THE INFLUENCE OF COMMUNITY SOCIOECONOMIC STATUS ON NORTH CAROLINIANS' HEALTH RELATED QUALITY OF LIFE

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ABSTRACT

KATHRYN REMMES MARTIN: The Influence of Community Socioeconomic Status on North Carolinians' Health Related Quality of Life
(Under the direction of Robert F. DeVellis (Chair), Brenda DeVellis, Michael Yonas, Leigh F. Callahan, & Malcolm P. Cutchin)

Community socioeconomic status (SES) influences the social, service, and physical environments of a community regardless of one's own socioeconomic position, and can in turn positively or negatively affect individual-level health outcomes. This study investigated the influence of community SES on the health related quality of life (HRQOL) of North Carolinians.

Secondary data analyses were conducted on a subset of Social Determinants of Health Study participants (N=1217) residing in 32 North Carolina communities. Community-level data came from two sources: publicly-available data sources for non-aggregated attributes (contextual) and the US Census 2000 for aggregated attributes (compositional). Contextual domains examined were: Shopping/Grocery, Restaurants/Fast-Food, Recreational Facilities, Medical Services, and Transportation; compositional community SES was: % individuals in a community living below poverty. The outcome variable was HRQOL: unhealthy days, physical functioning, and self-rated health. Qualitative methodology including data triangulation and quantitative (multi-level modeling) methods were used for data analysis.

Participants living in communities with public transportation reported fewer unhealthy days (B= -2.796, *p*=.004), better physical functioning (B= 3.215, *p*=.002), and

better self-rated health (B= .244, *p*=.007). Participants living in communities with higher rates of restaurants reported better self-rated health (B= .044, *p*=.007); participants in communities with higher rates of hospital beds reported worse self-rated health (B= -.010, *p*=.038).

Greater community poverty was predictive of participants reporting fewer unhealthy days (B=-.181, *p*=.001), however the relationship strength diminished with the addition of contextual community resources (B=-.147, *p*=.017). Community poverty did not significantly predict physical functioning (B= .027, *p*=.685); yet participants living in communities with public transportation reported higher physical functioning scores (B=3.052, *p*=.006). Community poverty did not significantly predict self-rated health; however participants reported better self-rated health if they lived in communities with public transportation (B=.229, *p*=0.018) and a higher rate of restaurants (B= .041, *p*=0.016), yet greater rate of community hospital beds predicted worse self-rated health (B= -.011, *p*=0.034).

Healthy People 2010 and 2020 goals affirm examining 'lives in context' through multiple perspectives, including a biological, genetic, social and environmental context. Better understanding of community characteristics could have policy implications for resource allocation, city and urban planning, and future health interventions to improve HRQOL.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BMI	Body Mass Index
BRFSS	Behavior and Risk Factor Surveillance System
CDC	Centers for Disease Control
HRQOL	Health Related Quality of Life
HS	High School
LINC	North Carolina Link into North Carolina
MCS	Mental Component Summary
NC	North Carolina
NCHP	North Carolina Health Project
NC-FM-RN	North Carolina Family Medicine Research Network
SES	Socioeconomic Status
SF-12v2	12-Item Short Form Survey Instrument
SIC	Standard Industrial Codes
SODE	Social Determinants of Health
PCS	Physical Component Summary

CHAPTER 1

INTRODUCTION

1.1. Overview

The purpose of the proposed research is to examine community-level socioeconomic status (SES) and its impact on health related quality of life in North Carolinians. It has been shown that health outcomes are associated with the socioeconomic environment of an individual's neighborhood independent of the individual characteristics like socioeconomic status. While research has examined the relationship between community SES and measures of health-related quality of life (HRQOL), most of this research has been conducted using compositional measures (i.e., those based on aggregating individual-level variables) of SES and in urban-sample populations. It is important to close the gap in research so as to better understand the relationship between community SES and health outcomes.

1.2 Dissertation Study Purpose and Aims

The overall goal of this proposed research is to learn more about the influence of compositional community SES and contextual community resources (i.e., those based on characteristics of communities themselves) on health outcomes for North Carolinians. The specific aims are as follows:

Aim 1. To identify contextual dimensions that effectively measure community level resources. Aim 1 will be achieved through data triangulation. Toward achieving this aim, we will examine contextual variables as they have been conceptualized from several

perspectives. First, the literature will be examined to understand how researchers conceptualize, measure, and operationalize neighborhood and community socioeconomic status. In addition, a Center for Disease Control (CDC) expert panel established twelve domains believed to be central to understanding objective contextual community socioeconomic status characteristics (Hillemeier et al., 2003), and will be discussed in-depth later in this paper. Also, qualitative analyses using data from the secondary focus groups of the parent study were conducted. Emerging qualitative findings, in conjunction with current literature and the CDC recommendations, were used to guide the choice of contextual domains of community level resources that may be especially relevant to North Carolinians.

Aim 2. To examine the association between contextual community resources and measures of Health Related Quality of Life (self-rated health, number of unhealthy days, and physical functioning) in adult North Carolinians, controlling for individual-level SES and demographic covariates. For Aim 2, there are three outcome variables: self-rated health and unhealthy days as measures of health related quality of life (HRQOL) and physical health functioning (SF12v2). These HRQOL outcomes were assessed via telephone interview and data are cross-sectional. Multi-level models (general linear mixed models) examined the relationship between contextual community resources and each health outcome, adjusting for individual level SES.

Aim 3. To examine the role that compositional community SES exerts on Health Related Quality of Life outcomes (self-rated health, unhealthy days, and physical functioning), both alone and within the context of contextual community resources. For Aim 3, the relative contributions of compositional SES and of contextual community resources were explored by examining how much additional variance is explained by the inclusion of

contextual community resources in explanatory models. Noting whether the two are of similar or different predictive value for each health outcome of interest is important. Because of the prevalence and ease of using compositional indicators of community SES, including the less readily available contextual indicators warrants empirical justification. Multi-level models (general linear mixed models) examined the relationship between compositional community SES and each health outcome, adjusting for individual-level SES and contextual community resources.

Individual-level data used in this study come from a preexisting project – Social Determinants of Health (N=2479), a sub-study of the North Carolina Health Project. Secondary data analyses were conducted on a subset (N=1217) of participants who reside in 32 North Carolina communities. Community-level data will come from two sources: Dimensions of contextual community-level resources (non-aggregated attributes of a community) were obtained using data from national and regional publicly available data-sources (e.g., ReferenceUSA). The compositional measure of community-level SES (aggregated attributes of the individuals in a community), percent of individuals in a community living below poverty), comes from US Census 2000 data.

CHAPTER 2

LITERATURE REVIEW

2.1 Health Related Quality of Life

Quality of Life is a concept that relates to overall well-being, and a number of factors in one's life can contribute to overall quality of life. Health is just one of those factors. Health Related Quality of Life (HRQOL) is a specific term that refers to the perceived mental and physical health of an individual or group. Health research has used HRQOL to capture, usually subjectively, physical, mental, as well as social functioning and well-being. A number of scales have been developed to assess HRQOL and they include: the Medical Outcomes Study Short Forms SF-12 and SF-36; the Sickness Impact Profile; the Quality of Well-Being Scale. The most commonly used tool is the Centers for Disease Control (CDC) four-core questions (the CDC HRQOL-4) and has been used in national and state-based health surveillance since 1993 (Centers for Disease Control and Prevention, 2000; Moriarty et al., 2005).

While HRQOL is subjective, that is it measures one's perception of health, it has been shown to be a valid indicator of objective health variables. HRQOL can accurately assess population rates of morbidity (chronic and/or infectious) and mortality (specific and all-cause) (Hennessy et al., 1994; Kaplan & Camacho, 1983; Idler & Angel, 1990; Sundquist & Johansson, 1997). Additionally, self-reported health status is strongly predictive of health care utilization (Krakau, 1991; Fylkesnes, 1993). HRQOL can therefore aid researchers and the healthcare field in projecting demand for and allocation of health services, as well as

develop targeted intervention programs and evaluate intervention effects (Hennessy et al., 1994).

Research has shown that HRQOL is influenced by a number of individual characteristics. Findings from the Behavioral Risk Factor Surveillance System, 1993-1997 reveal that women, older adults, and individuals with lower educational attainment and lower levels of annual household report greater number of unhealthy and activity limitation days, and are less likely to respond that they have good-to-excellent health (Centers for Disease Control and Prevention, 2000). These findings are also hold true for minorities (with the exception of Asians and Pacific Islanders) when compared to whites.

In addition to an established relationship between individual-level characteristics and health related quality of life, there is also an established association between community-level variables and health related quality of life. Before discussing this relationship in more depth, it is both necessary and important to highlight the extensive literature that has developed around the role of community on health and health inequalities. This will be accomplished by (a) reviewing how "community" is conceptualized and geographically defined in current health research, (b) creating a working definition of community for this study, (c) discussing the concept of "individual-level socioeconomic status", and finally (d) examining how current literature uses the concept of "community-level socioeconomic status", both compositionally and contextually.

2.2 Conceptualizing Community

The idea that one's environment has an influence on health is not new: the field of public health has a long history of linking community-level factors to patterns of health and

disease (Tyroler & Cassel, 1964; Goldberger et al., 1920; Catalano, 1979a; Catalano, 1979b). Yet recently, there has been a renewed interest in understanding the social determinants of health. Researchers examining these paradigms have conceptualized, defined, and operationalized community in numerous ways (see below) in order to capture key community-level factors, such as the socioeconomic context of communities. Modern methodologies and statistical analysis capabilities have helped researchers to demonstrate that community-level factors (e.g. community SES) influence individual health (e.g. mortality and mental illness) even after adjusting for individual-level variables like age, race, gender (Diez-Roux et al., 2001; Susser, 1994; Schwartz, 1994; Krieger et al., 1993; Robert, 1999) as well as individual SES (Diez-Roux et al., 2001; Diez-Roux et al., 2001; Yen & Kaplan, 1999a; Smith et al., 1998b; Pearl et al., 2001; Hart et al., 1997).

A lack of clear distinctions between neighborhood and community definitions has been noted (Diez Roux, 2001), however the definition of neighborhood appears to be the most consistent throughout the literature, generally considered as a geographic area that is in close proximity to an individual's place of residence (Altschuler et al., 2004). The concept of community varies by discipline, but is generally thought of as a geographic space larger than a neighborhood, encompassing both a geographic and a social area (Johnson & NetLibrary, 2000).

In order to establish how North Carolina community members involved in the Social Determinants of Health study understand and perceive the concepts of *neighborhood* and *community*, formative research (focus groups and semi-structured interviews conducted with study participants, described in detail in the sample and design section) was conducted asking participants to discuss what they think of when they hear the words neighborhood and

community. Many perceived "neighborhood" as being the geographic area close to one's home. "Community" was viewed as a larger geographic area that encompassed where they lived, shopped, and worked, and the people with whom they interacted. These definitions are conceptually similar to how both the general public (2007b) and academes understand neighborhood and community, giving credence to the definition of community as it applies to this research.

2.3 Geographically-Bounding Communities

While it is understood and accepted that neighborhoods and communities have an impact on the health outcomes of individuals, a geographic definition of 'community' varies in the literature, as does definitions of neighborhood. Researchers must decide which geographic level to investigate as they move forward with efforts to understand the relationship between place and health. To date, many studies have used geographic areas such as *census block* (Steenland et al., 2004; Diez-Roux et al., 2001), *census-tract* (Winkleby & Cubbin, 2003; Krieger et al., 2003; Balfour & Kaplan, 2002; Yen & Kaplan, 1999a; McGrath et al., 2006), *city* (Gillcrist et al., 2001; Takano & Nakamura, 2001; Li et al., 2009b; Li et al., 2009a), *county* (Karpati et al., 2002; Darlington et al., 1986), *electoral wards* (Whitfield, 2003; Whynes & Thornton, 2000), *enumeration areas* (Veugelers et al., 2001), *government districts* (Hart et al., 1997), *metropolitan statistical areas* (Lynch et al., 1998; Anderson et al., 1997), *municipality administrative area unit* (Martikainen et al., 2003b; Martikainen et al., 2003a; Bosma et al., 2001), *postal codes* (Feldman & Steptoe, 2004; Smith et al., 1998a), *small-area market statistics* (Malmstrom et al., 1999; Sundquist et al., 2004), and *state* (Lochner et al., 2001). Researchers obtain information for these geographic

areas to represent the concept of 'community SES' and 'neighborhood SES', yet most studies fail to give a rationale for why they have chosen to use a particular geographic area in their study (Hales et al., 2003; Drukker & van Os, 2003; Robert & Reither, 2004; Nordstrom et al., 2004; Giles-Corti & Donovan, 2002; Stafford & Marmot, 2003; Sooman & Macintyre, 1995; Reijneveld, 1998; Davey Smith et al., 1998; Waitzman & Smith, 1998; Inagami et al., 2006; Balfour & Kaplan, 2002; Juhn et al., 2005; Sundquist et al., 1999; Gordon-Larsen et al., 2006; Gillcrist et al., 2001; Petersen et al., 2006; Robert, 1998; Yen & Kaplan, 1999a; Morland et al., 2002b; Diez-Roux et al., 2001; Robert et al., 2004). It must be emphasized that there is a difference in geographically defining community or neighborhood as either encompassing a five hundred yard radius from a residence or as a census tract. Choice of a geographic area may be dependent on the research question, outcome of interest, feasibility, or the social context/history of a given area. Lack of clarity and transparency in this decision has the potential to lead to misinterpretation of findings and/or implications for future interventions, and it has been emphasized that use of theory is needed to justify geographic level and variables so that research findings are correctly interpreted (Kawachi & Berkman, 2003).

2.4 Defining Community for this Proposed Research

For the purposes of this research study, community is viewed as a geographically-defined area in which individuals live, work, shop, carry out the basic activities of life and socially interact within a defined territory. This territory has a geographic identity that is reflected in common place-names and the drawing of geographic boundaries (Johnson & NetLibrary, 2000). This definition comes from the aforementioned formative research and

prior discussions in the literature. Thus, in this study, community is a well-defined, commonly understood geographic area, namely a city, town or village. A three-part rationale for choosing cities, towns and villages is outlined below.

First, the choice to use North Carolina cities as a geographic unit for this study is both practical and feasible. While previous studies have used various geographic areas to define a community (e.g. census tracts, census blocks) it is not feasible to use these in the proposed research. North Carolina has the 11th highest resident population (8,046,579 residents) among the 50 states and occupies 48,843 square miles of land (2007a). There are 100 counties, 1,563 census tracts, 5,271 block groups, and 232,403 census blocks in North Carolina (2007c). A total of 2479 individuals participated in a telephone survey (secondary data source is discussed in the sample and design section) and self-reported their current address. Analyses show that these participants represent over 377 census tracts and while commonly used with aggregate census data, non-aggregated contextual community resource data may not be feasible at a census tract level in North Carolina.

A second reason for our chosen definition of community arises from how "community" has been previously conceptualized. "Community" has been described on the one hand as a combination of a sense of belonging, shared experiences, and interdependency, and on the other, as a "collection of people who share a geographical territory… [such that] geographically based communities involve living, working, and carrying out the basic activities of life within a territory defined by residents as having a geographic identity, most notably reflected in the assigning of place names and the drawing of boundaries" (Johnson & NetLibrary, 2000). Thus cities and towns reflect both the social and spatial components of community. Participants self-identified as residing in or belonging to a particular area when

giving their address during the parent study telephone survey. It is important to note that, while North Carolina has a number of urban areas (e.g. Asheville, Greensboro) there are large portions of the state that are quite rural. In fact, residents may live in an area that is not contained within proper city or town limits but have a physical address that lists the neighboring city or town. Residents may have a working knowledge of city or town boundaries that allow them to feel a part of shared community culture and/or resources that are available to them even though they do not reside inside proper 'city' geographical bounds. Since this study does not aim to examine the perception of community on measures of health related quality of life, nor does it intend to examine the relationship of multiple community spaces (differences between where one works, lives and plays), the use of 'city' or 'town' appears appropriate for this proposed research.

Third, while the use of census areas such as tracts or blocks is the most common in the current literature, it has not been established that these, or any other geographic areas, (e.g. cities, counties, metropolitan statistical areas) are the best way to empirically assign 'community' geographic bounds (Kawachi & Berkman, 2003). Census areas, such as block groups and tracts, were created solely for the purpose of collecting decennial data on US citizens and group together residents in such a way that they are similar in terms of demographics, economic status and living conditions. However, these areas have been adapted for use in research examining the role of neighborhood/community environment on individual health. While not collected specifically for health research, census areas are attractive because they offer large amounts of aggregate data that are easily obtained and can be used to represent community-level characteristics when examining area-level influences on health. Yet, aggregated census data may not "permit the investigator to separate out the

specific dimensions of neighborhoods that matter for health" (Kawachi & Berkman, 2003). This may be due in part to the fact that census tracts and census blocks (see Definition of Terms) often do not follow other municipal boundaries (e.g. city, town, or county limits), and several cities or town may be enclosed in a geographic area defined as a census block. The typical American is unlikely to know to which census area they belong. These boundaries have little to no bearing on allocation of resources or concepts such as community SES that might influence health. In addition, a census tract may reflect an extremely large geographic area in the suburban/rural areas of North Carolina. Therefore, assigning a census tract to represent a 'community' (as defined previously) does not appear to be the most practical solution. At best, these discussion points are not a rationale for cities and towns; rather they are arguments against the use of census-defined areas for this proposed research.

2.5 Individual-Level Socioeconomic Status

Generally speaking, human societies have historically created social systems that organize members into groups according to various characteristics (e.g. physical attributes, economic wealth, material possessions). These groupings often create social inequalities between society members, especially when certain groups have control of societal resources. Modern-day scholars have examined these social processes in relationship to how social inequalities influence health outcomes. An example of one of these groups is social position, and research has found that social position (as measured by concepts such as income, education, and occupation) is a good indicator of an individual's health (Marmot & Wilkinson, 1999; Oakes & Kaufman, 2006; Berkman & Kawachi, 2000; Kawachi &

Berkman, 2003). Terms like social position, social class, socioeconomic position and socioeconomic status are often used in the current literature to represent similar concepts.

2.6 Community-Level Socioeconomic Status

Currently no definition exists for community socioeconomic status, but it is generally thought to consist of similar concepts as individual socioeconomic status, but at a higher level such as community and neighborhood. Great variations exist in how researchers conduct studies using community and neighborhood variables, and even greater variation in the vernacular used to discuss such concepts. To date, researchers have characterized the influence of place on health disparities and health inequalities using terminology, including but not limited these terms: neighborhood (-SES, -disadvantage, -deprivation, -environment, -socioeconomic deprivation, -socioeconomic environment, -impoverishment), community (-SES, -disadvantage, -deprivation), area (-level SES, -deprivation), census-based SES, ecological SES, poverty-area residence, and residential neighborhood disadvantage. A review of these terms used in the literature suggests that 'neighborhood' and 'community' are often used interchangeably, inconsistently defined geographically (often both neighborhood and community defined as 'census tract'), and vary greatly in the number of residents (from 1000-15,000). The choice to use one of these concepts is often driven by the proposed research question, and while a few researchers give some rationale for why they are using one method of conceptualizing 'place' over another (Hales et al., 2003; Spilsbury et al., 2006; Breuer et al., 2005; Franzini et al., 2005), most do not (Drukker & van Os, 2003; Robert & Reither, 2004; Morland et al., 2002b; Nordstrom et al., 2004; Feldman & Steptoe,

2004; Stafford & Marmot, 2003; Bosma et al., 2001; Giles-Corti & Donovan, 2003; Winkleby & Cubbin, 2003; Luo et al., 2006).

2.7 Compositional Community Socioeconomic Characteristics

Area-based socioeconomic measures that are created from large national or regional databases are often compositional in nature, reflecting the characteristics of individuals in a given area. To date, most studies have used area-based socioeconomic measures that consist of aggregated, individual-level data (Diez-Roux et al., 2001; Diez-Roux et al., 1997; Yabroff & Gordis, 2003). These measures are most commonly created out of databases that are easy to obtain, such as a national Census (Spilsbury et al., 2006; Robert & Reither, 2004; Macintyre et al., 1993). Components including, but not limited to, percent living below poverty level, percent individuals living in households that are crowded, percent individuals with educational attainment (< High School; >= 4 years college), percent household receiving public assistance, or percent of adult unemployment are used either as individual variables or combined into an index (StataCorp, 2003; Brown et al., 2007; Breuer et al., 2005; Stafford & Marmot, 2003).

Krieger and colleagues noted that "there exists no consensus or standard as to which area based socioeconomic measures, at which level of geography, are best suited for monitoring US socioeconomic inequalities in health" (Krieger et al., 2003). Findings from the Public Health Disparities Geocoding Project indicate that using census based data (percentage below poverty) at the census tract level was an effective means of public health surveillance for health inequalities in mortality, birth, cancer, tuberculosis, sexually transmitted infections, childhood lead poisoning, and injury due to weapon use (Krieger et

al., 2003). Yet, the use of compositional measures has led researchers to ask: is a compositional method "characterizing a true group-level construct or is it simply an aggregate of individual-level properties?" (Diez Roux, 2004). In general and especially in the absence of individual-level data on the outcome of interest, it becomes increasingly difficult to disentangle which components of the community environment have an impact on individual health (Kawachi & Berkman, 2003).

2.8 Contextual Community Socioeconomic Characteristics

The field of "ecometrics" (Raudenbush & Sampson, 1999) is the study of the measurement properties of ecological settings that acknowledges that ecological constructs need not be solely the aggregate of individual constructs. Indeed, ecometric assessments use rigorous methods to assess neighborhood and community environments. While relatively young, ecometrics is furthering the development of contextual group-level variables so as to better understand how community influences individual health in terms of various health outcomes. Area-based socioeconomic measures that are contextual in nature do not directly reflect the individuals of a given area. Instead, they are a reflection of community characteristics. The contextual nature of community SES has not been studied as extensively as the compositional nature of community SES. This is largely due to the ease with which researchers can access compositional data, namely from the US Census. In fact, no measure or index currently exists for examining the contextual nature of community SES via community resources. However, a few researchers have used specific variables of interest in their studies to examine the influence of objective community resources on health. For example, Gordon-Larsen et al examined the relationship between community SES and

location of physical activity facilities by linking census block-groups with a count of facilities in the area (Gordon-Larsen et al., 2006). The location of food stores and food services was studied by strictly defining type of food store and food place and obtaining physical location addresses and geocoding to respective census tracts (Morland et al., 2002b). In another studies, geospatial modeling and mapping software, Geographic Information System (GIS) is used to objectively map contextual community characteristics and resources. One identified trails, sidewalks, public recreation areas, and areas of crime and to compare against participant perceptions' (Wilson et al., 2004) and another included geocoded businesses and recreational facilities to better understand their relationship to physical activity levels (Breuer et al., 2005).

In 2003, due to the increasing recognition of contextual importance, a group of researchers engaged in a discussion about the measurement of community contextual characteristics. This collaborative effort was put forth by the Centers for Disease Control and Prevention 1) to identify contextual characteristics that could affect patterns of population health and 2) to develop a list of datasets that contain geocoded contextual community characteristics. This project included a workshop with 39 invited consultants, "which included prominent investigators from the United States and around the world with a wide range of disciplines including epidemiology, sociology, geography, medicine, demography, economics, developmental psychology, education and toxicology" (Hillemeier et al., 2003) to discuss the creation of indices measuring community contextual health characteristics. Figure 1 shows the results of this workshop: 12 contextual dimensions related to health status. These twelve domains were further discussed and operationalized by workshop participants, with suggestions for potential data to assess contextual characteristics. Some specific examples of

contextual variables are: number of grocery stores in a given area and public transportation availability. Some of these dimensions of contextual community characteristics will be used and described in more detail when discussed in relationship to the present study in the methodology section.

2.9 Community Socioeconomic Status on Health Related Quality of Life

Prior research has examined the role of community socioeconomic status on health related quality of life in various ways, however it should be noted that studies examining this relationship have been predominantly in urban areas (Yen & Kaplan, 1999b; Reijneveld, 2002; Brown et al., 2007).

Aggregate, compositional measures have been used extensively in research to examine the role of community SES on measures of health related quality of life. Researchers have routinely found that community socioeconomic status independently predicts various measures of health related quality of life, above and beyond individual level factors in American and European cities (Reijneveld, 2002; Stafford & Marmot, 2003; Wainwright & Surtees, 2004; Lopez, 2004; Breeze et al., 2005; Wen et al., 2006; Callahan et al., 2009).

Researchers have conceptualized and measured community, as well as community SES, in differing ways. For example, in a study using a national sample of US adults, community SES (as measured by the census variable "percentage of households receiving public assistance income" obtained at a 'neighborhood-level' - tract, block and enumeration area) was independently predictive of self-rated health above and beyond individual-level and family-level SES (Robert, 1998). Another study used aggregated compositional measures

(e.g. proportion of unemployed, proportion of adults with low education attainment) of census tracts to create 'poverty area residence'. Findings revealed that individuals living in a poverty-area more often reported fair or poor health when compared to those not living in a poverty-area, even after adjusting for individual-level SES and health variables (Yen & Kaplan, 1999b). One Swedish study examined the role of neighborhood deprivation (Care Need Index and the Townsend Index at the level of small-area market statistics). Individuals living in areas of higher deprivation, independent of individual-level SES and lifestyle factors (BMI, smoking, physical activity), were at higher risk for poorer self-reported health (Malmstrom et al., 1999).

The mediating effects of individual-level variables such as housing, lifestyle, and perceived neighborhood environment, as well as social processes like social capital, collective efficacy, social disorder, and racism have been tested in the pathway between neighborhood socioeconomic deprivation/poverty and measures of health-related quality of life. One study found that neighborhood perceptions of social cohesion, as well as individual lifestyle (e.g. health behaviors – smoking, fresh fruit and vegetable consumption) mediated the relationship between neighborhood socioeconomic deprivation and physical and mental health (Drukker & van Os, 2003). Another study found individuals living in more impoverished neighborhoods reported lower levels of social capital, which in turn lowered self-rated health, and that individuals in poorer neighborhoods also reported higher rates of negative neighborhood social processes (social disorder, racism), which in turn lowered self-rated health (Franzini et al., 2005). Researchers have also examined the perception of physical and social neighborhood environment on self-reported health and physical functioning (Sooman & Macintyre, 1995; Feldman & Steptoe, 2004; Wen et al., 2006).

Finally, the relationship between community/neighborhood deprivation and self-rated health has been examined specifically within the context of older individuals and those with chronic conditions. Older adults of lower social class living in areas with greater deprivation had worse quality of life score when compared to older adults of higher social class living areas of less deprivation (Breeze et al., 2005). In addition, living with a chronic conditions was found to be associated with worse self-rated health for individuals living in neighborhoods with greater deprivation when compared to those living in more advantaged areas (Brown et al., 2007).

To date it appears as if only one study has examined neighborhood SES via a focused contextual approach. Researchers from Great Britain "aimed to get behind global measures of deprivation and investigate whether a range of attributes of local and social infrastructure" influenced health related quality of life" (Cummins et al., 2005b). They examined neighborhood (as measured by post code due to data availability) attributes such as physical quality of residential environment (public sector housing vacancy rate, vacant and derelict land), public recreation (e.g. number of swimming pools per 100,000 pop, number of public libraries per 10,000 pop), access to shops (number of multiple owned food stores available in postcode, number of banks per 1,000 pop), and access to private transport (number of cars per 1,000 population). These neighborhood attributes were chosen because they were believed to "meet universal human needs for a healthy life" (Cummins et al., 2005b), and poor physical quality residential environment, left wing political climate, low political engagement, high unemployment, lower access to private transport, and lower transport wealth (e.g., percentage of all cars in area with a high value/prestige insurance groups) were found to be associated with lower self-rated health.

2.10 Summary

The two goals of Healthy People 2010 are to "Increase Quality and Years of Healthy Life" and to "Eliminate Health Disparities" (2000). These objectives are furthered by the four proposed Healthy People 2020 goals, especially the second - which is to "achieve health equity, eliminate health disparities and improve health for all groups" (Krisberg, 2008). The examination of various community resources has the potential to increase the understanding of *community* on North Carolinians' health related quality of life. A deeper understanding of the relationship between place and health might help to shape future interventions targeting community aspects so as to improve the lives of individuals. Additionally, furthering methodology by comparing compositional community SES and contextual community resources may allow researchers to employ a method that is more robust in detecting a community socioeconomic influence on health.

If researchers are aware of appropriate measures to understand the impact of community SES and community resources on health outcomes, then they can more accurately talk about health disparities for given communities. Ultimately, knowledge about community impact on health can help public and private health agencies in guiding interventions and allow for greater awareness of how to reduce health disparities at both a community and a policy level. Defining community in terms of cities and towns allows researchers to capitalize on existing governmental structures by making recommendations to local, state, and federal lawmakers in regard to allocation of resources. While this study aims to examine community SES in relation to HRQOL, the greater findings of this study potentially can impact the lives of individuals and reduce health outcome disparities.

CHAPTER 3

SOCIAL ECOLOGICAL FRAMEWORK

3.1 Overview

The social ecological framework (SEF) recognizes the complex relationship between an individual and the external environment. It posits that health is influenced on many levels, including intra-personal, interpersonal, organizational, community, and policy. Stokols stresses that the health of an individual can be determined not only by the mutual influence of individual factors (biological and behavioral), but the physical and social environment as well (Stokols, 1992).

As a student of health behavior and health education, it is of utmost importance to acknowledge that macro-level forces can influence health behaviors and health outcomes. By incorporating multi-level perspectives into this proposed research, we can begin to examine health outcomes (such as HRQOL and physical functioning) within the larger historical, political, economic and social context.

3.2 Conceptual Framework Discussion

A conceptual framework is shown in Figure 2. As discussed above (in the context of the social ecological framework) health is influenced at multiple levels. Failure to conceptualize the process of how community SES (both contextual and compositional) influences HRQOL without taking into consideration the many influential factors at the individual, interpersonal, and policy levels could potentially oversimplify the complex

relationship between levels. This conceptual framework has not and will not be empirically tested. Instead the goal of this model is to give an overview of the various factors that may work to influence HRQOL and show the relationship through which they are believed to operate (as supported by prior research, the literature, and specific area of investigation).

Briefly, this conceptual model proposes a larger picture of how the various SEF levels might influence health outcomes directly, while also depicting how the macro levels might influence level characteristics which in turn influence HRQOL. For example, certain local, state or federal policies may influence the socioeconomic characteristics of a community (conceptualized both compositionally and contextually), which may then influence the individual and interpersonal levels, particularly influencing the behavior of an individual, and subsequently influence health outcomes such as HRQOL. For the purposes of explaining the proposed conceptual model, one example of public transportation will be used to work through two proposed pathways.

First, macro-level forces at the policy level might directly influence HRQOL. For example, state or local economic development or tax incentives may encourage the formation of or expansion of public transportation in a particular area of a state. Availability of transportation options in a community have the ability to have an effect on HRQOL by directly influencing resident health (e.g., lowering emissions through reduced personal vehicle usage or increasing accesses to areas providing services and resources).

In addition, macro-level forces at the policy level have the ability to influence the domains of community socioeconomic characteristics. For example, public transportation may influence the socioeconomics of a community by introducing new types of jobs/employment opportunity or encourage the relocation of individuals or businesses to an

area. The socioeconomic changes that occur to the community might influence individual educational attainment, income, occupation, homeownership and/or health via co-morbid conditions. Individual characteristics often shape ones social environment. For example, individuals bring to a social network a variety of personal beliefs shaped by one's individual background and experiences (e.g. race, income or educational background). The size and intensity of the social relationships within this group, combined with the proximity and location (worksite/neighborhood) of one's social network can influence health attitudes and beliefs. Perception of community and neighborhood characteristics, various health attitudes and believes may influence whether or not an individual is physically active or engages in risky behaviors (high fat diet or smoking). It follows that HRQOL could then be either negatively or positively influenced by these multiple levels and pathways.

While it is important to observe the pathway through which contextual community resources influence HRQOL, it is important to first establish and understand if contextual community resources have a direct effect on HRQOL. While a direct relationship between compositional community SES and HRQOL has been previously examined in a population of community-dwelling North Carolinians (Callahan et al., 2009), the direct effect of contextual community resources on HRQOL has not. The main pathway that will be examined in this study appears in bold in Figure 2.

Following Hillemeier, twelve domains are listed under objective contextual community characteristics (Hillemeier et al., 2003). These contextual characteristic domains were established in 2003 by a network of social determinants researchers in response to a perceived need for 'improved conceptualization…on how the social environment impacts the health of populations' (Hillemeier et al., 2003). This process is discussed in-depth later in

this proposal. The operationalized domains will be discussed in relation to the three outcomes -- self-rated health, unhealthy days, and physical functioning -- in the measures section of this proposal.

The domain, *Behavioral*, refers to how health behaviors such as tobacco use/smoking, physical activity, and dietary habits may be a consequence of community contextual characteristics. Individuals may choose whether or not to adopt behaviors dependent upon influential factors in their community environment (please note that this domain is unlike the others in this respect). For example, the presence, availability or quality of grocery stores has been shown to influence dietary habits (Inagami et al., 2006; Cheadle et al., 1991; Lee & Cubbin, 2002). In addition, community characteristics are related to smoking rates (Ross, 2000), and physical activity (Ross, 2000; Sallis et al., 1998; Breuer et al., 2005; Gordon-Larsen et al., 2006). Domains such as *Economic* (e.g. availability of banking/check cashing services), *Education* (e.g. teacher salaries, fiscal capacity of school district), *Employment* (e.g. number and size of local businesses), *Governmental* (municipal services, living wage/min. wage ordinances), and *Public Health* (e.g. budget allocation, program offerings) may influence HRQOL of residents by creating or diminishing access to health resources (Wallace & Wallace, 1990). Mortality rates are higher for those living in areas with greater unemployment (Guest et al., 1998; LeClere et al., 1998). For example, if the living wage or minimum wage of a given area is higher than other areas, residents might enjoy a higher quality of life. Associations between *environmental* factors and health are well established. For example, trash dumps and incinerators (Bullard, 2000) have been shown to be located in lower SES areas resulting in poorer air and water quality. In addition, residing in close proximity to highways and railroads often results in adverse health outcomes, including

asthma (Juhn et al., 2005). Quality of *Housing* (abandoned housing, housing stock – age, characteristics, safety violations) has been shown to differ by community SES, with lower SES areas having more housing with asbestos, led paint and pests (Troutt et al., 1993).

The contextual community characteristic domains *Medical* (# MDs, # clinics, hospitals, emergency services) and *Transport* (availability/type of public transportation) take into consideration the many ways in which the physical environment or tangible resources can influence health. For example, within the *medical* domain, the quality or extensiveness of health care (e.g. number of medical specialists) may facilitate greater access to care, which can lead to better health outcomes. The location of health care resources varies greatly throughout North Carolina (fewer in rural areas, more in more urban areas) and those individuals in rural areas may have to travel greater distances to seek care, potentially influencing health outcomes. In addition, the *transport* domain considers that individuals living in areas with a well-developed public transportation infrastructure (e.g. buses, vans, trains or road systems) may have better health outcomes because these individuals have more options or greater ability to reach medical, financial, employment and commerce areas in their community. Public transportation may enable those without private transportation and/or those of lower SES to access resources, especially healthcare and financial services.

Finally, the domain *Psychosocial* addresses the way in which community members organize, interact, and treat each other, as well as capturing the concept of community collectiveness and connectedness. Crime, civic engagement and voter turn-out have been used previously as indicators of social capital and social cohesiveness (Sampson et al., 1997; Kawachi et al., 1999b; Blakely et al., 2001). Low social cohesiveness may negatively influence HRQOL or health functioning at the individual level.

CHAPTER 4

METHODOLOGY

4.1. Overview of Design and Sample

This dissertation project will use both quantitative and qualitative data from a parent project, the Social Determinants of Health Project. Individual level data come from a telephone survey on health status, chronic health conditions, community and neighborhood characteristics, health attitudes and beliefs, and sociodemographic variables. In addition, focus groups were conducted to help identify contextual community resource domains that are relevant to this group of North Carolinians. The methodology of conducting the telephone survey (quantitative) and the focus groups (qualitative) are described in detail below.

4.2 North Carolina Family Medicine Research Network

The Social Determinants of Health Project is a Multidisciplinary Clinical Research Center project funded by the National Institute of Arthritis and Musculoskeletal and Skin Disease (PI: Dr. Leigh F. Callahan). This project stems from a larger, overarching study, the North Carolina Health Project (NCHP), which originated from a practice-based research network of family practitioners – the North Carolina Family Medicine Research Network (NC-FM-RN) (See Figure 3 for flow chart of research originating from the NC-FM-RN). The family practice settings were purposively selected, to insure that the patients receiving care at the participating practices would provide a representation of the range of income, age, and racial composition for the state, as well as represent the three geographic areas of the state

(the mountains, the Piedmont, and the Eastern coastal region) and rural and urban locations within these areas. In 2001, 4766 participants were enrolled (62% recruitment rate) from 17 family practice settings. In 2004, 1934 participants were enrolled (65% recruitment rate) from 5 enrichment family practice settings. The total number enrolled in 2004 into the NCHP participants was 6,700. A more detailed description of NC-FM-RN sampling and participant recruitment has been described elsewhere (Sloane et al., 2006). See Figure 4 for a map of North Carolina showing the NC-FM-RN sites.

4.3 Social Determinants of Health Telephone Survey

Out of the 6,700 NCHP participants, 4,442 met eligibility criteria for future studies and gave consent for follow-up. Eligibility criteria for the Social Determinants of Health (SODE) Study were 1) consent to follow-up/additional studies, 2) current address given, 3) current telephone number given, and 4) ability to speak English fluently.

In 2004 and 2005, NCHP participants who had consented to be contacted for future studies were mailed an introductory letter reminding them of their participation in the NCHP and stating that a member of the study team would be calling soon to ask questions about their health and their community. A dollar bill was enclosed in this letter to make the mailing memorable and serve as a conversation starter. Individuals with telephone call-blocks and those not reached after several call attempts were mailed a follow-up letter, reminding them of their participation in the study. The survey contained closed-ended questions assessing health status, chronic health conditions, community and neighborhood characteristics, health attitudes and beliefs, and sociodemographic variables. Average length of the telephone interview was 30 minutes and participants did not receive monetary compensation.

4.4 Focus Group Recruitment and Methods

A pilot focus group was conducted with five residents from Orange County, NC to increase the likelihood that questions used in the focus group guide would be relevant to participant's lived experience. Focus group participants were then recruited from six of the 23 family practice network sites, with sites chosen for geographic and demographic disparateness. Eligible participants were first contacted by letter and then followed up with invitational phone calls to participate in focus groups.

For recruitment, the Social Determinants of Health (SODE) research team used a standardized script when talking to potential participants about the study and provided information about the purpose of the group; a description of what would happen in the session; the date, time and expected size of the focus group; and the incentive ($20). Participants were also told that they would be asked to take photographs of their neighborhoods and communities before their group sessions to illustrate relationships between community and health. They were further instructed to return those photos to the SODE study staff in the mail before the focus group session.

Before each focus group, the SODE study staff drove through each community to observe type and quality of neighborhoods, buildings, businesses and open spaces. This unstructured observation allowed the study staff a familiarity with the community and surrounding area, as well as a visual context for the focus group discussion. In total, 21 individuals participated, and focus group sizes ranged from two to five participants with an average of three participants per group. Participants signed consent forms at the beginning of the focus group. To initiate conversation, focus group participants were asked to describe their community and neighborhood, and then discuss those community factors believed to

influence their health. They were specifically probed on seven topics: community connectedness, crime/safety, eating habits, environment, occupation, physical activity and services/resources available in their community. These topics were used based upon an extensive literature review and discussions raised in a pilot focus group. Occupation was later added, based on a suggestion by the first focus group participants. SODE study staff served as focus group leaders and invited participants to share their photographs if they believed the picture represented the topic being discussed. A large, multi-paneled board was used to display participants' photographs. At the end of each focus group, the photographs were kept grouped by topic for later content analysis. All focus groups were co-facilitated by two trained focus group leaders, with digital audio-recordings and hand transcription conducted at each session. Focus groups met at well-known community buildings (e.g., senior centers, libraries) and lasted 1.5 hours. At the close of the focus group, participants received their incentive and a written thank-you.

4.5 Social Determinants of Health Study Population

A total of 2479 individuals completed the telephone survey and the participation rate was 59.5% of eligible participants (277 individuals were ineligible due to living outside the country, no telephone, active military service or being incarcerated). SODE project participants were on average 53 years of age, female (72%), and non-Hispanic white (74%). Fifty-three percent of participants self-reported that they had been told by a doctor that they have some form of arthritis or rheumatic disease. Participant education varied, with 13% having less than a high school education, 30% having a high school degree, and 57% having

some college or more. The urban/rural split was nearly fifty-fifty (based on 2001 North Carolina Health Project enrollees).

4.6. Study Research Design

4.6.1 Revised Aims

This research project originally proposed four aims; however it was reduced to three aims (with original Aim 2 incorporated into basic descriptive analyses rather than serving as a separate aim. This decision was based on the realization that the original Aim 2 was more a procedural step than a true aim. Original Aim 3 thus became Aim 2 and original Aim 4 became Aim 3). Henceforth, aims are indicated by this revised nomenclature.

Aim 1 was to identify contextual dimensions of North Carolina community resources (that in this study conceptualize 'contextual community SES') and to obtain data from administrative and public-use data sources (e.g. Reference USA and NC Log into North Carolina (LINC)). The accomplishment of Aim 1 was guided by data triangulation, including a review of current, 12 domains of contextual community characteristics established in a CDC workshop by expert researchers (Hillemeier et al., 2003), and information emerging from focus group discussions. Identified domains were operationalized and data for each operationalized variable were obtained from public-use databases. These data were then used to address Aims 2 and 3.

Aim 2 examined the association between the contextual community resources identified in Aim 1 and participant health related quality of life (self-rated health, number of unhealthy days (CDC HRQOL), and physical health functional status (SF12v2 PCS). Aim 3

then examined the role of compositional community SES (% individuals in a city living in poverty) on health outcomes within the context of contextual community resources.

4.6.2 Data Sources

Individual level data were taken from the baseline Social Determinants of Health study questionnaire collected via telephone interviews (see above study population section). Transcripts and audio-recordings of focus groups provided qualitative data available for secondary data analyses.

Compositional community-level data based on aggregated individual-level data came from the 2000 US Census and were taken from the official US Census website (US Census Bureau, 2004). Each participant was assigned a compositional community SES value (% individuals in city living below poverty) according to his or her self-reported city of residence.

Data used to measure contextual community resource domains came from various public-use databases. One source, Reference USA, is a database consisting of directory information on U.S. businesses, health care, and residential listings (2009c). Searches can be conducted by company name (number of employees), geographic area (e.g. city, zip code, county), business type, and standard industrial classification (SIC) code (e.g. Eating Places = 5812). Finally, retail store websites also served as public use database in the identification of store and service locations. Each participant was assigned contextual community resource/SES values for each domain according to his or her self-reported city of residence, that is, the physical address given at the time of their participation in the Social Determinants of Health telephone survey.

4.7 Measures

4.7.1 Predictor Variables

Compositional Measure of Community Level SES: As a measure of community level SES, percent (%) individuals in poverty was used. Each participant was assigned a percent of individuals in poverty score for his or her community (city) using data obtained from the US Census 2000. This is a continuous variable. Percent of individuals living in poverty is widely used in the literature as a measure of Community Level SES (Krieger et al., 2003).

Contextual Measures of Community Level SES: A thematic review of the focus group discussions identified six themes, which this study conceptualized as community resource domains. These domains include: Recreational Facilities, Shopping Facilities, Restaurants/Fast Food, Medical Facilities and Services, and Transportation. These community resources conceptually capture contextual community level SES.

Each contextual community resource variable was treated independently and not as an index. Index creation could lead to a reduction in detail, that is, it could suppress the uniqueness of each contextual community resource variable. Currently, there is no known set of criteria for the relative importance of each contextual community characteristic or resource variable, and determination of appropriate weights would be arbitrary. Additionally, it should be noted that there are multiple indicators of a particular domain in some cases (e.g. shopping facilities) and that in these cases the indicators are not combined to form one global variable to represent the domain. In each case, the variables neither share a common cause (not capturing the same latent variable) nor a common effect in a way that would support forming a composite (variables of interest are not related in the same way and are not measured in the same non-arbitrary metric).

Recreational Facilities: Two variables were created in this domain: 1) private gyms and fitness facilities and 2) public recreational facilities. First, Standard Industrial Codes (SIC), put forth by the U.S. Department of Labor (a division of the Occupational Safety and Health Administration) were used to obtain information on private gyms and fitness facilities from ReferenceUSA (2009c). The SIC '799107' exercise - physical activity fitness program; '729906' exercise & physical activity fitness programs; '799101' health club studios '799102' gymnasiums; and '799103' aerobics were used in this search for each city and town. This procedure is consistent with the way in which previous researchers have used SIC parameters in their research to identify physical activity facilities (Gordon-Larsen et al., 2006). A rate of private gyms and fitness facilities was obtained for each city and town as a continuous variable (number per 1000 residents) was calculated, using each town's 2005 population.

In addition, a public recreational facility assessment tool was developed (see Appendix A and B) and each community was given a 'public recreational facility resource' score based on the tool. Using each community's website, the public recreational facilities were assessed for each community on a scale from 1 to 5: from a '1', indicating the community has no or poor recreational facilities (e.g., no website or sparse information given), to a '5', community resources are exceptional (e.g., dedicated indoor and outdoor space with complexity of program offerings, including multicultural/multi-language options). Inter-rater reliability was established for 16 of the 35 communities, with 18 raters following specific criteria for rating the public recreational facilities. These two variables (private gyms and fitness facilities and public recreational facilities were not combined, because they represent separate community recreational facility resources.

Shopping Facilities: Two measures were collected, grocery stores and so-called box stores and club warehouses (e.g., Wal-Mart, Costco) that offer a wide range of goods at a single location. All major food store chains were identified and the online 'store locator' was used to establish geographic confirmation of grocery stores for each city and town. Major food store (grocery) chains for these North Carolina communities were identified as: Aldi, Bi-Lo, Earth Fare, Food Lion, Harris Teeter, Ingles, Kroger, Lowes Food, IGA, Trader Joes, Whole Foods, Super Wal-Mart, Super Kmart, and Super Target (as of March 2008). A total sum of grocery stores for each city and town was obtained, and a rate of grocery stores (# per 1000 residents) was calculated, using each community's 2005 population. Previous research has demonstrated that a greater number of grocery stores in a given area can be an indicator of greater neighborhood/community wealth (Morland et al., 2002b).

The measure, 'Box stores and club warehouses', is the total sum of all 'Box stores' (Wal-Mart, Kmart and Target) and 'Club Stores' (Sam's Club, BJs, and Costco) in a given city or town. These data were obtained by visiting each box-store and club-store corporate website and using the online 'store-locator' to identify whether or not a store was in each city/town; a rate of box stores (number per 1000 residents) was calculated, using each town's 2005 population. The variables, *grocery stores*, and *box and club stores* represent separate community shopping facility resources.

Restaurants/Fast Food: The SIC code 5812(**) was used to assess restaurants/fast food places in a city or town, and data come from ReferenceUSA (2009c). The SIC code 5812 represents eating places, with ** extended codes representing specific types of eating places, and previous researchers have used SIC parameters in their research to identify eating facilities (Jeffery et al., 2006). These codes represent sit-down restaurants, as well as those

typically classified as ‘fast-food’ establishments and was used to calculate a total sum of restaurants and fast-food outlets. A rate of restaurants/fast-food establishments (number per 1000 residents) was calculated, using each community’s 2005 population.

Medical Facilities and Services: Two data sources were used to assess medical facilities and services, such as rate of hospital beds and rate of pharmacies. Data regarding licensed hospitals and their characteristics come from the North Carolina Division of Health Service Regulation: Licensed Facilities, which are reported for each community (2009a). A total count of general hospital beds and those beds set aside for nursing home, rehabilitation, and hospice hospitalization needs was summed, giving an overall synopsis of facility capacity. A rate of hospital beds (number per 1000 residents) was calculated, using each community’s 2005 population.

Pharmacy availability was also examined as part of the domain: *Medical Facilities and Services*. The Standard Industrial Code (SIC) ‘591205’ was used to obtain information on pharmacies for all 32 cities and towns, and data come from ReferenceUSA (2009c). A total sum was obtained for each community and a rate of pharmacies (number per 1000 residents) was calculated, using each community’s 2005 population.

These two variables represent separate community medical facility and service resources and were used as continuous variables.

Transportation: Data were collected to reflect availability of services at a community level. Cities and towns were assigned a value (Yes or No) depending upon whether or not a public transportation system was available in 2005 and information was obtained from the 2005 National Transit Database (2009b).

4.7.2 Outcome Variables

The Centers for Disease Control and Prevention Health-Related Quality of Life (CDC HRQOL) and the Medical Outcomes Study's 12-Item Short Form Survey (SF-12v2) were used to measure Health Related Quality of Life in this study. The CDC HRQOL measure is made up of 4 core questions (see Appendix C), where one measures global self-rated health and three measure specific aspects of HRQOL (recent physical health, recent mental health and recent activity limitation) (Centers for Disease Control and Prevention, 2000). Three of these four questions are used in this research project: the measure of self-rated health, self-report number of physically unhealthy days in the past 30 days, and self-report number of mentally unhealthy days in the past 30 days. An overall score of "unhealthy days" was used in this study by summing the reported number of physically and mentally unhealthy days (with a maximum of 30 days), with higher number indicating more unhealthy days (Moriarty et al., 2003) and has been used successfully in older adults (Moriarty et al., 2005). In addition, the CDC HRQOL measures have shown good construct validity, concurrent validity, and predictive validity, and have been validated against other objective HRQOL instruments (Moriarty et al., 2005; Mielenz et al., 2006).

The 12-Item Short Form Survey Instrument (SF-12v2), administered as part of the telephone survey uses just 12 items (selected from the eight subscales of the SF36) to measure physical and mental health through two summary scores: physical component summary (PCS) and mental component summary (MCS) (See Appendix C). The SF-12v2 is strongly correlated with the SF-36 and has proven reliable in general populations (Ware Jr., et al., 1996). Generally, a greater PCS score represents greater physical functioning, with scores ranging from 0 to 100. While MCS was originally considered as a potential outcome

measure for this study, only PCS will be used in this research project. This change narrows the focus of the project on how community resources influence general physical health outcomes. Community SES (census variable: % individuals poverty) was not previously found to influence MCS in the parent study participant sample of North Carolinians (Callahan et al., 2009) and thus, PCS seems worthy of greater attention.

4.7.3 Covariate Variables

Individual Level SES: Several demographic characteristics such as household income, occupation, and education were assessed at baseline and are available to use as markers for individual level SES. Household income was obtained in interval categories and dichotomized as < or ≥ $45,000. Occupation was recorded and assigned a category according to the US Census Industry and Occupation 2000 categories (Management/Professional, Service, Sales and Office, Farming/Fishing/Forestry, Construction/Extraction/Maintenance, and Production/Transportation and Material Moving). Occupation was later dichotomized into two categories: 1): Management/Professional & Service, Sales and 2): Office and Farming/Fishing/Forestry, Construction/Extraction/Maintenance & Production/Transportation/Material Moving). Education was assessed in seven categories from <8^{th} grade to Postgraduate school or degree, and collapsed into three categories: < High School, High School, or > High School. These three variables were used as separate markers of individual level SES and treated as categorical variables.

Age: Age is defined as participant age at the time of questionnaire administration. This is calculated by using participant date of birth and date of telephone interview. This variable is analyzed as a continuous variable.

Gender: Gender is a dichotomous variable in all models.

Race: Race was measured using the 2000 US Census definition of race and ethnicity. Individuals were categorized as non-Hispanic white, non-Hispanic black, or other race. The other race category accounts for Hispanics, Native Americans, Asians and Pacific Islanders, and individuals reporting more than one race. This variable was analyzed as a categorical variable in all models.

Body Mass Index (BMI): BMI is a commonly used screening tool for weight and obesity. It was calculated from self-reported height and weight obtained in the US Customary System (e.g., pounds, feet and inches) and converted to Metric (e.g., kilograms and meters). The formula for BMI is: weight (kg)/ [height (m)]^2 (2009d), and was used as a continuous variable in this study.

Arthritis Status: Arthritis status was determined according to participant response to the Behavioral and Risk Factor Surveillance System (BRFSS) questions regarding arthritis. A participant was classified as self-reporting arthritis by responding "yes" to "Have you ever been told by a doctor or another health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?" This self-reported arthritis question is recommended by the CDC to be used as a case-definition and has been used when a criterion of rheumatologist confirmed arthritis is not easily obtained. It has moderate sensitivity (70.3%) and moderate specificity (72.4%) (Bombard et al., 2005). It was analyzed as a dichotomous variable in all models (Yes/No).

Self-report depression: Depression was assessed as part of a chronic condition intake during the telephone survey. A participant was classified as self-reporting depression by responding "yes" to "Have you ever been told by your doctor that you have any of the

following chronic health conditions?...do you have Depression" and the variable was analyzed as a dichotomous variable in all models.

4.8 Statistical Analysis

4.8.1 Institutional Review Board Approval

Approval for this dissertation project was obtained from the University of North Carolina Biomedical Institutional Review Board (IRB), IRB# 05-ARTHR-1196. Initial IRB approval was given on May 24, 2006 and renewed 05/2007 and 05/2008.

Statistical Analyses.

The overall goal of data analysis was to examine whether a differential ability to capture community SES exists between the contextual and compositional SES measures, and to examine the relationship between these community measures and health-related quality of life. Descriptive analyses included examining data distributions for all key variables and identifying participants with missing values for key variables. These participants were dropped from the analyses. Bivariate analyses were conducted to explore whether any relationships exist between individual-level and community-level variables, and examine how they co-vary. These analyses were done with scatter plots, chi square tests (when variables were categorical), t-tests (when variables were continuous), or an analyses of variance (if variables are both continuous and categorical). All analyses were tested at α=0.05. Multilevel analyses were employed, and Stata v. 8 were used for all analyses.

4.8.2 Analysis for Aim 1

To identify contextual dimensions that effectively measure community level SES.

Identification of community-level variables was established through data triangulation; a literature review and unstructured observation, expert findings from a CDC workshop focused on identification of contextual community dimensions regarded as important for health, as well as results from focus group discussions. The focus group discussions were considered a formative component that lent support to dimensions identified through other sources and establishing their relevance to North Carolinians. Consequently, this study did not examine the focus group data independently; rather they were used in conjunction with findings in the literature and recommendations from the CDC expert workshops (Hillemeier et al., 2003).

Focus Group sessions were both audio recorded and transcribed verbatim, and transcripts from the 6 focus groups were analyzed. Reviewer #1 listened to the audio-recordings while following along with the transcripts. Because community resources and other characteristics relevant to health were of primary interest to this dissertation research, any mention of community characteristics or resources was noted along the margin of each transcript. These notes were reviewed and formed the basis for a list of super-codes (e.g., recreational facilities, grocery stores, availability of emergency services). This list of super-codes and code definitions were established after Reviewer #1 examined all focus group audio-recordings and transcripts (see Appendix D).

A matrix was created and included a weighting system for each community characteristic that mattered for health, so as to establish level of relevance of each characteristic. To determine a weight for a community, one point was assigned to each characteristic if it was mentioned in each focus-group; two if it was brought up by more than one individual in each focus group. Careful attention was given to ensuring that points were

not assigned for either general agreement of other focus group members after a particular characteristic was highlighted or the same focus group participant making the point numerous times. A final point tally was then assigned for each identified community characteristic, so that each might be examined within and across focus groups (see Table 1).

Validation coding was conducted to ensure that the codes and code definitions created by Reviewer #1were correctly applied to the focus group transcripts. Unlike Reviewer #1, Reviewer #2 was an independent researcher with no prior experience with the Social Determinants of Health study (or additional projects associated with these data). Reviewer #2 had prior training in qualitative data analyses and was instructed to carefully follow the super-code definition sheet, matrix and weighting system instructions. Reviewer #2 independently created a matrix (using the developed list of super-codes & definitions) and assigned weighing points to each community resource/characteristic using the pre-determined weighting scheme (see Table 2). A comparison of the matrices created by Reviewer #1 and Reviewer #2 was conducted by the same reviewers to identify discrepancies. Any discrepancies were documented, discussed, and resolved between the two reviewers. For example, a discrepancy emerged after review of the Bladen focus group transcript was conducted by Reviewer #1 and Reviewer #2. Reviewer #1 had noted that 'shopping facilities/grocery store' domain was discussed once during the focus group, but Reviewer #2 had not. This led to a review of the transcript and identification of the quote: "there are businesses that have closed…an entire shopping center gone." The discrepancy was therefore resolved in favor of Review #1's original finding and noted in the final validated matrix (Table 3).

Additionally, a literature review was conducted, to enhance understanding of the contextual community resource domains that emerged from the qualitative review. A search for articles relating to community characteristics, community socioeconomic status, and health related quality of life was conducted using the online databases Medline, CINAHL, and PsycINFO. Major search terms included: (community OR neighborhood) AND (services OR context OR characteristic OR amenities) AND quality of life; (community OR neighborhood) AND (SES OR disadvantage OR deprivation) AND quality of life; (area level OR built environment) AND (SES OR disadvantage). In addition, searches were also conducted with the MeSH terms residence characteristics, social class, community health services, and quality of life. Reference sections of articles were searched, as well as on key authors in the field (e.g. Diez-Roux, Kaplan, Krieger, Macintyre, and Yen). Over a hundred articles were reviewed.

Finally, as previously discussed in section 2.8 Contextual Community Socioeconomic Characteristics, a group of researchers explored potential contextual characteristics that could affect patterns of population health and developed a list of datasets that contained geocoded contextual community characteristics (Hillemeier et al., 2003). The article detailing the workshop findings was reviewed in detail and the suggested data-sources were explored.

Thus, the final choice of collected community-level variables for each North Carolina community in this study was based on the results of the data triangulation (focus group results, literature review and unstructured observation, as well as expert findings from the CDC workshop).

4.8.3 Analyses for Aim 2

To examine the association between contextual community resources and measures of Health Related Quality of Life outcomes (self-rated health, number of unhealthy days, and physical functioning) in adult North Carolinians, controlling for individual-level SES and demographic covariates.

Aim 2 of this dissertation was achieved through a number of steps. First, this study examined for multicollinearity among the predictor variables. This was accomplished by examining the variance inflation factor (VIF) for each health outcome. A high VIF value (10+) is evidence of multicollinearity, whereas a low VIF value (less than 5) indicates absence of multicollinearity among predictor variables. If variables show strong multicollinearity, and then those variables would not be used in the analyses. Second, strength of correlation between the three health outcomes (self-rated health, number of unhealthy days and physical functioning) were assessed to determine whether they should be considered as separate outcome variables in the multi-level model If the three health outcomes of interest were weakly correlated then use of multi-level modeling is indicated. If the health outcomes are moderately or strongly correlated, a multivariate analyses of variance (MANOVA) would be conducted to determine whether or not an outcome variable is affected by the predictor variables independent of the other outcomes. An overall multivariate test was used to determine whether a composite of the three outcome measures was statistically related to the predictors. The logic of this analysis is based on the potential redundancy among individual tests performed on each outcome separately if those outcomes are substantially correlated. In the latter case, the correlation of the outcomes would inflate the overall likelihood of a significant finding above the nominal probability value (e.g., .05).

Conducting the preliminary multivariate test obviates this problem by assessing the significance of the single composite outcome, in contrast to running three tests on redundant outcomes, each with an alpha probability of .05 as a criterion. Where the single multivariate test yields significance, there is then justification for decomposing the composite outcome effect through separate analyses involving each of the individual outcome measures. These analyses, in effect, are a means of accounting for the significant relationship observed in the multivariate analyses.

A further strategy is necessary to account for associations among entities that are members of a larger, shared group. Multi-level modeling was developed specifically to take into consideration the amount of dependence created by nested data. Multi-level modeling allows the researcher to examine variables at the individual-level, the community-level, and any interactions that occur between these two levels. The data for this study come from two levels, where individual-level data (level one; micro) are nested within community-level data (level-two; macro). Because these data are nested, it is reasonable to expect that observations from individuals that share the same community would be correlated. This correlation creates dependence and the strength of the dependence can be estimated via an intra-class correlation coefficient (ICC) (Hox, 2002). This, in turn, makes it possible to adjust for dependence within levels of analysis. The relevant intra-class correlation can be calculated using the formula:

$$ICC = \frac{\tau_{00}}{\tau_{00} + \sigma^2}$$

τ_{00} represents the between-groups variance and $\tau_{00} + \sigma^2$ represents total variance (sum of between-groups and within-groups variance). The ICC can range from 0 to 1, with a value near 0 indicating that little between-group variance and a value nearer to 1 indicating that the

variance is mostly between the group (versus within the group). The value 1-ICC represents the proportion of variance that exists between individuals within groups. Two important assumptions of multi-level models are as follows:

1). The residuals at both levels of the model are normally distributed: r_{ij} and μ_{ij}. This indicates that scores from each group are normally distributed with the same variance for every group.

2). The residuals at the community-level (macro) (μ_{oj}) are uncorrelated with residuals at the individual-level (micro) (r_{ij}). This second assumption implies that, in the population, the data values (group means) are normally distributed around the grand mean with variance τ_{00}. We are estimating the variance in the population using our particular sample of groups. The following is an example of the general linear mixed models that were tested for each health outcome to account for individual-level variables (level-1) and community-level variables (level-2):

Model 1 (Null Model): $SF12v2_{PCS} = \beta_{0j} + r_{ij}$

Model 2 (Level 2 only): $SF12v2_{PCS} = \beta_{0j} + \beta_{1j}$ Rate of Box Stores$+ \beta_2$ Rate of Grocery Stores$_{ij} + \beta_3$ Rate of Restaurants$_{ij} + \beta_4$ Rate of Private Gyms$_{ij} + \beta_5$ Public Rec. Facility Score$_{ij} + \beta_6$ Rate of Hospital Beds$_{ij} + \beta_7$ Rate of Pharmacies$_{ij} + \beta_8$ Public Transportation$_{ij} + r_{ij}$

Model 3 (Full Model: Level 1 and Level 2): $SF12v2_{PCS} = \beta_{0j} + \beta_1$ Rate of Box Stores$_j + \beta_2$ Rate of Grocery Stores$_j + \beta_3$ Rate of Restaurants$_j + \beta_4$ Rate of Private Gyms$_j + \beta_5$ Public Rec. Facility Score$_j + \beta_6$ Rate of Hospital Beds$_j + \beta_7$ Rate of Pharmacies$_j + \beta_8$ Public

Transportation $_j$ + β_9 education $_{ij}$ + β_{10} income $_{ij}$ + β_{11} occupation $_{ij}$ + β_{12} age $_{ij}$ + β_{13} gender $_{ij}$ + β_{14} race $_{ij}$ + β_{15} BMI $_{ij}$ + β_{16} arthritis $_{ij}$ + β_{17} depression $_{ij}$ + r_{ij}

The three models (Model 1, Model 2, and Model 3) described above were run for each health outcome. Noted below are Model 3 (Full Model: Level 1 and Level 2) for self-rated health and unhealthy days.

Self-rated Health: $\text{HRQOL}_{\text{self-rated health}}$ = β_{0j} + β_1 Rate of Box Stores $_j$ + β_2 Rate of Grocery Stores$_j$ + β_3 Rate of Restaurants$_j$ + β_4 Rate of Private Gyms$_j$ + β_5 Public Rec. Facility Score$_j$ + β_6 Rate of Hospital Beds$_j$ + β_7 Rate of Pharmacies$_j$ + β_8 Public Transportation$_{ij}$ + β_9 education $_{ij}$ + β_{10} income $_{ij}$ + β_{11} occupation $_{ij}$ + β_{12} age $_{ij}$ + β_{13} gender $_{ij}$ + β_{14} race $_{ij}$ + β_{15} BMI $_{ij}$ + β_{16} arthritis $_{ij}$ + β_{17} depression $_{ij}$ + r_{ij}

Unhealthy Days: $\text{HRQOL}_{\text{Unhealthy Days}}$ = β_{0j} + β_1 Rate of Box Stores $_j$ + β_2 Rate of Grocery Stores$_j$ + β_3 Rate of Restaurants$_j$ + β_4 Rate of Private Gyms$_j$ + β_5 Public Rec. Facility Score$_j$ + β_6 Rate of Hospital Beds$_j$ + β_7 Rate of Pharmacies$_j$ + β_8 Public Transportation$_j$ + β_9 education $_{ij}$ + β_{10} income $_{ij}$ + β_{11} occupation $_{ij}$ + β_{12} age $_{ij}$ + β_{13} gender $_{ij}$ + β_{14} race $_{ij}$ + β_{15} BMI $_{ij}$ + β_{16} arthritis $_{ij}$ + β_{17} depression $_{ij}$ + r_{ij}

In the models, subscripts are needed to track the nesting of individuals (i) within the communities (j). The subscript 'j' on the intercept parameter, β_0, indicates that the intercept varies across communities. In multi-level modeling, it is assumed that the macro-level observations (i.e., communities) emanate from a random sample from possible communities. Therefore the intercept for the communities in the sample represents a randomly drawn

intercept from the distribution of possible community intercepts (Hox, 2002; Hox, 2002). In models above, μ_j is the error term at the community level and r_{ij} is the error term at the individual level.

Individual level data such as HRQOL (self-rated health and unhealthy days), SF12v2 (physical functioning), and other socio-demographic information were obtained via telephone survey conducted with Social Determinants of Health participants (as noted above). Each contextual community resource/SES measure (see above) is linked to each participant's community.

4.8.4 Analyses for Aim 3

To examine the role that compositional community SES exerts on Health Related Quality of Life outcomes (self-rated health, unhealthy days, and physical functioning), both alone and within the context of contextual community resources.

To achieve Aim 3, three general linear mixed models were tested: Model 1 (Covariates only); Model 2 (Covariates and Compositional SES); Model 3 (Full Model: Covariates, Compositional SES, and Contextual Community resources/SES). These three models are detailed below for the health outcome SF12v2 PCS, but will also be run for HRQOL self-rated health and unhealthy days.

Model 1: $SF12v2_{PCS} = \beta_{0j} + \beta_1 \text{ education}_{ij} + \beta_2 \text{ income}_{ij} + \beta_3 \text{ occupation}_{ij} + \beta_4 \text{ age}_{ij} + \beta_5 \text{ gender}_{ij} + \beta_6 \text{ race}_{ij} + \beta_7 \text{ BMI}_{ij} + \beta_8 \text{ arthritis}_{ij} + \beta_9 \text{ depression}_{ij} + r_{ij}$

Model 2: $SF12v2_{PCS} = \beta_{0j} + \beta_1 \text{ education}_{ij} + \beta_2 \text{ income}_{ij} + \beta_3 \text{ occupation}_{ij} + \beta_4 \text{ age}_{ij} + \beta_5 \text{ gender}_{ij} + \beta_6 \text{ race}_{ij} + \beta_7 \text{ BMI}_{ij} + \beta_8 \text{ arthritis}_{ij} + \beta_9 \text{ depression}_{ij} + \beta_{10} \text{ Compositional SES}_{ij} + r_{ij}$

Model 3: $SF12v2_{PCS} = \beta_{0j} + \beta_1 \text{ education}_{ij} + \beta_2 \text{ income}_{ij} + \beta_3 \text{ occupation}_{ij} + \beta_4 \text{ age}_{ij} + \beta_5 \text{ gender}_{ij} + \beta_6 \text{ race}_{ij} + \beta_7 \text{ BMI}_{ij} + \beta_8 \text{ arthritis}_{ij} + \beta_9 \text{ depression}_{ij} + \beta_{10} \text{ Compositional SES}_{j} + \beta_{11} \text{ Rate of Box Stores}_{j} + \beta_{12} \text{ Rate of Grocery Stores}_{j} + \beta_{13} \text{ Rate of Restaurants}_{j} + \beta_{14} \text{ Rate of Private Gyms}_{j} + \beta_{15} \text{ Public Rec. Facility Score}_{j} + \beta_{16} \text{ Rate of Hospital Beds}_{j} + \beta_{17} \text{ Rate of Pharmacies}_{j} + \beta_{18} \text{ Public Transportation}_{j} + r_{ij}$

These analyses will examine how much variance is explained by the addition of contextual community resources/SES. If the addition of contextual community resources/SES weakens the relationship between compositional community SES and the health outcomes of interest, then it may indicate that a particular contextual community resource explains the relationship more fully, especially given if there is no multicollinearity between the contextual and compositional SES measures.

CHAPTER 5

RESULTS

5.1 Overview

This chapter describes the results of the study analyses. It begins with the findings for Aim 1: identification and operationalization of the contextual community resource domains (Recreational Facilities, Shopping Facilities, Restaurants/Fast Food, Medical Facilities and Services, and Transportation). This is followed by a description of the study sample and results of bivariate analyses. Next, the results for analyses examining multi-level predictors of the outcomes (Aim 2) are presented. Aim 3 is also presented in this chapter and shows the results of analyses examining the influence of compositional community SES.

5.2 Aim 1: Identification of Contextual Community Resource Domains

A thematic review, of previously held focus group discussions was conducted with a sub-sample of the Social Determinants of Health participants. The community resources that participants believed to be important for individual health and had the highest tallied points were: recreational facilities, employment opportunities, medical facilities and medical specialists, shopping facilities/grocery stores, transportation availability, and restaurants/fast food. These contextual community factors were then considered in light of findings from the literature review. Previous research has examined area-level contextual factors including shops, food/grocery stores, residential environment, political climate and political engagement, public recreation, transportation, and crime (Cummins et al., 2005b; Gordon-

Larsen et al., 2006; Morland et al., 2002b; Wilson et al., 2004). These contextual community factors and characteristics were also in-line with the compiled list of contextual dimensions, components and indicator variables that were collectively agreed upon by the expert CDC workshop participants.

The final contextual community resource domains chosen for examination in this dissertation study were: Recreational Facilities, Shopping Facilities, Restaurants/Fast Food, Medical Facilities and Services, and Transportation. Because these community resources emerged from the three data sources explored in the data-triangulation, they were evidence-based choices and conceptually represented contextual community resources. Operationalization of these domains was carried out after consideration to how it had been done previously by other researchers, as well as what made sense given available city/town level data from public data sources. A description of each contextual community resource domain has been discussed above.

5.3 Description of the Study Sample: Community Characteristics

In general, the 2005 population of the cities and towns represented in this study ranged from 247 residents to 237,316 with a mean of 34,471 residents (see Table 4). The percent of individuals living below poverty in each city was, on average, 15.8% (±6.9). The mean number of participants in each city and town was 38 and the number of study participants ranged from 11 to 123 in each city. Nearly 84.4% (N=27) of the 32 cities and towns did not have public transportation in 2005. The majority of cities and towns (65.7%, N=21) had public recreational facility scores of good, very good or excellent (see Appendix B). While the 2008 counts are reported for each community in Table 4, the 2005 community

rates were used in the main analyses (see Table 5). The mean 2005 rate and range of contextual community resource characteristics are as follows. There was an overall mean of 0.07 (0-.28) box stores and club warehouses per 1000 residents; 4.35 (0-10.05) restaurants per 1000 residents; .25 (0-1.4) private gyms and fitness facilities per 1000 residents; 6.63 (0-23.75) hospital beds per 1000 residents and .77 (0-5.6) pharmacies per 1000 residents.

5.4 Description of the Study Sample: Individual Characteristics

Total participants available for analyses was N=1217 after dropping missing data. The baseline age of the participants was 52 years (±14.8) and ranged from 19 to 92. Three-quarters of participants were non-Hispanic white (76.5%) and female (70.1%), as shown in Table 6. Nearly sixty-percent of participants (56.1%) had an annual income less than $45,000, yet most participants had a high school education or greater (88.7%). The majority of participants reported that their last occupation was either in management or sales (53.8%), with 25.0% in service-related jobs, 13.3% in production, 6.7% in Construction and 1.2% in Farming. In general, 74.4 % of participants reported being in good, very good or excellent health and had an average of 9 (±11) sick-days per year. Mean Physical Component Score (PCS) was 45.4 (±12.1) and the average sample Body Mass Index was 29.4 (±7.0) or being overweight. More than half of the participants had arthritis (53%) and about one-third self-reported depression (32%).

5.5. Relationships Between Individual-Level Characteristics and Health Outcomes

Individual-level characteristics, demographics such as age, gender, BMI, self-report arthritis status, self-report depression, income, education and occupation were significantly

associated with various health outcomes (see Table 7). Older participants more often reported worse physical functioning ($p<.001$), however they reported fewer unhealthy days in the past month ($p=.001$). Participants with higher BMI more often reported lower perceived health ($p<.001$) and worse physical functioning ($p<.001$). In addition, women more often reported more unhealthy days ($p=.005$) and worse physical functioning ($p=.008$). Those participants with household incomes less than $45,000 had lower levels of perceived health ($p<0.001$), greater number of unhealthy days ($p<0.001$), and worse physical functioning ($p<0.001$) when compared to those living in households with greater than $45,000 annual incomes.

Participants with lower levels of education (High School or less than High School) reported lower perceived health ($p=.007$ and $p<.001$, respectively). Those with less than High School had worse physical functioning ($p=.005$). Finally, those participants having ever worked or currently working at the time of the survey in service, farming/fishing/forestry, construction or production occupations self-reported worse health ($p=.016$) when compared to those in management, professional, sales type of occupations.

5.6 Relationships between Community-level (Community Resources and Compositional SES) and Individual-level SES factors (Race, Income, Education)

There were significant relationships between contextual community SES (community resources) and other social factors among SODE participants. Non-Hispanic black and other-race participants were more likely to live in communities with higher rates of persons living in poverty ($p=0.039$) and in communities with public transportation ($p=0.005$) when compared to non-Hispanic whites participants (see Table 8). Non-Hispanic blacks and other-race participants were more likely to live in communities with a higher rate of private gym

and fitness facilities (p=0.012) when compared to non-Hispanic whites. In addition, public recreational facility score was also significantly related to race. Non-Hispanic blacks were more likely to live in communities with lower public recreational facility scores (p=0.002) when compared to non-Hispanic whites and other-race participants. Non-Hispanic whites were more likely to live in communities with a higher 'rate' (i.e., more restaurants per 1000 residents (p=0.026) than were non-Hispanic black and other-race participants. There was no significant difference in means in the relationship between race and the rate of box stores and club warehouses, grocery stores, hospital beds and pharmacies.

Among individuals self-reporting less than $45,000 annual household income, there was a significant difference in means by nearly all community SES measures (see Table 9). Lower income participants were more likely to live in communities with a greater mean percentage of individuals living below poverty (p<.001), a greater rate of box and club stores (p=0.001), a greater rate of chain grocery stores (p=0.002), a greater rate of private gyms and fitness facilities (p=0.006), greater rate of hospital beds (p=0.002), and greater rate of pharmacies (p=0.003). Availability of public transportation was also significantly related to income. More individuals with income greater than $45,000 lived in communities with public transportation access as compared to those with income less than 45,000 (p<0.001). In addition, the public recreational facility score was significantly related to income level. More individuals with greater income (>$45,000) lived in communities that received higher public recreational facility scores (p<0.001) as compared to those with lower income (<$45,000). There was a trend for participants earning <$45,000 annually to live in communities with a higher rate of restaurants (p=0.064).

Most bivariate relationships between community SES and education were non-significant (see Table 10). Availability of public transportation was significantly related to educational level. More participants with higher education (high school or greater than high school) lived in communities with access to public transportation compared to those with less than a high school education ($p<0.001$). In addition, public recreational facility score was significantly related to education level. More individuals with greater education (>HS) lived in communities that received higher public recreational facility scores as compared to those with lower education (<HS and HS) ($p<0.001$). There was a trend for individuals with less education to live in communities with a greater mean percentage of individuals living below poverty ($p=.072$) and greater rate of pharmacies ($p=0.051$) than those with higher education.

Much like education, most bivariate relationships between occupation and community SES (compositional and contextual) were non-significant (see Table 11). However, availability of public transportation was significantly related to occupation status. Individuals working in less-professional occupations, such as service, farming, or production were more likely to live in areas with public transportation ($p<0.001$), higher rates of grocery stores ($p=0.020$) and a trend for higher rate of box and club stores ($p=0.072$) when compared to those in management, professional or sales types of occupations.

5.7 Relationships between Community-level (Contextual Resources and Compositional SES) and Individual-level Demographic factors (Age, Gender, Arthritis Status, Depression Status, BMI)

Older participants (those aged 52 years or older) were more likely to live in communities with a greater percentage of individuals living below poverty ($p=0.006$), a

greater rate of private gyms and fitness facilities (p=0.042), hospitals, (p=0.001), and a greater rate of pharmacies (p=0.045) as compared to younger participants (those aged less than 52 years), see Table 12. Older participants were more likely to live in communities with access to public transportation (p=0.001) when compared to younger participants. Age was significantly related to community public recreational facility score: those who are older tend to live in communities with lower-rated public recreational facility scores (p=0.022). There was no significant relationship between age and rate of box and club stores, grocery stores, or restaurants.

Most relationships between gender and community SES measures were non-significant (see Table 13); however, men were more likely to live in communities with public transportation then were women (p=0.035). Most relationships between arthritis status and community SES measures were not significant (see Table 14). However, those with arthritis were more likely to live in communities with a higher mean percentage of individuals living in poverty (p=0.014), and there was a trend for those with arthritis to live in communities with a higher rate of pharmacies (p=0.092). Likewise, most relationships between self-reported depression and community SES measures were not significant (see Table 15). However, those reporting depression were more likely to live in areas with a lower rate of private gyms and recreational facilities (p=0.040) and to live in areas without public transportation (p=0.047) when compared to those not reporting depression. Similarly, those with higher levels of body mass index (BMI) were more likely to live in areas without public transportation (p=0.001) and there was a trend for those with higher BMI to live in communities with a higher rate of pharmacies (p=0.093). All other relationships between BMI and community SES were non-significant (see Table 16).

5.8 Findings for AIM 2

To examine the association between contextual community resources and health outcomes (self-rated health, number of unhealthy days, and physical functioning) in adult North Carolinians, controlling for individual-level SES and demographic covariates.

First, the relationship between the community-level variables and individual-level variables were examined and can be found in the accompanying correlation matrix (Table 17). There was moderate positive correlation between rate of box stores and rate of private gym and recreational facilities (.546, $p<0.001$), rate of grocery stores and rate of restaurants (.654, $p<0.001$), rate of grocery stores and rate of private gym and recreational facilities (.543, $p<0.001$), public recreational facility score and public transportation availability (.486, $p<0.001$), and public transportation availability and community population (.664, $p<0.001$). Public recreational facility score and rate of pharmacies were moderately negatively correlated (-.539, $p<0.001$).

The variance inflation factor (VIF) was measured to examine the proportion of variance the outcome variables shared with the other independent variables (multicollinearity). The highest VIF value was 2.65 for each model separately examining health outcomes (see Table 18), and the mean VIF value is 1.67. This value indicates that coefficient for the public transportation variable is 2.65 times greater than it would have been if it was independent (i.e. uncorrelated with) of the other variables, and that there is no evidence of multicollinearity (Chatterjee & Hadi, 2006; StataCorp, 2003).

Second, the relationship between the three health outcomes of interest -- self-rated health, un-healthy days, and physical functioning (PCS score) -- were examined (see Table 19). It was found that self-rated health was negatively correlated with unhealthy days (-.526,

p<0.001) and was positively correlated with physical functioning (.712, p<0.001). That is to say, participants' with lower self-rated health were more likely to report a greater number of unhealthy days and have a lower physical functioning score. The number of unhealthy days was negatively correlated with physical functioning (-.532, p<0.001), that is those participants reporting a greater number of unhealthy days had a worse physical functioning score.

Because the health outcomes are moderately to strongly correlated, multivariate analysis of variance (MANOVA) was conducted to determine whether or not an outcome variable is affected by the predictor variables independent of the other outcomes. The Wilks' Lamda test (F=16.29, df=60, p<0.001*)* suggests that the predictor variables have a significant relationship with the joint distribution of all three heath outcomes (self-rated health, un-healthy days and physical functioning) and indicates that these outcomes are not affected by the explanatory factors independent of the other outcomes.

The results of the MANOVA lead to separately examining contextual community resource measures as predictors of self-rated health, unhealthy days, and physical functioning, using general linear mixed models that accounts for individual-level variables (level-1) and community-level variables (level-2).

5.8.1 Unhealthy Days

The effect of contextual community resources on un-healthy days was examined and results are presented in Table 20. The first model is a null model, showing the intercept value of (B=9.006, p<0.001), with an intra-class correlation (ICC) of B=0.026, SE=0.013). The second model examines contextual community resources and unhealthy days. In this model,

participants living in communities with public transportation have 4 fewer unhealthy days (B= -4.260, p<0.001). The final (full) model adjusts for individual-level covariates. The significant relationship between number of unhealthy days and public transportation remains, but is reduced. Participants living in communities with public transportation roughly had 2.8 fewer unhealthy days (B= -2.796, p=0.004). Participants who were women (B=1.689, p=0.006), younger (B= .054, p=0.008), had annual household incomes below $45,000 (B= 2.810, p<0.001), and self-reported arthritis (B=4.408, p<0.001) or depression (B=9.265, p<0.001) had greater numbers of unhealthy days.

5.8.2 Physical Functioning

The effect of contextual community resources on physical functioning (as measured by the Physical Component Summary (PCS) score) was examined and results are presented in Table 21. The first model is a null model, showing the intercept value of (B=45.58, p<0.001), and an ICC of B=0.034, SE=0.015. The second model examines contextual community resources and physical functioning. In this model, participants living in communities with public transportation have better physical functioning and score nearly 4 points higher on the PCS (B=3.774, p=0.001). In addition, participants living in communities with a higher community rate of hospital beds score slightly lower on the PCS (B= -.236, p=0.002). The final (full) model adjusts for individual-level covariates. A significant relationship between public transportation and physical functioning remains, however it is slightly reduced. Participants living in communities with public transportation scored 3 points higher on the PCS (B= 3.215, p=0.002), than those living in communities without public transportation. There was a trend for participants to have lower physical functioning if

they lived in communities with higher public recreational facility scores (B= -.579, p=0.088) or if they lived in communities with higher rates of hospital beds (B= -.132, p=0.054). Participants who were women (B= -1.746, p=0.008), younger (B= -.129, p<0.001), had annual household incomes below $45,000 (B= -4.094, p<0.001), had less than a high school education (B= -2.695, p=0.010), and self-reported arthritis (B= -6.263, p<0.001) or depression (B= -3.312, p<0.001) had lower physical functioning as measured by a lower PCS score.

5.8.3 Self-rated Health

The effect of contextual community resources on self-rated health was examined and results are presented in Table 22. The first model is a null model, showing the intercept value of (B=3.148, p<0.001). The second model examines contextual community resources and self-rated health. In this model, participants reporting better self rated health live in communities with public transportation (B=.375, p=0.005), and higher rates of restaurants (B= .051, p=0.042). In addition, participants living in communities with a higher community rate of hospital beds report worse self-rated health (B= -.020, p=0.015). The final (full) model adjusts for individual-level covariates. The significant relationship between public transportation, rate of restaurants, and rate of hospital beds remains. Participants report better self-rated health if they live in communities with public transportation (B= .244, p=0.007), communities with higher rates of restaurants (B= .044, p=0.007). Participants living in communities with higher rates of hospital beds report worse self-rated health (B= -.010, p=0.038). Participants who were older (B= -.004, p=0.050), had greater body mass index (B= -.025, p<0.001), annual household incomes below $45,000 (B= -.436, p<0.001), less

education: high school (B= -.160, p=0.009) and less than high school (B= -.337, p<0.001), less professional jobs, such as service, farming/forestry/fishing, or production (B= -.126, p=0.029), and self-reported arthritis (B= -.369, p<0.001) or depression (B= -.465, p<0.001) had lower self-rated health.

5.9 Findings for AIM 3

To examine the role that compositional community SES exerts on health outcomes (self-rated health, unhealthy days, and physical functioning), both alone and within the context of contextual community resources/SES.

5.9.1 Un-Healthy Days

The role of compositional community SES (% individuals in community living in poverty) on unhealthy days was examined and results are presented in Table 23. The first model, covariates only, examines the relationship between individual-level socio-demographic variables and unhealthy days. Compositional SES is added to the second model (Compositional SES). The relationship between socio-demographic variables and unhealthy days remains the same: Those that are younger (B=.059, p=0.003), women (B=1.68, p=0.006), live in households that earn less than $45,000 (B= -3.067, p<0.001), and self report arthritis (B=4.514, p<0.001) or depression (B=9.216, p<0.001), report a greater number of unhealthy days. In this model, compositional community SES (% individuals in a community living in poverty) is predictive of unhealthy days. That is, participants living in communities with higher levels of poverty self-reported fewer unhealthy days (B=-.181, p=0.001). When fully adjusting for other contextual community resource measures, the relationship remains for the individual-level socio-demographic variables. Inclusion of

community-level contextual resources (SES) reveals that there was a trend for participants living in communities with community-wide public transportation; the latter had nearly 2 fewer unhealthy days (B= -1.913, p=0.063). Furthermore, inclusion of contextual resources in the model reduces the significance of the relationship between compositional community SES (% individuals in a community living in poverty) and number of unhealthy days (B=-.147, p=0.017).

5.9.2 Physical Functioning

Table 24 presents the results examining the relationship between compositional community SES and physical functioning (as measured by the Physical Component Summary score). In the first model containing only socio-demographic covariates, being older (B= -.119, p<0.001), having a higher body mass index (BMI) (B= -.309, p<0.001), being a woman (B= -1.838, p=0.006), having an annual household income less than $45,000 (B= -4.127, p<0.001), having education less than high school (B= -2.880, p=0.006), and self reporting arthritis (B= -6.334, p<0.001) or depression (B= -3.259, p<0.001), significantly predicted a worse physical functioning score. In the second model, compositional community SES (% individuals in a community living below poverty) does not significantly predict physical functioning (B= .094, p=0.122), and the relationships for the individual-level socio-demographic covariates remain essentially the same. In the final full model, compositional community SES does not significantly predict physical functioning (B= .027, p=0.685); however, there is a predictive relationship for contextual community resource measures. Participants living in communities with public transportation had better physical functioning (3 PCS score points higher) (B=3.052, p=0.006) and there was a trend for those participants

living in communities with a greater rates of hospital beds to have worse physical functioning (B= -.112, p=0.049). The relationships for the individual-level sociodemographic covariates remain the same as in the first and second models.

5.9.3 Self-rated Health

The role of compositional community SES (% individuals in community living in poverty) on self-rated health was examined and results are presented in Table 25. In the first model containing only socio-demographic covariates, having a higher body mass index (BMI) (B= -.025, p<0.001), having an annual household income less than $45,000 (B= -.439, p<0.001), having education at the high school level (B= -.159, p=0.010) or less than high school (B= -.344, p<0.001), ever or currently working in occupation like service, farming/forestry/fishing or production (B= -.125, p=0.026), and self reporting arthritis (B= -.373, p<0.001) or depression (B= -.457, p<0.001), significantly predicted lower self-rated health. In the second model, compositional community SES (% individuals in a community living below poverty) was not associated with self-rated health (B=.007, p=0.199), and the relationships between the individual-level socio-demographic covariates and self-rated health remained the same. In the final, fully adjusted model, compositional community SES does not significantly predict self-rated health; however there is a predictive relationship for contextual community resources measures. Participants living in communities with public transportation had better self-rated health (B=.229, p=0.018). Those living in communities with a higher rate of restaurants (B= .041, p=0.016) had better self-rated health, while those participants living in communities with a greater rate of hospital beds had worse self-rated health (B= -.011, p=0.034).

CHAPTER 6

DISCUSSION

6.1 Overview

This Chapter reviews and highlights the results in Chapter 5 and offers an interpretation of these results. In addition, the strengths and limitations of this study are addressed. Finally, future applications and implications for community-level research are discussed.

6.2 Discussion of Findings -Aim 1

Community resource domains that emerged as relevant to this sample of North Carolinians' health after a thematic review of focus group discussions was conducted (see Table 3), were considered in conjunction with a review of the current community socioeconomic status (SES) literature, as well as the contextual dimensions, components and indicator variables that emerged from the expert CDC workshops (Hillemeier et al., 2003). Several community resource domains emerged from the data-triangulation (Recreational Facilities, Shopping Facilities, Restaurants/Fast Food, Medical Facilities and Services, and Transportation) were examined, however other dimensions that emerged from the focus group were not.

For example, 'employment opportunities' was one emerging theme that was not examined as a contextual community resource factor in Aim 2 and Aim 3, because it was not available at a city level. The Quarterly Census of Employment and Wages Program (QCEW),

a cooperative program involving the Bureau of Labor Statistics (BLS) of the U.S. Department of Labor and the State Employment Security Agencies (SESAs), collects interesting community-level SES information, such as the number of employment establishments and average weekly wage. These data, however, were only available to operationalize this 'employment opportunities' at the county level. Employment data are not collected by the BLS at a geographic level smaller than county or metropolitan statistical area, and therefore this measure could not be used in this study.

While water availability and quality were considered to be conceptually in line with contextual community resources, those variables posed some methodological difficulties. First, while information regarding water availability or quality for North Carolina cities and towns is available through individual city and town water departments, it appears to not be collected in a systematic way. A comprehensive state-wise public-use database was not readily identified. Moreover, if cities and towns offered water and/or sewer service, there would be little to no variability in the quality or rates of resident usage (e.g., all city residents are exposed to the same water quality).

Of note, environmental pollution and vehicular traffic emerged as community characteristics that were highlighted and discussed in the focus groups. While these two community characteristics may be considered important in relationship to health and health outcomes like quality of life, they were not considered community resources in this study and were not explored in further detail.

The five highest ranking community resources (excluding employment opportunities) that were examined as community level variables in Aim 2 and Aim 3 in this study are:

Recreational Facilities, Shopping Facilities, Restaurants/Fast Food, Medical Facilities and Services, and Transportation.

6.3 Overview of Main Findings

Aim 2 of this study examined the relationship between contextual community resource measures and measures of Health Related Quality of Life. Three contextual community resource measures emerged as significantly related to the health-related quality of life (HRQOL) outcome measures. These are community-wide public transportation, rate of restaurants, and rate of community-wide hospital beds. Findings for the Aim 2 main analyses will be discussed in relation to each contextual community resource domain finding, rather than being discussed for each HRQOL outcome measure. Possible explanations are offered for these findings, along with thoughts on why other measured contextual community resource variables were not significant predictors of health related quality of life.

Aim 3 examined the role of contextual community resource measures on health-related quality of life (self-rated health, number of unhealthy days, and physical functioning), adjusting for the effect of compositional community SES (operationalized as percent of individuals in the community living below poverty). These models demonstrate that contextual community resource (public transportation, rate of restaurants, and rate of community-wide hospital beds) significantly predict health-related quality of life outcomes in this group of North Carolinians.

6.4 Discussion of Findings – Aim 2

Transportation

Availability of community-wide public transportation emerged as an important factor to participants' health related quality life. Participants living in cities with community-wide public transportation reported greater physical functioning scores and greater self-rated health, as well as a trend toward fewer unhealthy days after controlling for other community-level and individual-level covariates. Two possible explanations are offered for these findings, as well as why other measured contextual community resource variables did not significantly predict health-related quality of life.

First, participants in this study were asked in the telephone interview, "What is the one way you most frequently get to places you want to go?" and were read a list of choices. The majority of participants self-reported that they drive themselves (88.4%) or that a friend/relative drives them (9.5%). Only 6 participants noted that they took public transportation as the one way they most frequently get to places they want to go. However, this one survey question only asks about primary mode of transportation; it fails to assess whether individuals occasionally use secondary modes of transportation, such as public transportation, to get to work, shopping centers, medical facilities, or entertainment venues. That is, the individual-level data may do a poor job of capturing the impact of transportation resources. The predictive value of the contextual variable suggests that there is value in public transportation despite low reliance on it as a primary means of getting from place to place. Our data suggest that further investigation using more nuanced assessment methods may reveal that individuals living in communities with public transportation *do* use it to 'get places they want to go' albeit to a lesser degree than personal vehicles. This access to alternate modes of transportation may have a positive influence on health, either by reducing

overall stress due to driving (Frumkin, 2002) increasing perceived control (Rittner & Kirk, 1995), or facilitating access to needed services (Rittner & Kirk, 1995).

Second, communities with a public transportation system are often required by law to have a parallel paratransit service. The goal of paratransit service is to accommodate older or disabled residents, making public transportation available to them for specific travel (e.g. to access medical services). While this sample is predominately middle aged (mean age=52.7), 52.1% of the participants were 52 to 92 years old. It is possible that participants living in communities with a fixed public transportation system use paratransit transportation to access additional health care resources or needed services. Public transportation can help older or disabled adults maintain independence longer by enabling them to conduct 'business as usual' without relying upon friends and family to get around town. Thus, in addition to facilitating direct access to needed resources, access to public transportation and paratransportation may lead to increased feelings of self-efficacy or belief that one can continue 'business as usual.' These, in turn, may influence health-related quality of life factors such as self-rated health and physical functioning, especially among older residents.

Restaurants

Participants living in communities with higher rates of restaurants self-reported significantly better self-rated health. A few possibilities will be explored for why a greater community rate of restaurants significantly predicts greater self-rated health, especially given that this rate consists of both fast food and sit-down restaurants.

First, while the availability of fast food restaurants has been linked by health professionals to negative health behaviors (increased consumption of higher fat/energy dense/lower fiber foods) and negative health outcomes (increased obesity and heart disease)

(Maddock, 2004), the public's perception of these food outlets may differ. The availability of a fast food outlet or restaurant may offer perceived convenience in terms of both the cost and value of time and money (Jekanowski et al., 2001 ; Rydell et al., 2008), especially given increasing work and home life demands. Increased convenience may reduce the overall psychological stress or physical burden that is created by financial cost and efforts associated with purchasing food for at home preparation. Therefore, fast food outlets and restaurants may be viewed by some as a helpful option (e.g., a way to obtain a meal in a time and cost-effective manner) versus being viewed as an unhealthy option, thus influencing the relationship between fast food outlets and restaurants and self-rated health.

Second, previous research has found that grocery store or commercial food outlet placement within communities is often in areas of higher income and percentage of non-black residents (Franco et al., 2008; Morland et al., 2002b; Ball et al., 2009). However while some researchers have found that 'deprived' areas tend to have more fast food restaurant establishments (Block et al., 2004; Hemphill et al., 2008; Cummins et al., 2005a), other intra-urban studies have noted that food outlets (restaurants or fast food) been found to be placed in target areas that are chosen for location accessibility (Jekanowski et al., 2001; Macintyre et al., 2005). It is possible that many of these outlets serve as a primary source of food - not only for individuals living in close proximity, but for other community residents as well. The stability of the availability of food, despite the unhealthy properties of most menu options, may relieve the psychological stress of obtaining a meal, either for oneself or one's family. In addition, comfort and familiarity with menu options, quality, and taste might be reflected in the higher reported self-rated health.

Finally, a greater community rate of restaurants may indicate more opportunities for individuals to make personally relevant food choices when purchasing food away from home. Fast food outlets, chain and other restaurants have increased their 'healthy menu' options to include salads and fruit as a response to public health campaigns combating the growing obesity epidemic, thus furthering the opportunity for individuals to control their food choices. Increased real or perceived control over food choices deemed 'healthy' by an individual might increase their self-rated health.

Hospital Beds

The finding that individuals who live in communities with a greater number of hospital beds experience lower health related quality of life (self-rated health and physical functioning) may seem counter intuitive. That is, it might be assumed that residents living in communities with greater medical resources (hospitals with larger bed facility capacity) would experience and self-report better health related quality of life. Given that this was a cross-sectional study and we are unable to determine causal effects, three interpretations are possible.

First, this sample is predominately older, and older participants reported worse physical functioning. Many retirement communities have been situated close to North Carolina cities (e.g., Asheville, Hendersonville, and the Triangle) that have major health care infrastructure and resources. It may be that participants of this study purposefully chose to live in communities with greater health care resources (e.g. greater hospital facility capacity) because they either have heath conditions that currently or will require attention in the future. Conversely, hospitals are also purposefully situated in areas of highest need. Again, because this was a cross-sectional study, it is difficult to ascertain causal effect.

Second, study participants living in communities with greater access to healthcare (e.g. greater health care infrastructure, greater access to prevention and detection technology, or more health care specialists/practitioners) might more frequently avail themselves of these resources than those participants living in communities with fewer resources. These participants may be more active health-care seekers and more accurately know their current health care status. For example, if one has regular medical appointments and is aware that their diabetes is not under control, they may report lower self-rated health than someone who does not seek regular care.

Finally, the rate of hospital beds was chosen as a proxy for the magnitude of medical infrastructure in a city or town. This may have not been an ideal indicator of medical resources, and future research might consider the role of primary care specialists in relationship to health related quality of life outcomes.

Other Contextual Community Resource Domains

While specific hypotheses were not made, we anticipated that grocery stores might have a statistically significant relationship with one or more of the health related quality of life measures. That is, a greater community rate of grocery stores would lead to better self-rated quality of life, better physical functioning, or a fewer number of self-reported unhealthy days. Our finding are not in line with previous research; that is research examining differential geographic placement of food/grocery stores due to area socioeconomics (Morland et al., 2002b; Morland et al., 2002a), found that lack of food availability negatively influenced health outcomes like obesity and heart disease(Diez-Roux et al., 1997; Ellaway et al., 1997; Sundquist et al., 2004; Sundquist et al., 1999), as well as negatively influencing health behaviors like maintaining a healthy diet and being physically active (Franco et al.,

2009; Morland et al., 2002a; Cheadle et al., 1991; Diez-Roux et al., 1999; Lee & Cubbin, 2002). Most of this prior research, however, has examined grocery stores in smaller geographic areas, like census tracts and often in more urban areas (Morland et al., 2002b; Franco et al., 2008; Block et al., 2004). Other factors may play an important role among individuals living in non-urban areas.

For example, North Carolinians may be obtaining their produce and meat from sources other than conventional food stores. Prior research (with the same group of North Carolinians as used in this current study) examined the role of perceived community environmental influences on fruit and vegetable intake. It was found that many participants obtained fruits and vegetables from local farm stands or even raise a garden themselves (Boyington et al., 2009). North Carolina has historically been and continues to be a predominately agriculturally-based state, with farming operations ranging from small family farms to large corporate operations. Grocery stores may not have emerged as contextual community resource factor predictive of health related quality of life because North Carolinians have a number of options available to them for obtaining food outside of commercial food stores.

Second, the results may be indicative of participant activity-space patterns. An overwhelming majority of participants self-reported driving themselves (88.4%) or having a friend drive them (9.5%) as their form of primary transportation. Even if a community lacked a grocery or food store, it appears that participants in this study could easily access a grocery store by driving themselves or being driven to a neighboring community. Participants might even go to shopping areas outside their city of residence to grocery shop at a preferred store. Finally, participants might choose to grocery shop in activity areas closer to work or other

social activity areas for convenience. Given these possible explanations, the community rate of grocery stores would have little impact on a health outcome like quality of life.

Alternatively, there may be a possibility that a threshold effect exists for the relationship between grocery stores and health related quality of life at this geographic level. A greater community rate of grocery stores did little to increase self-reported health related quality of life (HRQOL) in this study, when compared to communities with lower rates of grocery stores. It may be that there is some cut-point (e.g. above or below a certain rate per 1000 residents or per capita density) within a geographic area, like a city or town, that is positively or negatively influential to HRQOL. Other contextual community resource measures in this study, big box stores and pharmacies, may operate in the same regard.

Finally, as discussed above, most past research has examined grocery store placement at different geographic levels and in respect to health outcomes like heart disease and obesity or health behaviors like diet and exercise. Perhaps no observable relationship exists between shopping facilities (grocery, box stores or pharmacies) and health related quality of life, either because of the geographic area (city) or outcomes chosen (self-rated quality of life, physical functioning and number of unhealthy days).

Public Recreation Facility Score

Findings from this study indicate that there was a trend for participants living in communities that received a higher public recreational facility score to have worse physical functioning. Because the initial bivariate analyses examining the relationship between public recreational facility score and each health related quality of life outcome were not statistically significant, this emergent trend after controlling for other covariates might be an indication of a suppressor effect. That is to say, that the covariates are functioning as

suppressors, because their presence masks the true non-significant relationship by creating what looks like a stronger relationship between public recreational facility score and physical functioning.

Public recreational facilities were scored according to a review of public recreation pages on city and town websites for three reasons. First, an exhaustive search failed to uncover public-use data that outlined specific objective city and town public recreational facility characteristics (e.g. dollar expenditure or number of acres set aside). Private communication with Chapel Hill Parks and Recreation worker, Bill Webster, revealed that public parks and recreational facilities information was once collected from all cities and towns in a systematic way, under the "Million Acre" initiative lead by Governor Hunt in 1999. However, later administrations have not continued to collect state-wide data in the same way, so no public listing of city and town parks and recreation characteristics is currently available. Second, while most communities had websites highlighting their public areas for recreational activity, few gave information in a standardized way. Finally, previous research had suggested that quality of public activity areas is an important characteristic of the built environment and should be examined in the future (Ellaway et al., 2007). This score measure attempted to subjectively capture the quality of community public recreational facility resources in a systematic way to assess breadth and scope of community public recreational facilities, so that resource comparisons could be made between communities.

While not specifically hypothesized, it was believed that a greater community public recreational facility score would result in better health related quality of life in this group of study participants. Several reasons may exist for why a significant relationship did not emerge between the subjective measure of public recreational facilities and health related

quality of life. First, residents who live in areas with access to better community parks and recreational programs may not take advantage of these resources to be more physically active. Previous research conducted with this same group of participants revealed that the majority walk in their neighborhood for physical activity and cited lack of sidewalks as a top community barrier (Martin et al., 2007). Second, as discussed above, this group of North Carolinians is very mobile and has good access to personal transportation. Participants might also be taking advantage of areas outside of their community to be physically active, especially since there are a wide variety of natural, green spaces from the coast to the mountains. And finally, it could be that rating city website pages to gauge the quality and capacity of the city's park and recreational facilities was an imperfect measure. That is to say, that the measure was capturing information (not about the parks) but rather the quality, commitment or city resources available to post current information and manage a city website. The ability to disentangle the relationship between city resources devoted to website management and actual parks and recreational facility quality is difficult to tease apart.

6.5 Discussion of Findings –Aim 3

Building upon Aim 2, the analyses of Aim 3 were conducted in order to better understand whether or not the identified contextual community resources (as proxy for the concept of community SES) added to or clarified the relationship between community-level SES and the health related quality of life (HRQOL) outcomes. While not formally hypothesized, it was believed that greater community-level poverty (% individuals in community living in poverty) would be associated with lower HRQOL, specifically lower physical functioning and greater number of unhealthy days. This expectation was born from

results of a previous study that found better HRQOL (physical functioning – PCS and healthy days) were associated with higher levels of community SES (low census block-group poverty) in a group of North Carolinians, after adjusting for demographics and clustering (Callahan et al., 2009).

While compositional community SES was predictive of number of unhealthy days, it was inversely related. That is, participants living in communities with higher levels of community poverty reported a fewer number of unhealthy days. Two possible explanations for this finding are offered. First, communities with higher poverty rates may offer more social programs to city and town residents than those communities with lower poverty rates. Local community government, community agencies, or non-profits may be more present in higher-need communities than in wealthier communities, and are more likely to offer meal services, physical and mental health care services, and/or programs to network residents to additional local, state or federal programs, which in may have been related to the number of unhealthy days reported by our participants. Second, participants living in communities with higher community poverty, even after adjusting for individual income and occupation, may regularly encounter additional negative community environmental conditions. Participants may have reported a fewer number of unhealthy days because their perception of their individual health is relative to their external environment and they have additional barriers to navigate, thus diminishing the amount of attention they have available to assess their daily health status.

Moreover, compositional community SES did not fully explain the relationship for self-rated health or physical functioning, yet inclusion of contextual community resources revealed that community-wide public transportation, rate of hospital beds, and rate of

restaurants are important community resources that influence individual HRQOL. The findings for Aim 3 show that adding contextual community resource measures into the multi-level models helped to more fully explain the role of community SES on individual HRQOL than the singular measure of compositional community for this participant population. These findings indicate that use of only one compositional community SES variable (in this case, % of individuals in a community living below poverty) might fail to account for the importance of contextual community resources on HRQOL, especially if geographically defining community as city or town.

6.6 Alternate Explanation of Findings

In addition to the discussion above, it is necessary to highlight other possible explanations for the study findings. First, this study aimed to identify community resources and quantitatively capture these characteristics. While this was accomplished, it must be noted that this methodology yields a strictly objective measurement of a particular community resource by purposefully acknowledging, yet somewhat simultaneously ignoring the complexity of community-level research. There are an incredible number of historical, social, economic, political and environmental considerations that influence current community characteristics and resources. These are often so tightly intertwined that these influencing factors are nearly impossible to separate apart. In the case of transportation, other community aspects that influence resident health related quality of life may have been captured in addition to city-wide public transportation availability in 2005. For example, the presence of a public transportation system might indicate a commitment to provide for the well-being of community residents on behalf of local government. This type of community

resource might also reflect the ability of local government to obtain local, state or federal funds (e.g. corporate and residential tax structure, application for grants) that contribute to the overall wealth of a community. Finally, it could also be that a community resource (like public transportation) also reflects the historical and/or current spirit of community residents and government officials to organize, structure, and operate services and resources. It has been previously stated that "people make places and places make people" (Kawachi & Berkman, 2003), and availability of community resources may be reflective of other social contexts (e.g. in and out migration patterns or a history of racial/geographical segregation of residents).

6.7 Strengths and Limitations

This study has a number of strengths that should be noted. It was conceptualized after careful consideration, understanding and appreciation of the complex relationship between community and individual influences on health outcomes. Building from previous research, this study is the first to examine the combined role of compositional community SES and contextual community resources on measures of health related quality of life. In addition, this research furthers the field, by examining the influence of community SES on individual health across North Carolina cities. The majority of prior research has examined these types of relationships in predominately urban settings; this research encompasses rural, suburban and urban areas of North Carolina.

A methodological strength is that this study used data triangulation (formative research, literature, and report of CDC experts) to identify domains that best represent relevant contextual community resources for this sample of North Carolinians. This type of

complimentary mixed methodology allowed for greater interpretability and validity that the domains are relevant to this participant sample (given that they emerged as part of the data triangulation), while potentially decreasing any potential biases that might have come from only using one method (Greene et al., 1989; Tashakkori & Teddlie, 2003). This allowed the research to go beyond the use of standard aggregate individual-level data (e.g. US Census) as a proxy for community socioeconomic status.

Finally, this study took advantage of no-cost secondary data that were available both at the individual level (survey and qualitative data from the Social Determinants of Health Study) and community level (from various public-use data sources, e.g. ReferenceUSA). Most research makes use of US Census data because those data are free and easy to obtain; this research provides support for the assertion that non-aggregate community data can also be accessed at no cost, yet requires some effort. Identification of which data to use and where 'usable' data are located may become easier as researchers further examine contextual community variables.

In this study, the primary outcome measures of health related quality of life (self-rated quality of life, physical functioning and number of unhealthy days) were subjective self-report measures. Self-report data are often at risk for introducing bias into the study, especially given that information is acquired in a telephone-survey rather than in-person. Yet, these health-related quality of life measures have been examined and found to have low response error (Centers for Disease Control and Prevention, 2000; Ware, Jr. et al., 1996), and provide useful information about individual self-reported health.

A second limitation concerns how the communities in which participants lived were identified. City of residence was obtained using the home addresses participants self-reported

during the parent study telephone survey. It is important to note again that while North Carolina has a number of urban areas (e.g. Durham and Greensboro), there are large portions of the state that are quite rural. It is possible for a participant to live in an area not contained within official city or town limits, but have a city or town address. This may have lead to misclassification of some participants' city of residence and therefore introduced some bias into the results, so cautious interpretation of results was warranted. This study did not aim to examine the perception of community on measures of HRQOL, nor did it intend on examining the relationship of multiple community spaces (differences between where one works, lives and plays). Future studies may want to explore these concepts in relation to contextual community socioeconomic status.

City data was not obtained at the time of telephone survey data collection. This meant that those contextual community measures created from 2008 counts and standardized per 1000 residents using the city/town 2005 population, were not true measures of the community resource in 2005. It is possible that during the elapsed time from 2005 to 2008, the make-up of North Carolina cities and towns may have changed. If community data had been collected during the original survey data collection, rates might have been higher or lower than the data used in this study. Using more current city data may have increased the community effect on the health related quality of life outcomes measures, as well as having a more robust between-community variance as measured by intra-class correlation (ICC). One possible explanation for the low ICC is that North Carolina has witnessed immense economic and growth in infrastructure over the past decade. As rural and suburban areas have developed, residents of these communities have greater access to retail, medical and other resources that influence daily life and quite possibly, health related quality of life. These

changes may have reduced the differences in availability of services between North Carolina communities, both before and during the time that elapsed between telephone survey data collection and downloading public use data. However, despite this limitation, the study has provided useful insights and can form a foundation for further research.

Additionally, this study examined cities of variable size (from sparsely populated to highly populated) and examined the influence of contextual community resources by creating a standardized rate and controlling for city population. It is important to be aware of potential problems that might arise if contextual community resources are non-normally distributed within extremely small or extremely large cities or if certain community variables sampled are not representative of the participant population being examined. For example, the community of Charlotte was dropped from these analyses for two reasons. First, the city population (640,000) was much larger than the second largest city, Greensboro (237,000) that it constituted an extreme outlier. Second, the SODE participants living in Charlotte had been sampled from one small clinic in a specific area of the city. Use of variables representing community resources to examine the influence of community on individual HRQOL in these individuals would have been problematic and could have led to potentially erroneous findings. Future studies might benefit from stratifying by city-size (grouping small, medium and large communities together), and should examine the benefits of conducting multivariate outlier analyses.

Finally, it should be noted that these study findings may not be generalizable outside of the Social Determinants of Health Study (SODE) cohort. While the parent cohort, the North Carolina Health Project, aimed at purposively selected family practice settings so that patients receiving care at the participating practices might be representative of North

Carolinians (based on income, age, racial composition, geographic areas of the state, and rural/urban locations), the SODE cohort was a convenience sampling (participants who agreed to a telephone survey). Because SODE focus group participants were a sub-sample of the larger SODE cohort and both samples are non-representative of North Carolina, we must be careful not to assume that these community resources are important for all North Carolinians or generalize the focus group findings to other populations outside of this Social Determinants of Health Study sample.

6.8 Future Considerations

Future researchers interested in using contextual measures of community socioeconomic status (SES) must understand that not all data are easily available. While this electronic age has made accessing data much easier and the world-wide web can offer social epidemiology researchers a host of current and historical data, there are a few considerations to note. First, the use of census data has made the examination of area-based socioeconomic measures possible. However, as this research highlights, sole use of census data does not fully explain the role of community SES factors on individual health outcomes. Inclusion of contextual community resource measures relevant to the health outcome of interest, population, and geographic area can lead to a richer understanding of the phenomena being examined Secondly, it is important to note that not all ideal data for one's research will be systematically collected and publically-available online in the 'plug and chug' way that census data are available. Obtaining contextual community resource data may be more time-intensive and require an investment on the part of the researcher. Data not available online may be publically available if requested from the right institution or individual. Working

with an information science librarian can facilitate easier identification of sources for useful and relevant publically-available data. Thirdly, it is important to note that as a researcher, one might decide a priori which contextual community resource variables they wish to obtain and the ideal way in which it should be measured. If data are not publically available online, through an institutional contact, or collected in that ideal format , it may be necessary to actively collect information more directly or creatively. Such was the case in this study with the measure, 'public recreational facilities'. Additionally, there are a great number of data sources, such as DemographicsUSA, that have rich datasets available, but at a cost. Researchers with funds for data may have an easier time obtaining contextual community resource data though one of these sources. Finally, it is possible that public electronic online data could become inaccessible if currently available web domains and data pages are taken removed from public access. The specifics of where and how data were collected should be carefully documented so that methods might be replicated if necessary.

In addition, it must be stressed again that there are a multitude of complexities that surround community-level research. The definitions researchers assign to a 'community', be it social or geographic, differ widely in the literature. Communities can be considered as analogous to living organisms that are continually changing due to dynamic forces at play within the community (residents, policy makers, economic environment, employment opportunities), as well as events in the natural environment (natural disasters, extreme weather conditions). Formative research was instrumental in this study for developing and moving this project forward. It also allowed for greater understanding of the historical and current factors (e.g. economic climate) playing a role in community resident's health related quality of life. Fully understanding these current and historical considerations of a

geographical area can allow the researcher to more accurately tailor their investigation in a more meaningful way, as well as interpret findings. Future researchers might benefit from incorporating formative research (like focus groups) into their research as they explore the role of community on individual health outcomes. Additionally, the social determinants of health field must begin to examine these issues longitudinally in the same population over time, rather than just cross-sectionally, so as to determine cause and effect. Greater understanding of these community contextual characteristics and resources might help to identify communities with significant gaps in their infrastructure and resources. Researchers could then begin to translate their knowledge of community-level causes of health disparities to develop community-level interventions that reduce inequalities and poor health outcomes.

Another important direction for future research would be to not only use theoretical frameworks when conceptualizing the mechanisms through which community-level SES influences individual-level health outcomes (as in the case of this study), but to begin to explicitly test theoretically driven models. As researchers continue to examine the many hypothesized pathways through which community socioeconomic status influences health outcomes, particularly in relationship to social support and/or individual-level health behaviors, theory use will become increasingly important. One macro-level perspective that warrants further attention is the Political Economy of Health (PEH). The basic principles are that health is influenced on many levels, including intra-personal, interpersonal, organizational, community and policy. It incorporates historical, economic, political and social-force considerations into the examination individual-level outcomes and suggests that such forces within American society result in health inequalities among community residents (Doyal & Pennell, 1979; Link & Phelan, 1995). PEH has been used previously in informing

health behavior interventions (Linnan & Ferguson, 2007; Linnan et al., 2001) and could prove useful in informing community or policy-level interventions.

Future research might give consideration to an important community resource: social capital. The discussion around social capital and its significance to public health is quite extensive. Briefly, social capital has been conceptualized as a fundamental component of social networks, which goes beyond social support. Social capital is most often captured using subjective measures of physical environment, neighborhood connections, trust, reciprocity, safety and local civic action, and previous research has examined its influence on health outcomes (e.g. mortality, self-rated health) (Kawachi et al., 1997; Veenstra, 2005; LeClere et al., 1998; Kawachi et al., 1999a; Ziersch et al., 2005). Most often, individual-level self-report data are aggregated to create a community-level measure of social capital (Baum & Ziersch, 2003).

In this current study, qualitative analyses revealed that participants considered community organizations a community resource that mattered for health. Conceptualizing social capital as "a product of broadly defined social relations" (Lynch et al., 2000), rather than the standard psychological conceptualization, might lead researchers to consider community organizations or agencies as a type of formal, structural and/or linking social capital (Baum & Ziersch, 2003; Altschuler et al., 2004). That is, research interested in examining the role of social capital on health inequalities could measure social capital not only subjectively, but objectively as well (e.g. transportation, meals, housing, or medical outreach). Perhaps the breadth and depth of resources provided by community agencies is predictive of health outcomes, (e.g. self-rated health, mortality or chronic diseases like heart

disease and diabetes) above and beyond aggregated levels of membership in civic organizations. Assessing this possibility merits further attention.

Additionally, prior studies often have used composite indices to measure community socioeconomic status or area-level deprivation when examining the relationship between place and health. Most indices include variables such as percentage below poverty, age 25+ with less than high school education, housing units lacking plumbing, percent owner occupied housing. Because this study was exploratory in nature, only one measure, "percentage of individuals below poverty", was used to examine the role of compositional community SES on health related quality of life. While this one measure is proven to be a robust single measure of area-based SES and has performed as well as composite SES measures (Krieger et al., 2003), future research might examine whether an index measuring compositional SES operates differently.

Conceptual differences may be created when choosing to contextually measure 'deprivation' or 'disadvantage', rather than measuring 'wealth' or 'resources' with non-aggregated community data . A community might be viewed as 'resource rich' or 'not deprived' depending upon the choice of community characteristics being studied; however examining a different set of characteristics may lead the research to consider the community 'resource poor' or 'deprived.' For example, larger communities might have public transportation (which might be considered a community characteristic beneficial to health), but might also have high crime and illegal drugs (may be considered a community characteristic detrimental to health).

Two final points are offered for future consideration. First, the choice to use aggregated individual-level data to create a community-level variable (e.g., US Census data)

may be limiting if the data do not, in fact, reflect intended community qualities. Second, even if communities have resources that are believed to positively influence resident health, residents may not be aware of the resources or avail themselves of those resources.

6.9 Conclusions and Recommendations

This dissertation is an attempt to begin a discussion about what types of data should be used to conceptualize and measure community socioeconomic status (SES). Findings highlight the possibility of using community resources from public-use data sources to examine community-level influence on individual-level health outcomes. Research findings also show that a community-level influence on measures of health related quality of life might be missed if one is reliant upon a single measure of compositional community SES using census data.

As 2010 nears (especially given Healthy People 2010 and 2002 goals), it appears as if health research will continue to examine 'lives in context', through multiple perspectives and lenses. Individual-level health outcomes will most likely continue to be framed in the biological, genetic, social and environmental context. Greater emphasis may be placed on understanding how these contexts are interacting and mutually influencing, while understanding the role these contexts play on individual-level behavior. Research examining the influence of community socioeconomic status or the geographical location of community resources must work toward creating a common language with consistent terms. Researchers must actively and explicitly articulate their choice of geographic area (e.g. census tract, neighborhood, city, or metropolitan service area) and choice of community-level variables as they pertain to study aims and health outcomes of interest. Better understanding of contextual

community characteristics can have policy implications for resource allocation, city and urban planning, and future health interventions to reduce health disparities.

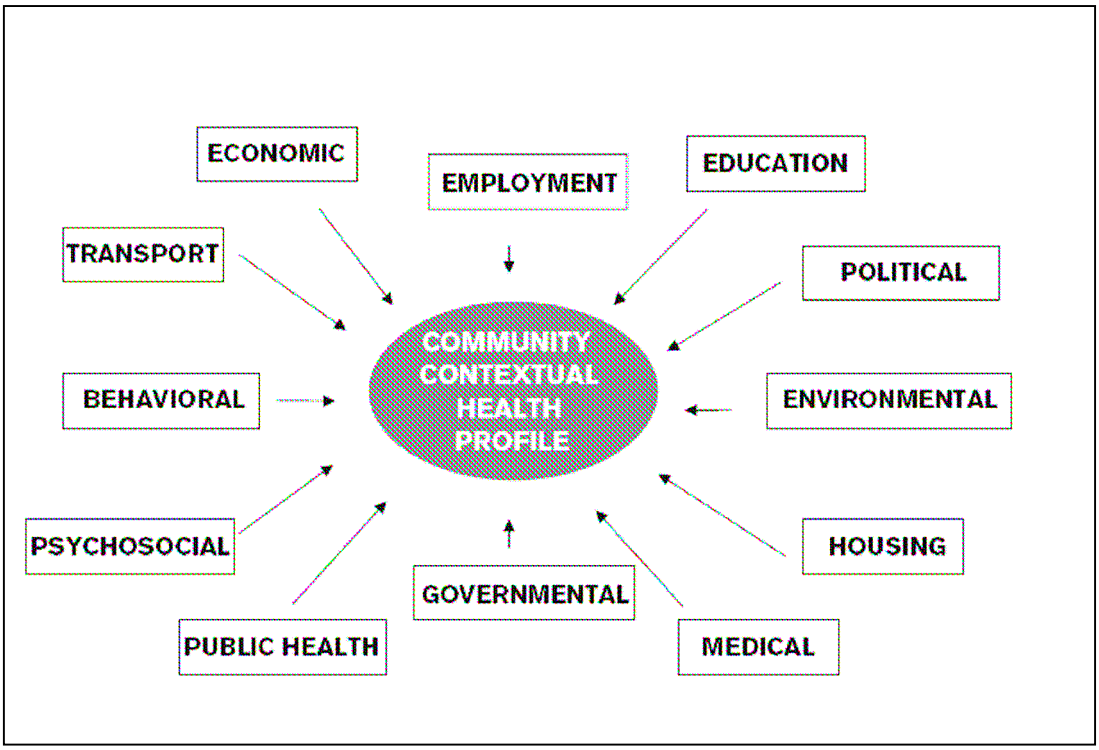

Figure 1. The 12 Community Contextual Dimensions Related to Health

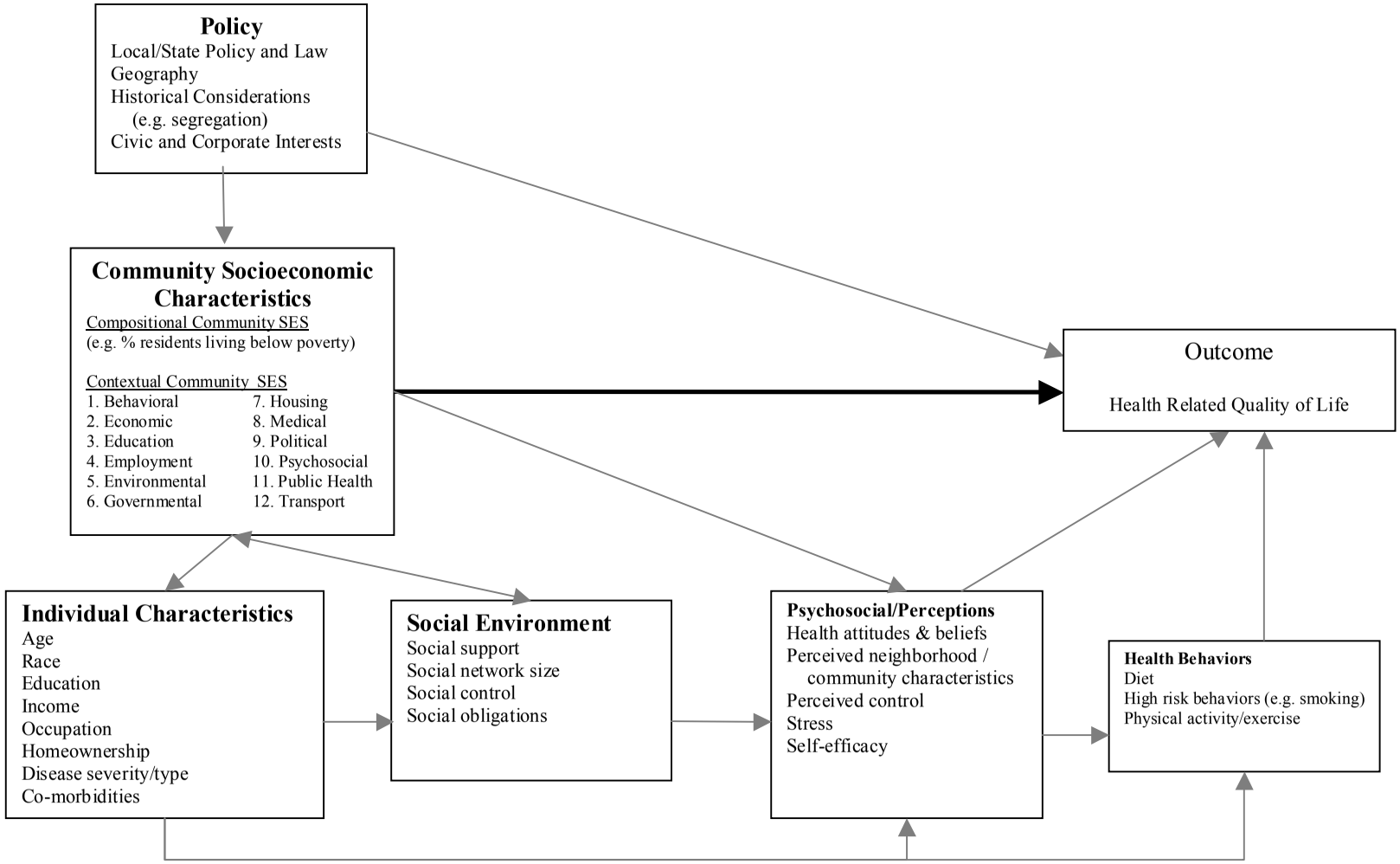

Figure 2. Conceptual Framework of How Contextual Community Characteristics Influence Health Related Quality of Life

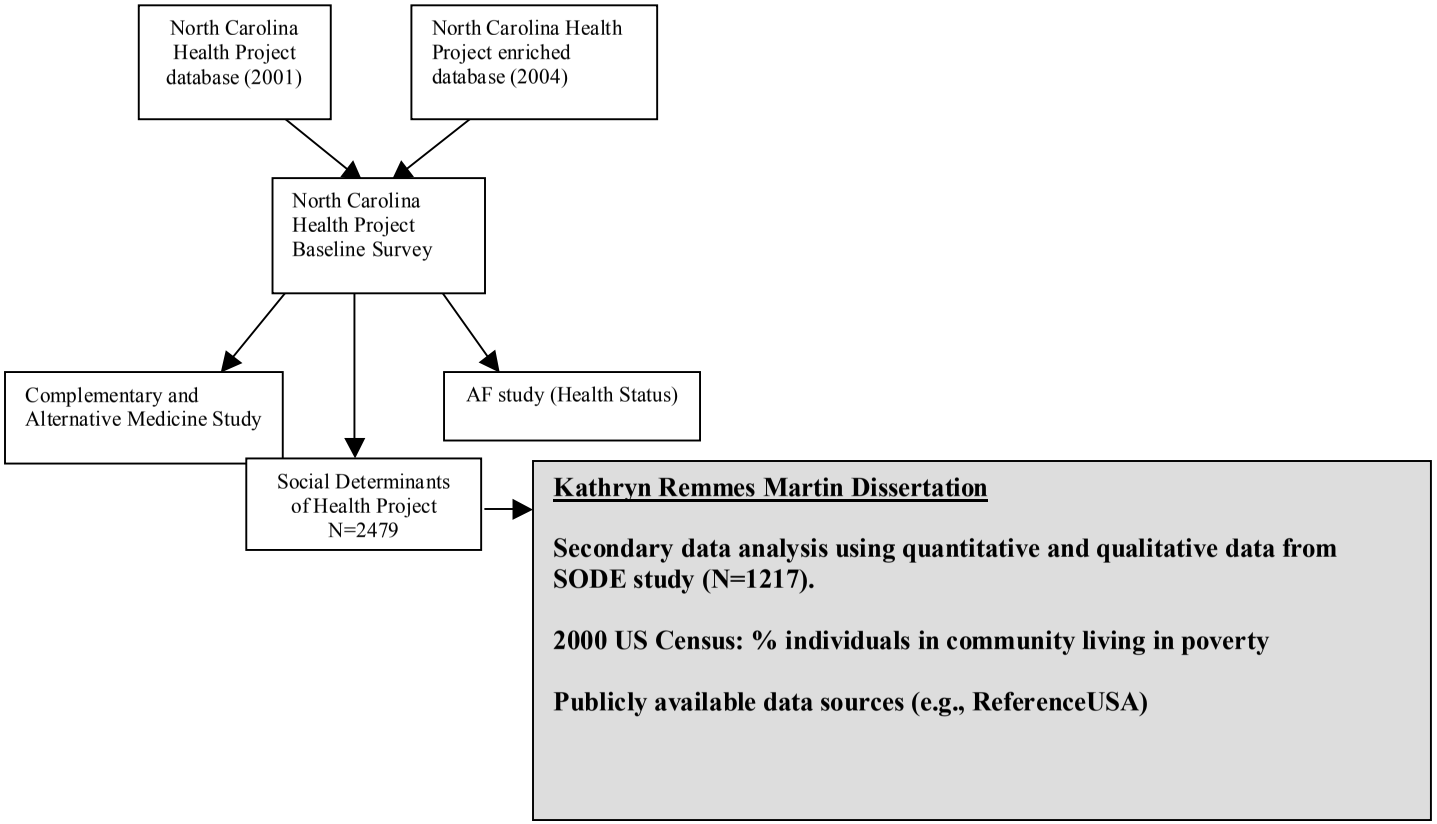

Figure 3. Research Originating from the North Carolina Family Medicine Research Network

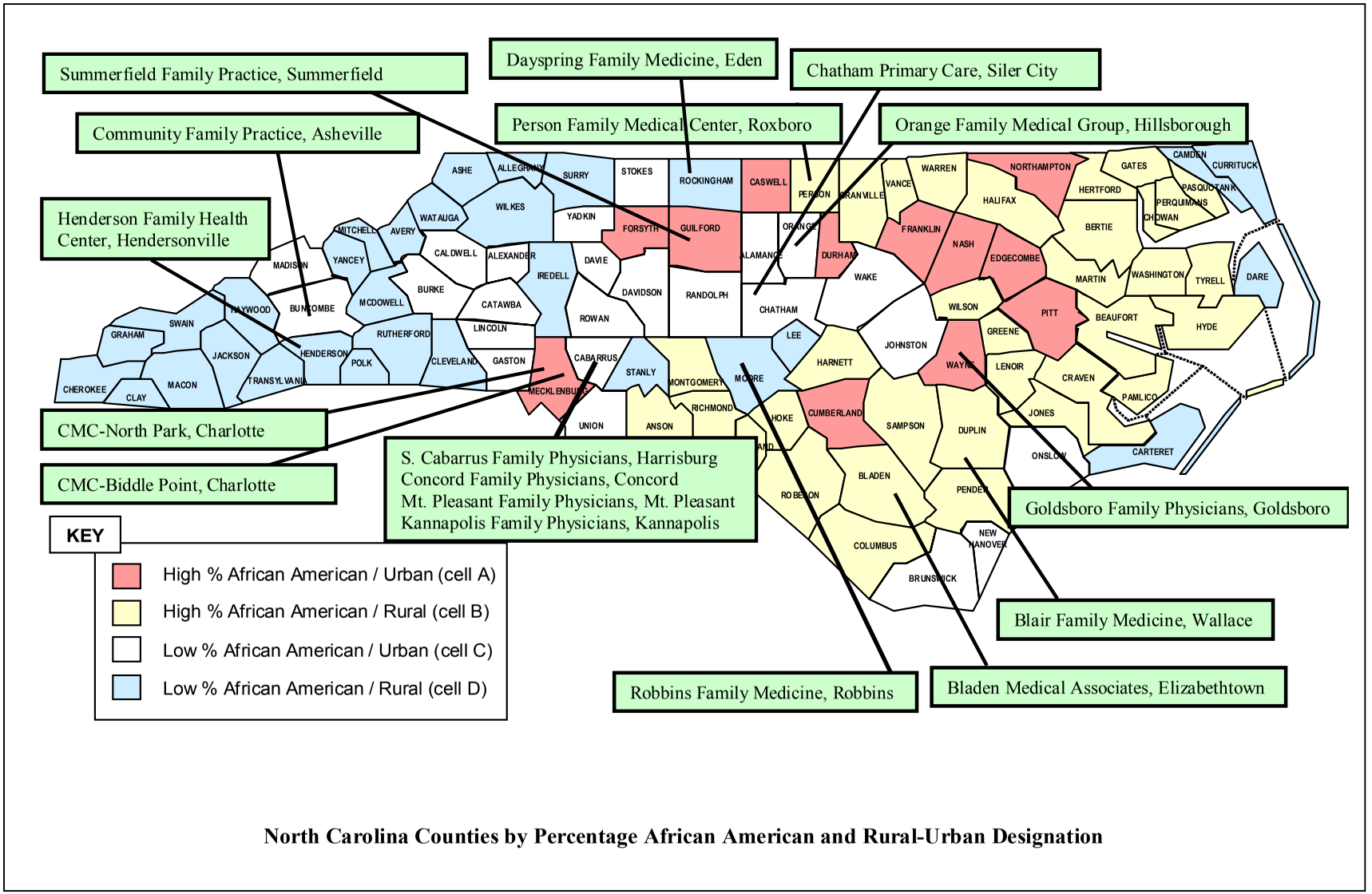

Figure 4. Map of North Carolina Family Medicine Research Network Sites

Table 1. Reviewer #1 Coded Community Resources: Emerging Themes from the Social Determinants of Health Transcripts

"Community Resources that matter for health"	Tally	Asheville n=3	Bladen n=4	Dayspring n=2	Goldsboro n=5	Hendersonville n=3	Person n=3
Recreational facilities	12	X	X	X	X	X	X
Medical Facilities and Medical Specialists	12	X	X	X	X	X	X
Community Service Organizations	11	X	X	X	X	X	X
Shopping facilities/grocery stores	11	X	X	X	X	X	X
Transportation Availability (Public/Medical)	10	X	X	X	X	X	X
Restaurants/Fast food	10	X	X	X		X	X
Employment opportunities	8		X	X	X	X	X
Availability of Emergency services	8	X	X	X	X	X	X
Schools/Educational Programs	8	X	X	X	X	X	
Water Availability and Quality	7	X	X	X	X		
Traffic	7	X	X		X	X	X
Illegal Drugs	6	X	X	X	X	X	X
Church	6	X		X		X	X
Environmental pollution		X	X				X
Mental Health Services			X	X			X
City Government		X		X		X	
Farming/Farms			X				X
Sidewalks			X			X	
Pharmacy			X				
City wide no-smoking policy		X					
Library				X			
Landfill					X		
Noise Pollution					X		
Land Development						X	
Arts & Theatre						X	
Retirement communities						X	
Road maintenance							X

Table 2. Reviewer #2 Coded Community Resources: Emerging Themes from the Social Determinants of Health Transcripts

"Community Resources that matter for health"	Tally	Asheville n=3	Bladen n=4	Dayspring n=2	Goldsboro n=5	Hendersonville n=3	Person n=3
Recreational facilities	12	X	X	X	X	X	X
Employment opportunities	12	X	X	X	X	X	X
Medical Facilities and Medical Specialists	10	X	X	X	X	X	X
Shopping facilities/grocery stores	10	X		X	X	X	X
Restaurants/Fast food	10	X	X	X		X	X
Community Service Organizations	8	X	X	X	X	X	
Availability of Emergency services	8	X	X	X	X	X	X
Illeagal Drugs	8	X	X	X	X	X	X
Church	8	X	X	X		X	X
Transportation Availability (Public/Medical)	7	X	X		X		X
Schools/Educational Programs	7	X	X	X		X	X
Traffic	6	X	X		X	X	X
Environmental pollution	6	X		X	X		X
Water Availability and Quality	5	X	X		X		
Mental Health Services	3		X	X			X

Table 3. Validated Community Resources: Emerging Themes from the Social Determinants of Health Transcripts

"Community Resources that matter for health"	Tally	Asheville n=3	Bladen n=4	Dayspring n=2	Goldsboro n=5	Hendersonville n=3	Person n=3
Recreational facilities	12	X	X	X	X	X	X
Employment opportunities	12	X	X	X	X	X	X
Medical Facilities and Medical Specialists	11	X	X	X	X	X	X
Shopping facilities/grocery stores	11	X	X	X	X	X	X
Transportation Availability (Public/Medical)	10	X	X	X	X	X	X
Restaurants/Fast food	10	X	X	X		X	X
Community Service Organizations	9	X	X	X	X	X	X
Environmental pollution	9	X	X	X	X		X
Schools/Educational Programs	8	X	X	X	X	X	X
Illegal Drugs	8	X	X	X	X	X	X
Water Availability and Quality	7	X	X	X	X		
Traffic	7	X	X		X	X	X
Church	7	X	X	X		X	X
Availability of Emergency services	6	X	X	X	X	X	X
Mental Health Services	3		X	X			X

Table 4. City and Town Characteristics, (N=32)

	Mean (range)
2005 Population	34,471 (247-237,316)
# Participants per city	38.0 (11-123)
% Individuals living below Poverty	15.8 (3.8-31.1)
Box and Club Stores†	.28 (0-2)
Chain Grocery Stores†	5.41 (0-33)
Restaurants†	89.31 (0-645)
Private Gyms and Fitness Facilities†	5.44 (0-37)
Hospital Beds†	173.72 (0-1,318)
Pharmacies†	10.09 (0-57)
2005 City-wide Public Transportation Available, % (N)	
No	84.4 (27)
Public Recreational Facility Score, % (N)*	
None/Poor	21.8(7)
Fair	12.5 (4)
Good	18.8 (6)
Very Good	34.4 (11)
Excellent	12.5 (4)

† Please note that these values are 2008 counts. The 2005 rate (2008 count/2005 city population) *1000 individuals) is used in main analyses. *Please see Table X for a more complete description of scoring for Public Recreational Facilities.

Table 5. Rate of Community Resources and Community SES by City

2005 City Population	City	Rate of Box Stores and Clubhouses	Rate of Chain Grocery Stores	Rate of Restaurants	Rate of private gyms and fitness facilities	Public recreational resource score	Rate of City Hospital Bed	Rate of Pharmacies	Public Transportation Availability	2000 US Census % Households in Poverty (City)
247	ATKINSON	0	0	0	0	1	0	4.05	No	10
311	IVANHOE	0	0	0	0	1	0	0	No	6.2
714	PIKEVILLE	0	1.40	8.40	1.40	1	0	5.60	No	8.2
981	STONEVILLE	0	0	6.12	0	1	0	1.02	No	12.7
1,262	ROBBINS	0	0.79	7.13	0	2	0	1.58	No	22
1,417	MT PLEASANT	0	0.71	4.23	0	2	0	0.71	No	6.7
1,690	BLADENBORO	0	0	5.33	0	1	0	0.59	No	30
2,165	YANCEYVILLE	0	0.46	6.47	0.92	2	0	0.92	No	27.7
2,402	PITTSBORO	0	0.42	7.08	0	1	0	1.25	No	18.3
3,526	WALLACE	0	0.28	7.09	0.57	4	0	2.27	No	23.3
3,543	STOKESDALE	0	0	7.06	0	4	0	0	No	5.3
3,621	BURGAW	0	0.28	3.04	0.55	1	23.75	1.38	No	19.3
3,718	ELIZABETHTOWN	0.27	0.27	5.92	0.27	4	15.60	0.81	No	31.1
4,610	MT OLIVE	0.22	0.43	4.12	0.22	3	0	0.87	No	22.8
6,162	HILLSBOROUGH	0.16	0.65	5.68	0.65	3	0	0.49	No	12.6
7,230	ELON	0	0	1.11	0	3	0	0	No	20.9
7,370	SUMMERFIELD	0	0.14	0.81	0.14	4	0	0.41	No	3.8
7,937	SILER CITY	0.13	0.25	4.28	0.38	3	8.57	0.63	No	14.7
8,100	MEBANE	0.12	0.37	6.67	0.49	4	0	0.49	No	11.8
8,835	ROXBORO	0.11	0.57	4.19	0.34	2	12.45	0.79	No	16.8
12,237	HENDERSONVILLE	0.25	0.74	10.05	0.74	3	15.77	1.23	No	16.8
14,025	GRAHAM	0	0.14	2.28	0.14	4	0	0.36	No	14.9
14,621	REIDSVILLE	0.14	0.34	3.83	0.27	4	10.40	0.62	No	15.1
15,773	EDEN	0.06	0.19	3.23	0.19	3	15.34	0.57	No	17.2
38,186	GOLDSBORO	0.13	0.18	3.72	0.21	4	6.68	0.42	Yes	19.2
40,139	KANNAPOLIS	0.05	0.15	1.92	0.05	4	0	0.25	No	10.5
47,295	BURLINGTON	0.08	0.23	3.72	0.27	5	3.85	0.38	No	13.7
52,397	CHAPEL HILL	0	0.19	3.28	0.29	5	12.42	0.27	Yes	21.6
63,429	CONCORD	0.06	0.24	0.89	0.17	5	7.05	0.38	No	8.2
73,189	ASHEVILLE	0.12	0.45	5.36	0.33	5	10.75	0.55	Yes	15.5
209,123	DURHAM	0.03	0.11	2.30	0.11	4	6.30	0.23	Yes	15
237,316	GREENSBORO	0.07	0.10	2.72	0.16	4	4.26	0.24	Yes	12.4

Table 6. Individual Participant Demographic Characteristics, (N=1217)

Age in Years, Mean (SD)	52.7 (14.8)
Body Mass Index, Mean (SD)	29.4 (7.0)
Women, % (N)	70.1% (853)
Arthritis, % (N)	53.4% (650)
Depression, % (N)	31.9% (389)
Education, % (N)	
Less than High School	11.3% (138)
High School	26.4% (321)
Some college or higher	62.3% (758)
Race, % (N)	
Non hispanic White	76.5% (931)
Non hispanic Black	17.8% (216)
Other	5.7% (70)
Income, % (N)	
<$45,000	56.1% (683)
≥$45,000	43.9% (534)
Occupation, % (N)	
Management & Professional	33.7% (410)
Service	25.0% (304)
Sales and Office	20.1% (245)
Farming, Fishing, Forestry	1.2% (15)
Construction, Extraction & Maintenance	6.7% (81)
Production, Transportation & Material Moving	13.3% (162)
Un-Healthy Days, Mean (SD)	9.0 (11.2)
Physical Functioning, Mean (SD)	45.4 (12.1)
Self-Rated Health Related Quality of Life, % (N)	
Poor	7.2% (88)
Fair	18.4% (224)
Good	36.1% (439)
Very Good	29.6% (360)
Excellent	8.7% (106)

Table 7. Individual Level Predictors of Health Outcomes, (N=1217)

	Self- Rated Health B (S.E.)	Unhealthy Days B (S.E.)	Physical Functioning B (S.E.)
Intercept	4.183 (.171)***	5.997 (1.807)***	64.447 (1.965)***
Age	-.003 (.002)	-.067 (.020)***	-.117 (.022)***
Gender (women)	.031 (.058)	1.743 (.617)**	-1.797 (.671)**
Body Mass Index	-.026 (.004)***	.042 (.040)	-.312 (.044)***
Self-Report Arthritis (Yes)	.377 (.056)***	4.446 (.594)***	-6.33 (.646)***
Self-Report Depression (Yes)	.460 (.058)***	9.214 (.611)***	-3.262 (.664)***
Race			
Non hispanic White (referent)			
Non hispanic Black	-.015 (.071)	-.903 (.756)	.900 (.822)
Other	-.094 (.110)	1.135 (1.166)	.584 (1.267)
Income (≥$45,000)	.457 (.059)***	-2.945 (.620)***	4.239 (.675)***
Education			
Some college or higher (referent)			
High School	-.167 (.062)**	.794 (.654)	-.904 (.711)
Less than High School	-.369 (.092)***	1.583 (.969)	-2.976 (1.054)**
Occupation			
Management, Professional & Sales	.136 (.056)*	-.493 (.595)	.986 (.647)
Model Statistics			
R-squared	.290	.301	.297
F	44.79	47.11	46.17
p-value	<0.001	<0.001	<0.001

Note: †$p<0.10$; *$p<0.05$; **$p<0.01$; ***$p\leq0.001$

Table 8. Bivariate Analyses of the Relationship between Contextual Community Resources among Participants by Race, (N=1217)

Variable	Non-Hispanic White	Non-Hispanic Black	Other	*p*-value
% Individuals living below Poverty, Mean (SD)	15.974 (5.397)	16.964 (5.765)	16.733 (5.099)	.039
2005 Rate of Box and Club Stores, Mean (SD)	.072 (.077)	.083 (.081)	.076 (.077)	.135
2005 Rate of Chain Grocery Stores, Mean (SD)	.315 (.245)	.304 (.215)	.323 (.259)	.759
2005 Rate of Restaurants, Mean (SD)	4.408 (2.463)	4.118 (1.964)	4.285 (2.299)	.026
2005 Rate of Private Gyms and Fitness Facilities, Mean (SD)	.238 (.230)	.285 (.236)	.284 (.244)	.012
2005 Rate of Hospital Beds, Mean (SD)	6.758 (6.282)	6.099 (6.099)	6.647 (6.252)	.377
2005 Rate of Pharmacies, Mean (SD)	.749 (.746)	.849 (.939)	.740 (.789)	.242
				X2, *p*-value
2005 City-wide Public Transportation Available, % (N)				
No	75.5(703)	85.6 (185)	74.3 (52)	10.62, .005
Yes	24.5 (228)	14.4 (31)	25.7 (18)	
Public Recreational Facility Score, % (N)*				
None/Poor	15.6 (145)	18.1 (39)	10.0 (7)	24.912, .002
Fair	9.8 (92)	18.5 (40)	15.7 (11)	
Good	25.9(241)	16.2 (35)	15.7 (11)	
Very Good	27.3 (254)	25.9 (56)	34.3 (24)	
Excellent	21.4 (199)	21.3 (46)	24.3 (17)	

Table 9. Bivariate Analyses of the Relationship between Contextual Community Resources among Participants by Income, (N=1217)

Variable	<$45,000	≥$45,000	*p*-value
% Individuals living below Poverty, Mean (SD)	16.701 (5.454)	15.445(5.398)	<.001
2005 Rate of Box and Club Stores, Mean (SD)	.080 (.080)	.066 (.074)	.001
2005 Rate of Chain Grocery Stores, Mean (SD)	.333 (.009)	.289 (.233)	.002
2005 Rate of Restaurants, Mean (SD)	4.461 (2.375)	4.207 (2.365)	.064
2005 Rate of Private Gyms and Fitness Facilities, Mean (SD)	.265 (.233)	.228 (.224)	.006
2005 Rate of Hospital Beds, Mean (SD)	7.127 (6.497)	6.005 (5.862)	.002
2005 Rate of Pharmacies, Mean (SD)	.825 (.806)	.692 (.761)	.000.
			X2, *p*-value
2005 City-wide Public Transportation Available, % (N)			
No	83.5 (570)	69.3 (370)	34.214, <.001
Yes	16.5 (113)	30.7 (164)	
Public Recreational Facility Score, % (N)*			
None/Poor	16.1 (110)	15.2 (81)	47.809, <.001
Fair	16.4 (112)	5.8 (31)	
Good	25.5 (174)	21.2 (113)	
Very Good	22.5 (154)	33.7 (180)	
Excellent	19.5 (133)	24.1 (129)	

Table 10. Bivariate Analyses of the Relationship between Contextual Community Resources among Participants by Education, (N=1217)

Variable	< High School	High School	> High School	*p*-value
% Individuals living below Poverty, Mean (SD)	16.741 (5.382)	16.614 (5.856)	15.916 (5.282)	.072
2005 Rate of Box and Club Stores, Mean (SD)	.075 (.075)	.073 (.078)	.074 (.078)	.947
2005 Rate of Chain Grocery Stores, Mean (SD)	.362 (.233)	.322 (.252)	.302 (.236)	.021
2005 Rate of Restaurants, Mean (SD)	4.401 (2.274)	4.453 (2.287)	4.297 (2.428)	.591
2005 Rate of Private Gyms and Fitness Facilities, Mean (SD)	.274 (.224)	.228 (.237)	.253 (.232)	.107
2005 Rate of Hospital Beds, Mean (SD)	7.599 (7.003)	6.454 (6.599)	6.536 (5.974)	.154
2005 Rate of Pharmacies, Mean (SD)	.867 (.730)	.822 (.799)	.725 (.792)	.051
				X2, *p*-value
2005 City-wide Public Transportation Available, % (N)				
No	92.0 (127)	84.7 (272)	71.4 (541)	42.272, <.001
Yes	8.0 (11)	15.3 (49)	28.6 (217)	
Public Recreational Facility Score, % (N)*				
None/Poor	16.7 (23)	19.3 (62)	14.0 (106)	91.829, <.001
Fair	29.0 (40)	16.8 (54)	6.5 (49)	
Good	20.3 (28)	25.2 (81)	23.5 (178)	
Very Good	16.7 (23)	25.5 (82)	30.1 (229)	
Excellent	17.3 (24)	13.2 (42)	25.9 (196)	

Table 11. Bivariate Analyses of the Relationship between Contextual Community Resources among Participants by Occupation, (N=1217)

Variable	Management/ Sales	Service, Farming	*p*-value
% Individuals living below Poverty, Mean (SD)	16.211 (5.168)	15.803 (5.756)	.903
2005 Rate of Box and Club Stores, Mean (SD)	.070 (.077)	.075 (.077)	.072
2005 Rate of Chain Grocery Stores, Mean (SD)	.307 (.243)	.304 (.239)	.295
2005 Rate of Restaurants, Mean (SD)	4.273 (2.339)	4.295 (2.391)	.226
2005 Rate of Private Gyms and Fitness Facilities, Mean (SD)	.253 (.240)	.236 (.217)	.504
2005 Rate of Hospital Beds, Mean (SD)	6.535 (6.104)	6.511 (6.263)	.549
2005 Rate of Pharmacies, Mean (SD)	.721 (.799)	.782 (.761)	.020
			X2, *p*-value
2005 City-wide Public Transportation Available, % (N)			
No	70.1 (459)	85.6 (481)	41.39, <.001
Yes	29.9 (196)	14.4 (81)	
Public Recreational Facility Score, % (N)*			
None/Poor	15.0 (98)	16.6 (93)	48.34, .995
Fair	6.6 (43)	17.8(100)	
Good	22.4 (147)	24.9 (140)	
Very Good	31.0 (203)	23.3 (131)	
Excellent	25.0 (164)	17.4 (98)	

Table 12. Bivariate Analyses of the Relationship between Contextual Community Resources among Participants by Age, (N=1217)

Variable	<52 years	≥52	*p*-value
% Individuals living below Poverty, Mean (SD)	15.638 (5.618)	16.704 (5.259)	.006
2005 Rate of Box and Club Stores, Mean (SD)	.076 (.076)	.072 (.079)	.363
2005 Rate of Chain Grocery Stores, Mean (SD)	.309 (.234)	.318 (.246)	.548
2005 Rate of Restaurants, Mean (SD)	4.274 (2.339)	4.419 (2.404)	.283
2005 Rate of Private Gyms and Fitness Facilities , Mean (SD)	.235 (.226)	.262 (.238)	.042
2005 Rate of Hospital Beds, Mean (SD)	6.026 (6.013)	7.194 (6.412)	.001
2005 Rate of Pharmacies, Mean (SD)	.719 (.702)	.810 (.859)	.045
			*X*2, *p*-value
2005 City-wide Public Transportation Available, % (N)			
No	81.5 (475)	73.3 (465)	11.42, .001
Yes	18.5 (108)	26.7(169)	
Public Recreational Facility Score, % (N)			
None/Poor	14.8 (86)	16.6 (105)	11.44, .022
Fair	10.1 (59)	13.2 (84)	
Good	24.7 (144)	22.6 (143)	
Very Good	31.0 (181)	24.1 (153)	
Excellent	19.4 (113)	23.5 (149)	

Table 13. Bivariate Analyses of the Relationship between Contextual Community Resources among Participants by Gender (N=1217)

Variable	Male	Female	*p*-value
% Individuals living below Poverty, Mean (SD)	16.359 (5.383)	16.122 (5.490)	.489
2005 Rate of Box and Club Stores, Mean (SD)	.070 (.074)	.076 (.079)	.209
2005 Rate of Chain Grocery Stores, Mean (SD)	.308 (.238)	.316 (.242)	.598
2005 Rate of Restaurants, Mean (SD)	4.340 (2.307)	4.354 (2.402)	.926
2005 Rate of Private Gyms and Fitness Facilities, Mean (SD)	.241 (.225)	.252 (.236)	.429
2005 Rate of Hospital Beds, Mean (SD)	6.582 (6.118)	6.657 (6.307)	.849
2005 Rate of Pharmacies, Mean (SD)	.754 (.779)	.772 (.719)	.712
			X2, *p*-value
2005 City-wide Public Transportation Available, % (N)			
No	73.4 (267)	78.9 (673)	4.46, .035
Yes	26.6 (97)	21.1 (180)	
Public Recreational Facility Score, % (N)*			
None/Poor	15.7 (57)	15.7 (134)	1.16, .885
Fair	11.8 (43)	11.7 (100)	
Good	22.8 (83)	24.0 (204)	
Very Good	26.4 (96)	27.8 (238)	
Excellent	23.3 (85)	20.8 (177)	

Table 14. Bivariate Analyses of the Relationship between Contextual Community Resources among Participants by Arthritis Status (N=1217)

Variable	Arthritis	No Arthritis	*p*-value
% Individuals living below Poverty, Mean (SD)	16.553 (5.363)	15.781 (5.539)	.014
2005 Rate of Box and Club Stores, Mean (SD)	.076 (.079)	.072 (.076)	.443
2005 Rate of Chain Grocery Stores, Mean (SD)	.315 (.236)	.312 (.245)	.841
2005 Rate of Restaurants, Mean (SD)	4.392 (2.391)	4.301 (2.354)	.506
2005 Rate of Private Gyms and Fitness Facilities, Mean (SD)	.251 (.228)	.247 (.237)	.783
2005 Rate of Hospital Beds, Mean (SD)	6.916 (6.371)	6.312 (6.095)	.092
2005 Rate of Pharmacies, Mean (SD)	.789 (.780)	.741 (.798)	.298
			X2, *p*-value
2005 City-wide Public Transportation Available, % (N)			
No	78.3 (509)	76.0 (431)	.906, .341
Yes	21.7 (141)	24.0 (136)	
Public Recreational Facility Score, % (N)*			
None/Poor	16.0 (104)	15.3 (87)	2.308, .679
Fair	12.3 (80)	11.1 (63)	
Good	23.9 (155)	23.3 (132)	
Very Good	25.7 (167)	29.5 (167)	
Excellent	22.1 (144)	20.8 (118)	

Table 15. Bivariate Analyses of the Relationship between Contextual Community Resources among Participants by Depression Status (N=1217)

Variable	Depression	No Depression	*p*-value
% Individuals living below Poverty, Mean (SD)	16.185 (5.393)	16.197 (5.491)	.971
2005 Rate of Box and Club Stores, Mean (SD)	.075 (.078)	.073 (.078)	.660
2005 Rate of Chain Grocery Stores, Mean (SD)	.313 (.232)	.314 (.245)	.918
2005 Rate of Restaurants, Mean (SD)	4.354 (2.331)	4.348 (2.394)	.962
2005 Rate of Private Gyms and Fitness Facilities, Mean (SD)	.229 (.211)	.258 (.241)	.040
2005 Rate of Hospital Beds, Mean (SD)	6.433 (6.289)	6.729 (6.231)	.440
2005 Rate of Pharmacies, Mean (SD)	.768 (.729)	.766 (.816)	.968
			X2, *p*-value
2005 City-wide Public Transportation Available, % (N)			
No	80.7 (317)	75.6 (626)	3.940, .047
Yes	19.3 (75)	24.4 (202)	
Public Recreational Facility Score, % (N)*			
None/Poor	16.5 (64)	15.3 (127)	.935, .920
Fair	12.6 (49)	11.4 (94)	
Good	22.4 (87)	24.2 (200)	
Very Good	27.2 (106)	27.5 (228)	
Excellent	21.3 (83)	21.6 (179)	

Table 16. Bivariate Analyses of the Relationship between Contextual Community Resources among Participants by Body Mass Index (N=1217)

Variable	<30	30+	*p*-value
% Individuals living below Poverty, Mean (SD)	16.195 (5.447)	16.192 (5.479)	.993
2005 Rate of Box and Club Stores, Mean (SD)	.074 (.077)	.074 (.079)	.955
2005 Rate of Chain Grocery Stores, Mean (SD)	.313 (.247)	0.314 (.231)	.949
2005 Rate of Restaurants, Mean (SD)	4.366 (2.339)	4.325 (2.428)	.771
2005 Rate of Private Gyms and Fitness Facilities, Mean (SD)	.253 (0.236)	.243 (.227)	.478
2005 Rate of Hospital Beds, Mean (SD)	6.830 (6.178)	6.332 (6.351)	.174
2005 Rate of Pharmacies, Mean (SD)	.736 (.774)	.814 (.810)	.093
			X2, *p*-value
2005 City-wide Public Transportation Available, % (N)			
No	73.1 (540)	83.7 (400)	18.59, .<001
Yes	26.9 (199)	16.3 (78)	
Public Recreational Facility Score, % (N)*			
None/Poor	15.3 (113)	16.3 (78)	3.86, .426
Fair	10.7 (79)	13.4 (64)	
Good	23.1 (171)	24.3 (116)	
Very Good	29.0 (214)	25.1 (120)	
Excellent	21.9 (162)	20.9 (100)	

Table 17A. Correlation Matrix for Individual and Community Characteristics

	1	2	3	4	5	6	7	8
1. Box Store‡	1							
2. Grocery Store‡	.29***	1						
3. Restaurant‡	.39***	.65***	1					
4. Gyms‡	.55***	.54***	.42***	1				
5. Public Rec. Score	.24***	-.03***	-.32***	.13***	1			
6. Hospital Beds‡	.38***	0.04	0.01	.34***	.24***	1		
7. Pharmacy‡	-.01	.04***	.29***	.26***	-.54	-.18***	1	
8. Public Transportation	-.05	-.24***	-.19***	-.03***	.49***	.18***	-.29***	1
9. % Poverty (Household)	.18***	.06**	.33***	.05	-.13***	.26***	.01	.15***
10. 2005 City Population	-.05	-.29***	-.31***	-.10***	.44***	.04	-.32***	.66***
11. Age	-.05	.03	.04	.05	.01	.10***	.05	.16***
12. BMI	-.01	-.01	-.03	-.01	-.04	-.02	.05	.10***
13. Gender	.04	.02	.01	.02	-.01	.01	.01	-.06*
14. Income	-.09**	-.09**	-.05	-.08**	.12***	-.09**	-.08**	.17***
15. Race	.04	-.01	-.04	.08**	-.01	-.03	.03	-.05
16. Occupation	-.05	-.03	-.04	.02	.14***	-.02	-.06*	.18***
17. Arthritis	.02	.01	.02	.01	-.01	.05	.03	-.03
18. Depression	.01	-.01	.01	-.06*	-.02	-.02	.01	-.06*

*p<.05; **p< .01; ***p< .001; ‡ denotes the 2005 Rate

Table 17B. Correlation Matrix for Individual and Community Characteristics

	9	10	11	12	13	14	15	16	17	18
1. Box Store‡										
2. Grocery Store‡										
3. Restaurant‡										
4. Gyms‡										
5. Public Rec. Score										
6. Hospital Beds‡										
7. Pharmacy‡										
8. Public Transportation										
9. % Poverty (Household)	1									
10. 2005 City Population	-.18***	1								
11. Age	.14***	-.02	1							
12. BMI	.01	-.05	-.08**	1						
13. Gender	-0.02	-.04	-.08**	.03	1					
14. Income	-.11***	.17***	-.10***	-.12***	-.20***	1				
15. Race	.06*	-.03	-.01	.11***	.09**	-.14***	1			
16. Occupation	.01	.16***	.01	-.11***	.08**	.25***	-.14***	1		
17. Arthritis	.07*	-.07*	.31***	.16***	.03	-.16***	-.21	-.07*	1	
18. Depression	-.01	-.05	-.10***	.08**	.18***	-.18***	-.02	-.06*	.16***	1

*p<.05; **p< .01; ***p< .001; ‡ denotes the 2005 Rate

Table 18: Variance Inflation Factor Examination

Variable	VIF	1/VIF
Transportation Availability	2.65	0.377969
Rate of Restaurants	2.63	0.379898
Public Rec. Facility Score	2.56	0.391291
Rate of Chain Grocery Stores	2.44	0.409936
Rate of Private Gyms & Fitness Facilities	2.35	0.424935
2005 City Population	2.24	0.446396
Box Stores and Club Warehouses	1.97	0.507052
Rate of Pharmacies	1.88	0.532498
% Households in Community Living Below Poverty	1.61	0.619732
Rate of Hospital Beds	1.53	0.652908
Income (above $45,000)	1.35	0.740777
Education (less than high school)	1.34	0.746469
Age	1.27	0.787019
Occupation (management, professional)	1.26	0.796080
Arthritis (self-report yes)	1.22	0.819262
Race (non-Hispanic Black)	1.21	0.824695
Education (high school)	1.18	0.847378
Depression (self-report yes)	1.13	0.884741
Gender (women)	1.11	0.901475
Body Mass Index	1.10	0.910857
Race (other)	1.03	0.971592
Mean VIF	1.67	

Table 19. Correlation of Health-Related Quality of Life Outcome Measures: Unhealthy Days, Physical Functioning, and Self-Rated Health

	Self-Rated Health	Physical Functioning	Unhealthy Days
Self-Rated Health	1.0000 1217		
Physical Functioning	0.7117 0.0000 1217	1.0000 1217	
UnHealthy Days	-0.5256 0.0000 1217	-0.5323 0.0000 1217	1.0000 1217

Table 20. Aim 2 – Multilevel Predictors of Unhealthy Days, (N=1217)

	Null Model B (SE)	Level 2 Model B (SE)	Full Model B (SE)
Intercept	9.006 (.475)	9.409 (1.631)	5.653 (2.243)
2005 Rate of Community Box Stores and Club Warehouses		3.117 (5.582)	-3.520 (4.780)
2005 Rate of Community Chain Grocery Stores		2.952 (2.011)†	2.264 (1.702)
2005 Rate of Community Restaurants		-.338 (.199)	-.270 (.172)
2005 Rate of Community Private Gyms/Fitness Facilities		-2.389 (2.036)	.372 (1.739)
Public Recreational Facility Score		.278 (.365)	.256 (.312)
2005 Rate of Community-wide Hospital Beds		.065 (.059)	.028 (.051)
2005 Rate of Community Pharmacies		.161 (.544)	.014 (.462)
Community-wide Public Transportation (yes)		-4.260 (.899)***	-2.796 (.962)**
2005 Community Population			<0.001 (<0.001)
Age			-.054(.020)**
Body Mass Index			.034 (.040)
Gender (women)			1.689 (.611)**
Income (≥$45,000)			-2.810 (.621)***
Race			
Non hispanic White (referent)			
Non hispanic Black			-.959 (.760)
Other			1.078 (1.156)
Education			
Some college or higher (referent)			
High School			.676 (.655)
Less than High School			1.199 (.970)
Occupation (Management, Professional, Sales & Office)			-.430 (.595)
Arthritis (yes)			4.408 (.589)***
Depression (yes)			9.265 (.606)***
Model Statistics			
LR $\chi 2$; *p*-value		32.45; $p<0.001$	449.90; $p<0.001$
ICC	.026 (.013)		

Note: †$p<0.10$, *$p<0.05$; **$p<0.01$; ***$p\leq 0.001$

Table 21. Aim 2 – Multilevel Predictors of Physical Functioning (PCS), (N=1217)

	Null Model B (SE)	Level 2 Model B (SE)	Full Model B (SE)
Intercept	45.584 (.548)***	45.955 (2.059)***	6.283 (2.434)***
2005 Rate of Community Box and Club Stores		.699 (6.916)	2.299 (5.189)
2005 Rate of Community Chain Grocery Stores		-1.842 (2.455)	-1.973 (1.848)
2005 Rate of Community Restaurants		.326 (.243)	.269 (.187)
2005 Rate of Community Private Gyms/Fitness Facilities		1.877 (2.440)	.665 (1.877)
Public Recreational Facility Score		-.239 (.477)	-.579 (.339)†
2005 Rate of Community-wide Hospital Beds		-.236 (.076)**	-.107 (.055)†
2005 Rate of Community Pharmacies		-.541 (.648)	-.132 (.501)
Community-wide Public Transportation (yes)		3.774 (1.178)***	3.215 (1.044)**
2005 Community Population			<0.001 (<0.001)
Age			-.129 (.022)***
Body Mass Index			-.305 (.043)***
Gender (women)			-1.746 (.663)**
Income (≥$45,000)			4.094 (.674)***
Race			
Non hispanic White (referent)			
Non hispanic Black			.882 (.825)
Other			.655 (1.254)
Education			
Some college or higher (referent)			
High School			-.913 (.711)
Less than High School			-2.695 (1.053)**
Occupation (Management, Professional, Sales & Office)			.961 (.646)
Arthritis (yes)			-6.263 (.639)***
Depression (yes)			-3.312 (.658)***
Model Statistics			
LR $\chi 2$; p-value		16.00; p=0.042	447.87; p<0.001
ICC	.034 (.015)		

Note: †p<0.10, *p<0.05; **p<0.01; ***p≤0.001

Table 22. Aim 2 – Multilevel Predictors of Self-Rated Health, (N=1217)

	Null Model B (SE)	Level 2 Model B (SE)	Full Model B (SE)
Intercept	3.148 (.058)***	2.907 (.209)***	4.214 (.211)***
2005 Rate of Community Box and Club Stores		-.660 (.729)	-.303 (.450)
2005 Rate of Community Chain Grocery Stores		-.100 (.257)	-.178 (.160)
2005 Rate of Community Restaurants		.051 (.025)*	.044 (.016)**
2005 Rate of Community Private Gyms/Fitness Facilities		.155 (.252)	.078 (.164)
Public Recreational Facility Score		.039 (.050)	-.022 (.029)
2005 Rate of Community-wide Hospital Beds		-.020 (.008)*	-.010 (.005)*
2005 Rate of Community Pharmacies		-.034 (.065)	-.023 (.044)
Community-wide Public Transportation (yes)		.375 (.134)**	.244 (.091)**
2005 Community Population			<0.001 (<0.001)
Age			-.004 (.002)*
Body Mass Index			-.026 (.004)***
Gender (women)			.037 (.058)
Income (≥$45,000)			.436 (.059)***
Race			
Non hispanic White (referent)			
Non hispanic Black			-.008 (.072)
Other			-.090 (.109)
Education			
Some college or higher (referent)			
High School			-.160 (.062)**
Less than High School			-.337 (.091)***
Occupation (Management, Professional, Sales & Office)			.126 (.056)*
Arthritis (yes)			-.369 (.055)***
Depression (yes)			-.465 (.057)***
Model Statistics			
LR $\chi 2$; p-value		17.81; p=0.023	441.68; p<0.001
ICC	.066 (.023)		

Table 23. Aim 3 – Unhealthy Days, (N=1217)

	Covariates Only B (SE)	Compositional SES B (SE)	Fully Adjusted B (SE)
Intercept	5.742 (1.818)***	8.461 (1.952)***	7.659 (2.390)***
Age	-.063 (.020)**	-.059 (0.020)**	-.053 (.020)**
Body Mass Index	.039 (.040)	.040 (.039)	.037 (.040)
Gender (women)	1.749 (.612)**	1.668 (.6011)**	1.620 (.610)**
Income (≥$45,000)	-2.866 (.621)***	-3.067 (.620)***	-2.906 (.621)***
Race			
Non hispanic White (referent)			
Non hispanic Black	-.845 (.769)	-.710 (.759)	-.729 (.764)
Other	1.166 (1.160)	1.285 (1.155)	1.265 (1.156)
Education			
Some college or higher (referent)			
High School	.742 (.653)	.832 (.650)	.729 (.654)
Less than High School	1.426 (.970)	1.536 (.965)	1.281 (.968)
Occupation (Management, Professional, Sales & Office)	-.369 (.598)	-.347 (.594)	-.303 (.596)
Arthritis (yes)	4.480 (.590)***	4.514 (.588)***	4.444 (.587)***
Depression (yes)	9.209 (.606)***	9.214 (.604)***	9.259 (.605)***
% Persons living in Poverty (Community)		-.181 (.053)***	-.147 (.062)*
2005 Community Population			<0.001 (<0.001)
2005 Rate of Community Box and Club Stores			-2.227 (4.799)
2005 Rate of Community Chain Grocery Stores			1.564 (1.723)
2005 Rate of Community Restaurants			-.131 (.181)
2005 Rate of Community Private Gyms/Fitness Facilities			-.179 (1.750)
Public Recreational Facility Score			.133 (.315)
2005 Rate of Community-wide Hospital Beds			.059 (.053)
2005 Rate of Community Pharmacies			-.014 (.461)
Community-wide Public Transportation (yes)			-1.913 (1.029)†
LR $\chi 2$; *p*-value	424.80; <0.001	445.63; <0.001	456.59; <0.001
ICC	.013 (0.010)		

Note: †$p<0.10$, *$p<0.05$; **$p\leq0.01$; ***$p\leq0.001$

Table 24. Aim 3 – Physical Functioning (PCS) (N=1217)

	Covariates Only B (SE)	Compositional SES B (SE)	Fully Adjusted B (SE)
Intercept	64.639 (1.974)***	63.238 (2.160)***	65.912 (2.601)***
Age	-.119 (.022)***	-.122 (0.022)***	-.129 (.022)***
Body Mass Index	-.309 (.043)***	-.310 (.043)***	-.306 (.043)***
Gender (women)	-1.838 (.666)**	-1.793 (.666)**	-1.733 (.664)**
Income (≥$45,000)	4.127 (.676)***	4.225 (.679)***	4.112 (.675)***
Race			
Non hispanic White (referent)			
Non hispanic Black	1.039 (.839)	.933 (.838)	.839 (.831)
Other	.679 (1.263)	.597 (1.262)	.620 (1.257)
Education			
Some college or higher (referent)			
High School	-.893 (.208)	-.927 (.709)	-.937 (.649)
Less than High School	-2.880 (1.053)**	-2.914 (1.051)**	-2.710 (1.053)**
Occupation (Management, Professional, Sales & Office)	.960 (.647)	.925 (.647)	.937 (.649)
Arthritis (yes)	-6.334 (.641)***	-6.360 (.641)***	-6.270 (.639)***
Depression (yes)	-3.259 (.659)***	-3.259 (.658)***	-3.311 (.658)***
% Persons living in Poverty (Community)		.094 (.061)	.027 (.067)
2005 Community Population			<0.001 (<0.001)
2005 Rate of Community Box and Club Stores			2.061 (5.222)
2005 Rate of Community Chain Grocery Stores			-1.844 (1.875)
2005 Rate of Community Restaurants			.243 (.197)
2005 Rate of Community Private Gyms/Fitness Facilities			.767 (1.904)
Public Recreational Facility Score			-.556 (.343)
2005 Rate of Community-wide Hospital Beds			-.112 (.057)*
2005 Rate of Community Pharmacies			-.126 (.051)
Community-wide Public Transportation (yes)			3.052 (1.119)**
LR $\chi 2$; *p*-value	414.10; <0.001	416.41; <0.001	448.04; <0.001
ICC	.012 (.009)		

Note: †$p<0.10$, *$p<0.05$; **$p\leq0.01$; ***$p\leq0.001$

Table 25. Aim 3 – Self-Rated Health (N=1217)

	Covariates Only B (SE)	Compositional SES B (SE)	Fully Adjusted B (SE)
Intercept	4.207 (.172)***	4.098 (.191)***	4.179 (.226)***
Age	-.003 (.002)	-.003 (.002)	-.004 (.002)*
Body Mass Index	-.025 (.004)***	-.025 (.004)***	-.025 (.004)***
Gender (women)	.027 (.058)	.029 (.058)	.038 (.058)
Income (≥$45,000)	.439 (.059)***	.446 (.059)***	.438 (.059)***
Race			
Non hispanic White (referent)			
Non hispanic Black	-.002 (.073)	-.009 (.073)	-.012 (.072)
Other	-.078 (.109)	-.084 (.110)	-.094 (.109)
Education			
Some college or higher (referent)			
High School	-.159 (.062)**	-.162 (.062)**	-.161 (.062)**
Less than High School	-.344 (.092)***	-.348 (.092)***	-.338 (.091)***
Occupation (Management, Professional, Sales & Office)	.125 (.056)**	.124 (.056)**	.124 (.056)*
Arthritis (yes)	-.373 (.056)***	-.375 (.056)***	-.369 (.055)***
Depression (yes)	-.457 (.057)***	-.457 (.057)***	-.465 (.057)***
% Persons living in Poverty (Community)		.007 (.006)	.003 (.006)
2005 Community Population			<0.001 (<0.001)
2005 Rate of Community Box and Club Stores			-.326 (.453)
2005 Rate of Community Chain Grocery Stores			-.165 (.163)
2005 Rate of Community Restaurants			.041 (.033)**
2005 Rate of Community Private Gyms/Fitness Facilities			.088 (.165)
Public Recreational Facility Score			-.019 (.029)
2005 Rate of Community-wide Hospital Beds			-.011 (.005)*
2005 Rate of Community Pharmacies			-.024 (.044)
Community-wide Public Transportation (yes)			.229 (.097)**
LR $\chi 2$; *p*-value	376.98;<0.001	378.58;<0.001	441.88; <0.001
ICC	.018 (.011)		

Note: †$p<0.10$, *$p<0.05$; **$p\leq0.01$; ***$p\leq0.001$

APPENDIX A: INSTRUCTIONS FOR RATING PUBLIC PARKS AND RECREATIONAL FACILITIES USING CITY AND TOWN WEBSITE INFORMATION

Thank you for agreeing to help me with my dissertation! My dissertation is focused on better understanding more about community resources, that is city/town resources and which resources influence North Carolinian's health related quality of life and functional health status. My aim is to use convenient, publicly available data sources for this research.

As you might know, higher levels of physical activity are very important for overall health and well-being. Public parks and recreational facilities are often available in cities and towns, and are places where people get physical activity and even socialize with friends or other community members.

Because there is no comprehensive listing of North Carolinian town/city parks and recreational facilities, I must turn to using another form of public information. Most cities and towns have websites for residents, so that residents can have access to important information (e.g. municipal government and offices, sanitation services, and community happenings). I'm going to have you visit four (4) city and town websites and examine their 'parks and recreational facility' site.

You'll be using the criteria listed below to assign each city or town a score (ranging from 1 to 5, with a lower number meaning lower score). You will only choose one number; one that comes close to or that you believe best represents the town's parks and recreational facilities as a community resource. If you are having trouble deciding between two numbers, chose just one number (feel free to jot down some notes about the city/town resource to give context if you believe it will help).

I will be rating 35 cities and towns that I am examining in my dissertation. I hope to have twelve (12) other individuals assist me with this rating, and I will calibrate all the scores. Greater consistency in scores between individuals will indicate that the city/town rating schema is reliable.

Keep in mind: You are not rating the website as a resource. You are rating the parks and recreational facilities as a COMMUNITY RESOURCE.

APPENDIX B: CRITERIA FOR SCORING PUBLIC PARKS AND RECREATIONAL FACILITIES USING CITY AND TOWN WEBSITE INFORMATION

Score	Criteria
1	• No website for city or town OR no parks and rec. website/mention of parks and recreation
2	• Unsure if there is a parks and rec. website, department OR if there are parks and rec. personnel. • Information on website is not updated or current OR information is minimal/ incomplete OR confusing
3	• Website(s) may or may not include photos of available space and resources. If pictures are available, resources may appear poor or fair (old, unattractive or minimal). • City or town has a parks and rec. website, department OR has personnel listed (look for specific contact information or that it is listed as a city/town department). • Information on website is somewhat updated and current OR information is clear. • Website might include photos of available space, and if so those resources appear moderate. • Website lists dedicated physical indoor and outdoor space and mentions hours of operation. • Downloadable information with or without a map • Gives links to other recreational resources (e.g. NC state parks)
4	• City or town has a park and recreational facilities website, department OR has personnel listed (look for specific contact information) • Information on website is updated and clear AND rich descriptions of the space are given (look for examples of space use or dedicated miles/acreage) • Website(s) includes photos of available space, and resources appear good or very good. • In addition to listing dedicated physical indoor and outdoor space AND hours of operation, there might be details about program offerings (look for ball programs, exercise classes). • Downloadable information with or without a map • Gives links to other recreational resources (e.g. NC state parks) • Parks and recreation department/town offers a vision/mission statement

5	• City or town has a parks and recreational facilities website, department OR has personnel listed (look for specific contact information) • Information on website is updated and clear AND/OR rich descriptions of the space are given (look for examples of space use or dedicated miles/acreage) • Website(s) includes photos of available space, and resources appear exceptional • In addition to dedicated physical indoor and outdoor space and program offerings (look for ball programs, exercise classes), there are a complexity of offerings (e.g. tennis, ball parks, jungle gyms) - especially a range of offerings for children and adults • Downloadable information with or without a map • Gives links to other recreational resources (e.g. NC state parks) • Parks and recreation department/town offers a vision/mission statement • Evidence/mention of planned expansion in the future OR has a master plan. • Information is translated into Spanish for diverse audiences. • City or town has a parks & recreational facilities advisory council/ commission OR elected town representatives.

Where 1 = Poor; 2 = Fair; 3 = Good; 4= Very Good; 5= Excellent

APPENDIX C: CDC-HRQOL 4 CORE QUESTIONS AND SF-12v2 PCS AND MCS QUESTIONS

CDC HQROL CORE-4

The next three questions I am going to ask you about your health all refer to how you have felt in the past month, or the past 30 days.

1. In general, would you say your health is:

a. Excellent……..1
b. Very Good……...2
c. Good…….3
d. Fair……4
e. Poor……..5

Don't know/Not sure……7
Refused…….9

2. Now, thinking about your physical health, which includes physical illness and injury, for how many days <u>during the past 30 days</u> was your physical health <u>not</u> good?
   a. Number of days ___ ___
   b. None…….88
   Don't know /Not sure……..77
   Refused……99

3. Now, thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days <u>during the past 30 days</u> was your mental health <u>not</u> good?
   a. Number of days ___ ___
   b. None **[IF Q.17 ALSO "NONE", SKIP Q.19]**……..88
   Don't know /Not sure……..77
   Refused……99

4. <u>During the past 30 days</u>, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

   a. Number of days ___ ___
   b. None……..88
   Don't know /Not sure……..77
   Refused……99

SF12v2 PCS and MCS

5. The following questions are about activities you might do during a typical day. Please tell me if your health now limits you in these activities and if so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all	Dk/Ns	Ref
a. Moderate activities such as moving a table, pushing a vacuum cleaner, bowling or playing golf	1	2	3	7	9
b. Climbing several flights of stairs	1	2	3	7	9

6. During the <u>past 4 weeks</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of your physical health</u>?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time	Dk/Ns	Ref
a. Accomplished less than you would like	1	2	3	4	5	7	9
b. Were limited in the kind of work or other activities	1	2	3	4	5	7	9

7. During the <u>past 4 weeks</u>**,** how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of any emotional problems</u> (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time	Dk/Ns	Ref
a. Accomplished less than you would like	1	2	3	4	5	7	9
b. Didn't do work or activities as carefully as usual	1	2	3	4	5	7	9

8. These questions are about how you feel and how things have been with you during the past 4 weeks**.** For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks…

	All of the time	Most of the time	Some of the time	A little of the time	None of the time	Dk/Ns	Ref
a. Have you felt calm and peaceful?	1	2	3	4	5	7	9
b. Did you have a lot of energy?	1	2	3	4	5	7	9
c. Have you felt downhearted and depressed?	1	2	3	4	5	7	9

9. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

a. All of the time……..1
b. Most of the time……..2
c. Some of the time…….3
d. A little of the time…….4
e. None of the time……..5

Don't know/Not sure……7

Refused……9

APPENDIX D: LIST OF SUPER-CODES AND CODE DEFINITIONS USED IN QUALITATIVE ANALYSES OF FOCUS GROUP DISCUSSIONS

Total Number of Codes:

Code: Recreational Facilities
"Recreational Facilities include public areas (either indoors or outdoors) that community members may access (either free or for a fee) to be physically or socially active."

Code: Shopping facilities/Grocery stores
"Shopping facilities/Grocery stores refers to areas where community members might go to shop for goods or food. This also includes any reference to a big-box store such as a Wal-Mart or Kmart."

Code: Employment opportunities
"Employment opportunities refers to the types of employers or businesses in a community that are available and employing workers. This can also refer to perceptions regarding job availability, job quality or unemployment."

Code: Availability of Emergency Services
"This code includes the perception of availability of emergency services (e.g. fire, police and emergency medical services)."

Code: Drugs
"Drugs refers to any mention of the presence of illegal drug-related use or activity in a community. It also refers to any mention of negative outcomes related to drug use or activity as perceived by the community member."

Code: Medical Facilities and Medical Specialists
"This code includes the participant's perceptions about the availability and quality of medical facilities (e.g. hospitals, clinics) and/or medical specialists (e.g. cardiologists, rheumatologists)in their community.

Code: Community Service Organizations
"Community Service Organizations include any mention of a community organization that offers goods or services to community members (e.g. dial-a-ride, meals-on-wheels). This code specifically excludes mental health services, as it is its own code."

Code: Schools/Educational Programs
"This code refers to any mention of the quality of a community's school system, or availability of additional educational services (e.g. presence of a community college, classes offered to seniors)."

Code: Transportation Availability (Public/Medical)
"Transportation Availability (Public/Medical) includes the availability of

transportation to get around the community for regular use or medical appointments, regardless of cost. Examples might be a bus system or private ambulance service."

Code: Restaurants/Fast Food
"Restaurants/Fast food includes mention of purchasing food or drink for consumption outside of the home. Examples include McDonalds or Charlies."

Code: Water Availability and Quality
"Water Availability and Quality refers to mention of concerns such as water source, water treatment, water pollution."

Code: Church
"This code includes the participant's perceptions about church as a social and community resource, offering services or social support."

Code: Traffic
"This code includes the participants' perception about automobile traffic in their community."

Code: Mental Health Services
"Mental Health Services includes any mention of the availability of community services that are specifically targeted to Mental Health."

Code: Environmental pollution
"Environmental pollution refers to any industrial or mis-use of the environment that may have negative impact on a community member's health."

Codes: Farming/Farms, Sidewalks, Pharmacy, City-wide no smoking policy, Library, Landfill, Noise Pollution, Land Development, Arts & Theatre, Retirement Communities and Road Maintenance were initially coded but do not emerge in the majority of the focus groups (less than two times).

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