert.htm

Sampson, R. J., Morenoff, J. D., & Gannon-Rowley, T. (2002). Assessing "Neighborhood effects": Social processes and new directions in research. *Annual Reviews of Sociology, 28*, 443-478.

Sampson, R. J., & Raudenbush, S. W. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science, 277*(5328), 918-922.

Sapolsky, R. M. (1989). Hypercortisolism among socially subordinate wild baboons originates at the CNS level. *Archives of General Psychiatry, 46*(11), 1047-1051.

Sapolsky, R. M., & Mott, G. E. (1987). Social subordinance in wild baboons is associated with suppressed high density lipoprotein-cholesterol concentrations: The possible role of chronic stress. *Endocrinology, 121*, 1605-1610.

The Sarstedt Group. (2003). Salivette® A standardized method for the collection of saliva Retrieved June 2006, from http://www.sarstedt.com/php/main.php?newlanguage=en

Schlotz, W., & Schulz, P. (2004). *The short version of the Trier inventory for the assessment of chronic stress (tic-s): Abstract with questionnaire and scale description*. Johanniterufer, Germany: University of Trier.

Schulz, A., Parker, E., Israel, B., & Fisher, T. (2001). Social context, stressors and disparities in women's health. *Journal of the American Medical Women's Association, 56*, 143-149.

Schulz, A., Williams, D., Israel, B., Becker, A., Parker, E., Sherman, A. J., et al. (2000). Unfair treatment, neighborhood effects, and mental health in the Detroit metropolitan area. J*ournal of Health and Social Behavior, 41*, 314-332.

Schulz, A. J., Israel, B. A., Zenk, S. N., Parker, E. A., Lichtenstein, R., Shellman-Weir, S., et al. (2006). Psychosocial stress and social support as mediators of relationships between income, length of residence and depressive symptoms among African American women on Detroit's eastside. *Social Science & Medicine, 62*, 510-522.

Schwartz, E. B., Granger, D. A., Susman, E. J., Gunnar, M. R., & Laird, B. (1998). Assessing salivary cortisol in studies of child development. *Child Development, 69*, 1503-1513.

Seeman, T. E., & McEwen, B. S. (1996). Impact of social environment characteristics on neuroendocrine regulation. *Psychosomatic Medicine, 58*, 459-471.

Seeman, T. E., Singer, B. H., Rowe, J. W., Horwitz, R. I., & McEwen, B. (1997). Price of adaptation--allostatic load and its health consequences. *Archives of Internal Medicine, 157*(2259-2267).

Singh, G. H., & Siahpush, M. (2002). Increasing inequalities in all-cause and cardiovascular mortality among U.S. Adults aged 25-64 years by socioeconomic status, 1969-1998. *International Journal of Epidemiology, 31*, 600-613.

Smith, C. A., Smith, C. J., Kearns, R. A., & Abbot, M. W. (1993). Housing stressors, social support and psychological distress. *Social Science & Medicine, 37*(5), 603-612.

Smith, G. D., Wentworth, D., D., N. J., Stamler, R., & Stamler, J. (1996). Socioeconomic differentials in mortality risk among men screened for the multiple risk factor intervention trial: Ii: Black men. *American Journal of Public Health, 86*(4), 497-503.

Smyth, J. M., Margit, C., Ockenfels, A. A., Gorin, D. C., Porter, L. C., Kerschbaum, D., et al. (1997). Individual differences in the diurnal cycle of cortisol. *Psychoneuroendocrinology, 22*(2), 89-105.

Spiegel, K., Leproult, R., & Van Cauter, E. (1999). Impact of sleep dept on metabolic and endocrine function. *The Lancet, 354*, 1435-1439.

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *State-trait anxiety inventory for adults - form y: Manual, test and scoring key review set*. Redwood: Mind Garden, Inc.

Stafford, M., Bartley, M., Mitchell, R., & Marmot, M. (2001). Characteristics of individuals and characteristics of areas: Investigating their influence on health in the Whitehall II study. *Health & Place, 7*, 117-129.

Steptoe, A., & Feldman, P. J. (2001). Neighborhood problems as sources of chronic stress: Development of a measure of neighborhood problems and associations with socioeconomic status and health. *Annals of Behavioral Medicine, 23*(3), 177-185.

Steptoe, A., Lundwall, K., & Cropley, M. (2000). Gender, family structure and cardiovascular activity during the working day and evening. *Social Science and Medicine, 50*, 531-539.

Steptoe, A., & Marmot, M. (2002). The role of psychobiological pathways in socio-economic inequalities in cardiovascular disease risk. *European Heart Journal, 23*, 13-15.

Stewart, J., & Seeman, T. (2000). Salivary cortisol measurement. *John D. and Catherine T. MacArthur Research Network on Socioeconomic Status and Health* Retrieved October 2004, from http://www.macses.ucsf.edu/Research/Allostatic/notebook/salivarycort.html#Samples

Sundquist, J., Malmstrom, M., & Johansson, S. (1999). Cardiovascular risk factors and the neighbourhood environment: A multilevel analysis. *International Journal of Epidemiology, 28*, 841-845.

Takai, N., Yamaguchi, M., Aragaki, T., Eto, K., Uchihashi, K., & Nishikawa, Y. (2004). Effect of psychological stress on the salivary cortisol and amylase levels in healthy young adults. *Archives of Oral Biology, 49*, 963-968.

Taylor, S. E., Repetti, R. L., & Seeman, T. E. (1999). What is an unhealthy environment and how does is get under the skin? In Kawachi I., Kennedy B. P. & W. R. G. (Eds.), *The society and population health reader: Income inequality and health.* (pp. 351-378). New York: The New Press.

Trekson, M., & Pelletiere, D. (2004). America's neighbors: The affordable housing crisis and the people it affects. Retrieved January 2004, from http://www.nlihc.org/research/lalihd/neighbors.pdf

Turner, R. J., & Avison, W. R. (2003). Status variations in stress exposure: Implications for the interpretation of research on race, socioeconomic status and gender. *journal of Health and Social Behavior, 44* (December), 488-505.

Turner, M. A., Popkin, S., & Cunningham, M. (1999). *Section 8 mobility and neighborhood health: Emerging issues and policy challenges.* Paper presented at the Section 8 Mobility and Neighborhood Health, Washington DC.

Turner, M. A. (2003). Strengths and weaknesses of the housing voucher program. Retrieved July 2004, from http://www.urban.org/urlprint.cfm=?ID=8450

Turner, R. J., & Avison, W. R. (2003). Status variations in stress exposure: Implications for the interpretation of research on race, socioeconomic status and gender. *journal of Health and Social Behavior, 44*(December), 488-505.

U. S. Census Bureau. (2005, August 30). Income stable, poverty rate increases, percentage of Americans without health insurance unchanged. Retrieved April 2006, from http://www.census.gov/Press-Release/www/releases/archives/income_wealth/005647.html

U. S. Department of Health and Human Services. (2005). Healthy people 2010. Retrieved April 2006, from http://www.healthypeople.gov/About/

U. S. Department of Health and Human Services. (2006). The 2006 HHS poverty guidelines. Retrieved May 2006, from http://aspe.hhs.gove/poverty/06poverty.shtml

U. S. Department of Housing and Urban Development. (1998). A picture of subsidized households: U. S. Retrieved May 2006, from http://www.huduser.org/datasets/assthsg/statedata98/index.html

U. S. Department of Housing and Urban Development. (2002). HUD's public housing program. Retrieved July 2002, from http://www.hud.gov/renting/phprog.cfm

U. S. Department of Housing and Urban Development. (2003a). Housing choice vouchers fact sheet. Retrieved September 2003, from http://www.hud.gov:80/offices/pih/programs/hcv/about/fact_sheet.cfm

U. S. Department of Housing and Urban Development. (2003b). HUD's public housing program. Retrieved September 2003, from http://www.hud.gov:80/renting/phproj.cfm

U. S. Department of Housing and Urban Development. (2003c). Public housing customer service and satisfaction survey: Scoring methodology. Retrieved October 2004, from http://www.hud.gov/offices/reac/pdf/pih_scoring_process.pdf

U. S. Department of Housing and Urban Development. (2004). Section 8 rental certificate program. Retrieved May 2006, from http://www.hud.gov/progdesc/certifi8.cfm

U. S. Department of Housing and Urban Development. (2004). HUD customer service and satisfaction survey. Retrieved October 2004, from http://www.hud.gov/offices/reac/products/rass/rass_mission.cfm

van Eck, M., Berkhof, H., Nicolson, N., & Sulon, J. (1996). The effects of perceived stress, traits, mood states, and stressful daily events on salivary cortisol. *Psychosomatic Medicine, 58*, 447-458.

Vedhara, K., Miles, J., Bennett, P., Plummer, S., Tallon, D., Brooks, E., et al. (2003). An investigation into the relationship between salivary cortisol, stress anxiety and depression. *Biological Psychology, 62*, 89-96.

Von Hoffman, A. (1996). High ambitions: The past and future of American low-income housing policy. *Housing Policy Debate, 7*(3), 423-446.

Wamala, S. P., Lynch, J., & Kaplan, G. A. (2001). Women's exposure to early and later life socioeconomic disadvantage and coronary heart disease risk: The Stockholm female coronary risk study. *International Journal of Epidemiology, 30*, 275-284.

Ware, J. E., Kosinski, M., & Keller, S. D. (1996). A 12-item short form health survey: Construction of scales and preliminary tests of reliability and validity. *Medical Care, 34*, 220-233.

Ware, J. E., Kosinski, M., Turner-Bowker, D. M., & Gandek, B. (2002). *How to score version 2 of the sf-12 health survey (with a supplement documenting version 1)* Lincoln, RI: Quality Metric Incorporated.

Wasylishyn, C., & Johnson, J. L. (1998). Living in a housing co-operative for low income-women: Issues of identity, environment, and control. *Social Science and Medicine, 47*(7), 973-981.

Wasylyshyn, S. M., & El-Masri, M. M. (2005). Handling missing data in self-report measures. *Research in Nursing & Health, 28*, 488-495.

Weissman, M. M., Sholomskas, D., Pottenger, M., Prussoff, B. A., & Locke, B. Z. (1977). Assess depressive symptoms in five psychiatric populations: A validation study. *American Journal of Epidemiology, 106*(3), 203-214.

Welch, K. (1997). Women's health and low-income housing. *Journal of Nurse Midwifery, 42*(6), 521-526.

Wilkinson, R. G. (1996). *Unhealthy societies: The afflictions of inequality*. London: Routledge.

Wilkinson, R. G. (1997). Comment: Income inequality and social cohesion. *American Journal of Public Health, 87*(9), 1504-1506.

Williams, D. R., & Collins, C. (1995). U.S. Socioeconomic and racial differences in health: Patterns and explanations. *Annual Review of Sociology, 21*, 349-386.

Williams, D. R., Yu, Y., Jackson, J. S., & Anderson, N. B. (1997). Racial differences in physical and mental health: Socio-economic status, stress, and discrimination. *Journal of Health Psychology, 2*, 335-351.

Yudkin, J. S., Kumari, M., Humphries, S. E., & Mohamed-Ali, V. (2000). Inflammation, obesity, stress and coronary heart disease: Is interleukin-6 the link? *Atherosclerosis, 148*, 209-214.

Zarkovic, M., Stefanova, E., Ciric, J., Penezic, Z., Kostic, V., Sumarac-Dumanovic, M., et al. (2003). Prolonged psychological stress suppresses cortisol secretion. *Clinical Endocrinology, 59*, 811-816.

BIOGRAPHICAL SKETCH

Dinah Welch was born in Lumberton, North Carolina. She received her associate's degree in nursing in 1985 from Sandhills Community College. Upon completion of her degree, she worked as a registered nurse in emergency and intensive care settings focusing on cardiovascular nursing practice. She received her Bachelor of Science and Master of Science in Nursing degree in 2002. After completing her master's degree in 2002, Dinah went remained in academia as a doctoral student in nursing. She also enrolled in the Masters of Public Health program focusing on epidemiology. During the course of her doctoral studies, Dinah worked as a research assistant for Dr. Shawn Kneipp, and was awarded a National Institutes of Health, National Institute for Nursing Research Ruth L. Kirschstein Predoctoral Fellowship. Dinah also worked as an adjunct clinical assistant professor working with undergraduate community health nursing students in the clinical setting. She graduated with her master's in public health in May 2006.

During the four years of her doctoral studies, Dinah was mentored by Dr. Shawn Kneipp. As a predoctoral research fellow, research assistant, and adjunct clinical assistant professor, Dinah has had valuable experiences in learning about how neighborhoods and housing impact women's health, grant writing, proposal development, participant recruitment, data management and analysis, presenting at national meetings, and publishing.

Dinah has presented oral and poster presentations at the American Public Health Association's annual meetings since 2003. At the 2005 American Public Health Association meeting, Dinah's poster presentation, "Neighborhood Effects on Psychosocial Well-being in Women," won the first place award for doctoral student community research project in the public health nursing section. She has published a manuscript in the journal *Policy, Politics and Nursing Practice.* Dinah will graduate in August 2006 with her Ph.D. in nursing and minor area in public policy. She plans to continue her work in the field of social epidemiology as a nurse researcher, educator and public health nurse clinician.