Chapter 1
Introduction

The numbers of older adults in the population are increasing due to higher life expectancies (Gavrilov and Heuveline 2003). One out of every eight people in the United States is 65 years old or older. In 2002, women reaching age 65 could expect to live another 19.5 years. Men could expect to live another 16.6 years. In 2002 the life expectancy was 77.3 years, 30 years longer than in 1900.

In 2003, 17.6% of adults aged 65 and over were racial and ethnic minority group members (Williams 2005). Over 8% of these older adults were Black, 5.7% of them were Hispanic adults, 2.8% were old Asian or Pacific Islanders, and fewer than 1% of these older adults were Native American or Native Alaskan. Minority group member populations are continuing to increase. The Hispanic population is projected to be 17.5% of the elderly population by 2050 (Williams and Wilson 2001). Old Hispanic adults are expected to outnumber old Black adults soon due to their historically high fertility and immigration rates. The elderly Black population has doubled from 1.2 million in 1960 to over 2.6 million today. The smallest ethnic minority group, elder Native Americans, will triple in size by 2050, numbering around 473,000 people (Williams and Wilson 2001).

Black and Hispanic adults have not benefited as much as Whites have from increases in life expectancy or better health (Spalter-Roth, Lowenthal and Rubio 2005). For example, health trends depict decreases in major chronic illnesses and diseases and higher levels of functioning for adults at older ages. However, these health generalizations obscure racial and ethnic differences in health status. Many minority group members do not live as long as Whites and

suffer worse health at earlier ages. Black adults, for example, are more likely to be disabled than Whites are--and at earlier ages (Geronimus et al. 2000).

In addition, there are sex differences in health status in old age. Though women live longer than men, they have more chronic conditions and higher levels of disability than men (Verbrugge 1985). In contrast, men have shorter life expectancies and more life-threatening chronic diseases. While reasons for these sex differences are unclear, biological (see Hazzard 1990 for a discussion of biological differences), behavioral (see Verbrugge 1985 for a discussion of behavioral differences), and social explanations have been posed. While it is likely that health outcomes result from the intersections of these (Rieker and Bird 2005), this research focuses on differences in social position and access to protective social resources that differentially affect men's and women's health status in old age. For example, differences in job types, work histories, and caregiving duties contribute to women's lower socioeconomic status and poorer health outcomes in old age (Moen 2001).

Literature and Framework

Racial health disparities have been explored within two literatures: socioeconomic status (SES) and race. The SES-based literature argues that race and SES intersect to affect health, but that most disparities in health operate through SES mechanisms (Marmot et al. 1997). The race-based literature adds that there are independent effects of race on health and that race and SES are interlocking, but not interchangeable, systems of inequality (Williams 2005). This current study aims to address these two literatures, examining the ways in which race and SES affect health among older adults.

Though the effects of SES on health are many--low SES is correlated with poor health (Adda, Chandola and Marmot 2003) and early mortality (Spalter-Roth et al. 2005), emphasizing

the role of SES on health can obscure and underestimate the role of race. Even after considerations of SES, racial health differences remain. For example, Black and White adults of like SES have worse overall health outcomes (Farmer and Ferraro 2005). There may also be racial differences in benefits to health care treatment (Cagney, Browning, and Wen 2005; Schneider, Zaslavsky, and Epstein 2002) and social integration (Dilworth-Anderson and Burton 1999). Health care treatment differences have been explained by racism (Balsa and McGuire 2001) while social integration differences have been explained by cultural factors (Berkman et al. 2000).

The purpose of this research is to improve understandings of specific old age health mechanisms, paying particular attention to racial and ethnic differences in health. A more complex understanding of old age health outcomes leads to better informed interventions and policies which can more successfully alleviate health inequalities. Because race and SES inequalities are persistent, the effects of race and SES are hypothesized to accumulate over time and widen the gap in health between old Whites and old Black and Hispanic adults.

Using a cumulative advantage lens to frame this discussion, this study examines the ways in which SES and race are interwoven systems of inequality and the ways in which these may be associated with widening health inequalities over time. SES is expected to be associated with accumulating and widening health disparities not only through income, education, and wealth, but also through health insurance, health problems, early life course disadvantages, and disability. In addition, race is expected to be independently associated with accumulating and widening health disparities through differential benefits to health care treatment and social integration.

This study also recognizes that health differs by sex. The relationship between health and sex is complex. Women have higher morbidity rates than men due to chronic conditions whereas men have higher mortality rates than women due to acute life-threatening conditions. This study uses two measures of health to better understand these sex differences in health. Examining functional limitations, this study hypothesizes that women will have worse health at earlier ages than men and that these effects will accumulate and widen sex differences in health. Self-reported health is less of a physical health measure, and better able to capture mortality. This study predicts that men will have worse self-reported health than women.

Overarching Research Questions

While more detailed research questions follow, the following research questions are used to guide the discussion of the health models below and the corresponding literature review.

1. Through what mechanisms do race and SES affect health in old age? How do the effects of race and SES affect health over time, widening the health gap between old Whites, other racial and ethnic minority group members, and old Blacks and Hispanics?
2. How does health differ by sex in old age? In what ways is sex associated with accumulating and widening health disparities?

Modeling Health Disparities

Health is conceptualized in two ways in this study--functional limitations and self-reported health. The corresponding models and hypothesized relationships with race, SES, and sex are presented below. Figure 1 shows the hypothesized relationships between functional limitations and race, SES, sex, and health-related mechanisms. Race is expected to have an independent effect on health and also affect health through differential health care treatment and benefits to social integration. Race and SES are hypothesized to intersect and affect health

through early disadvantages, health problems, and health insurance. Adult SES is also expected to have a direct effect on health. Sex is expected to affect health directly and through health problems. Though age and marital status are not in Figure 1, increasing age is expected to be associated with more functional limitations while marriage is expected to be associated with fewer functional limitations.

Figure 1

Conceptual Functional Limitations Model

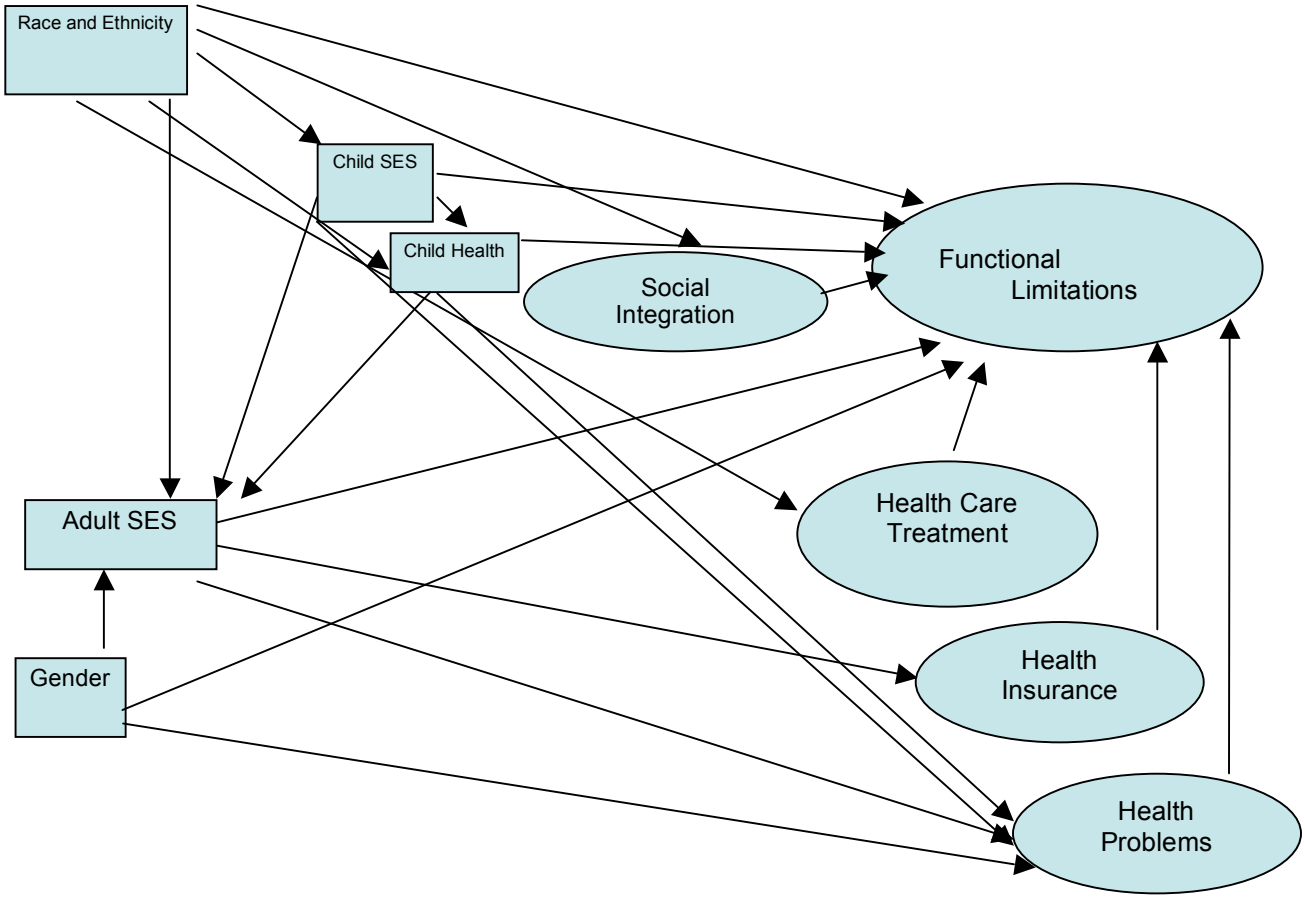


Figure 2

Conceptual Self-Reported Health Model

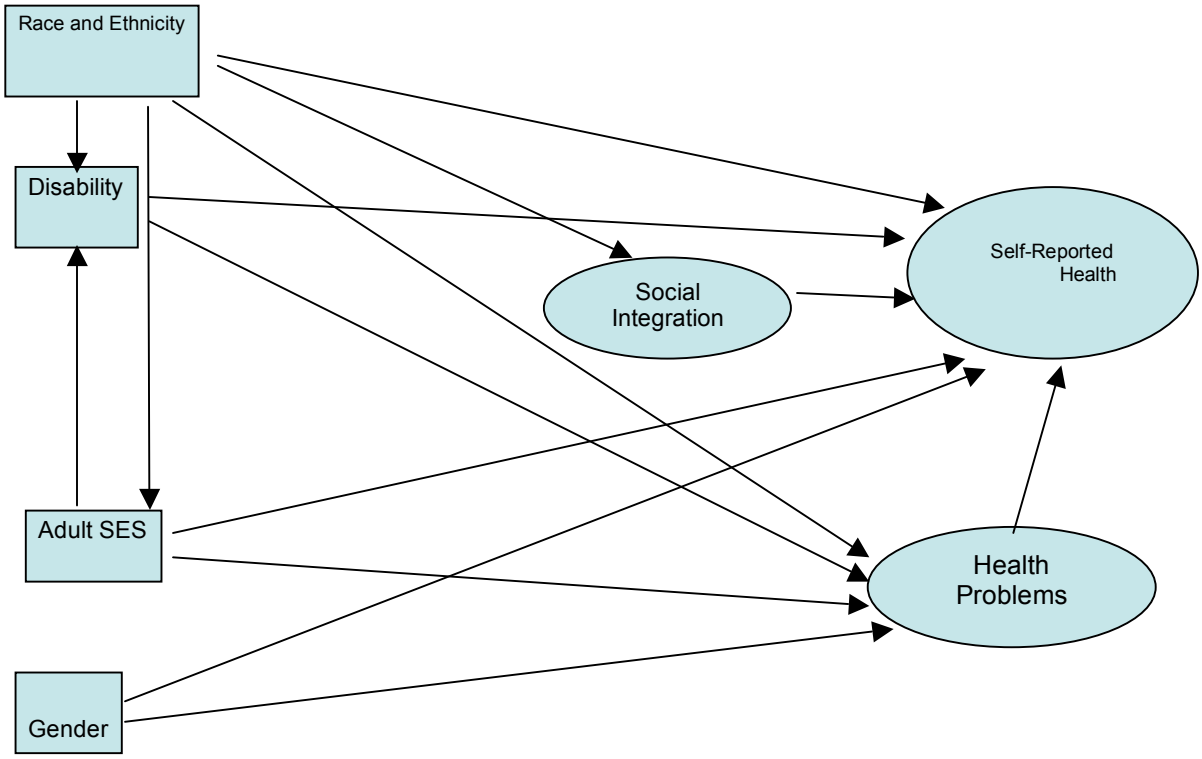


Figure 2 shows the hypothesized relationships between self-reported health and race, SES, and sex. Race is expected to have an independent effect on health and also affect health through social integration. Race and SES are hypothesized to intersect and affect health through disability. Sex is hypothesized to have a direct effect on functional limitations. Age and marital status are not in Figure 2, but increasing age is expected to be associated with poor health reports whereas marriage is expected to be associated with good health reports. The following literature review clarifies reasons for these hypothesized relationships and provides evidence for the relationships suggested here.

Chapter 2
Literature Review

Death and disability rates, life expectancies, and age-specific mortality patterns differ by race and ethnicity. Between 1980 and 2002, White adults experienced a substantial decline in death rates (Williams 2005). Comparatively, the decline in death rates for Black adults was not as sharp. Black adults continue to have a 30% overall higher death rate than White adults. White life expectancies have also been increasing over time. Whites gained 2.5 years between the years 1900 and 1960 and 3.9 years between the years 1960 and 2002. Black adults who have not experienced the same gains in life expectancies live an average of 5 fewer years than Whites. At advanced ages, there is evidence for a mortality crossover between Black and White adults (Crimmins 1996). Though 65 year-old Blacks can expect to live fewer years in good health than their White counterparts, Blacks who live to the age of 85 can expect to live longer and in better health than their White counterparts (Grundy 1997).

Heath disparities between Whites and Blacks are also apparent at early ages. Blacks have higher infant mortality rates than Whites, and Blacks continue to be at a higher mortality risk than Whites until 4 years of age (Williams and Collins 1995). Blacks are also more likely than Whites to be disabled--and at earlier ages (Geronimus et al. 2000). Twelve percent of Blacks are disabled by age 30 (Hayward and Heron 1999). In comparison, White adults do not reach a 12% disability rate until the age of 50. While these disability rates are reduced somewhat with age, Black adults continue to be 1.5 times more likely than Whites to be disabled (National Center for Health Statistics 1998). Also, Black adults have higher mortality rates than White adults for eight of ten leading causes of death, including heart disease, cancer, stroke, and diabetes.

Hispanic adults have higher mortality rates than Whites for diabetes, cirrhosis of the liver, and AIDS (National Center for Health Statistics 1998). Hispanic adults also have higher

rates of disability than Whites and are disabled at earlier ages than Whites (Geronimus et al. 2000). Despite this, overall mortality rates among Hispanic adults are decreasing, and currently Hispanic adults have lower mortality rates than Whites (National Center for Health Statistics 1998). Lower mortality rates among Hispanic adults compared to Whites have been attributed to the effects of nativity—otherwise known as immigrant advantage (Angel and Angel 1998). Hispanic immigrants tend to have health advantages over their native-born counterparts. Elderly males born in Mexico, for example, have lower death rates than elderly Whites from chronic and degenerative diseases. However, these health advantages decline after living in the United States for a certain period of time (Angel, Buckley, and Sakamoto 2001), and Hispanic immigrants continue to be disadvantaged on other health indicators. For example, Hispanic immigrants are more likely than Whites and other racial groups to suffer from infectious and parasitic diseases (Angel and Angel 1998).

Compared to other minority group members, Asian Americans are advantaged. Asian Americans have the lowest disease and disability rates and the highest life expectancies compared to all other racial and ethnic groups (National Center for Health Statistics 1998). In fact, Asian American adults have higher life expectancies than White adults. Asian American men are the most removed from disability, reaching a 12% disability rate around the age of 60. There are notable differences among Asian American groups, however. Compared to other Asian Americans, Pacific Islanders have the highest rates of disability and mortality.

Because racial health disparities have largely been framed within two competing perspectives, SES and race, this study addresses these literatures. Though each perspective examines the relationship between race, ethnicity, and SES, they disagree on the ways in which each shape health outcomes. The SES literature argues that the effects of race on health operate

mainly through class mechanisms whereas the race literature argues that there are additional independent effects of race on health.

This study makes several contributions to the literature by identifying gaps in the race and SES literature and building on this literature, and examining race and SES as interwoven but not interchangeable, social determinants of health within a cumulative advantage lens that frames old age inequalities as accumulating and widening over time.

Social Class and Socioeconomic Status: A Conceptual Framework

Social class is complex and has been conceptualizes in various ways. Social class conceptualizations have also changed over time with transformations in capitalism (Wallace 1990). The original conceptualizations of social class derive from Marx (1818-1883) and Weber (1864-1920). Marx's theoretical orientation views social class as a relationship between individuals and their control over the means of production. Within these relationships, some individuals are owners of some part of the distribution, production, or consumption process whereas other individuals are workers, or non-owners, within this system. Owners have more control over social resources than non-owners and gain economically from their workers. Within Marx's conceptualization, owners have control of assets, either through goods, services, or information, and also possess valuable skills and credentials.

Weber (1946) further conceptualizes social class by acknowledging the importance of sociocultural factors in status hierarchies. In particular, Weber (1946) makes distinctions between class, status, and party. Class refers to income, wealth, and market factors whereas status refers to culture and lifestyle. Weber uses party to refer to access to the state and the ability to create and enforce the law.

Other social class conceptualizations have drawn from these two perspectives, including the political economy perspective (Estes 1979; Quadagno 1988). The political economy approach to social class is largely structural. Political economy perspectives frame social class around public policies which are shaped by ongoing social struggles and power relations. Social differentiation is the result of the state providing differential access to power and resources. Differential access to power and resources allow some individuals to enhance their status and power while disadvantaging other individuals in terms of status and power. As such, the state is critical in social class conceptualizations, as it determines the distribution of social resources and ranks individuals within a social hierarchy.

Another important view of social class comes from Bourdieu (1986), who builds on Weber's conceptualizations of social class. Bourdieu distinguishes social relationships in terms of acquired tastes and dispositions, which he locates within certain class cultures. For Bourdieu (1986) symbolic capital, or prestige and status based on group membership, and cultural capital, or knowledge, skills, and qualifications, are crucial to social class conceptualizations and are used to locate individuals within a social hierarchy. Bourdieu (1986) argues that education is crucial to social class conceptualizations, because education structures not only group memberships and knowledge, skills, and qualifications, but also individual tastes, lifestyles, and behaviors. Knowledge, skills, tastes, and so forth, are social resources which are reproduced and passed on from parents to their children.

Each of these perspectives recognizes the importance of economic conditions in the formation of social hierarchies, though each perspective characterizes the role of income and wealth, and their distributions, differently. These various conceptualizations of social class are important because, taken together, they demonstrate the complexity of social class and provide a

lens through which distributions of income, wealth, and most importantly, resulting health outcomes can be examined (Krieger, Williams, and Moss 1997). Though social class is a social relationship that precedes income, wealth, and health inequalities, it is directly related to these. Income, wealth, and health inequalities result from the unequal distributions of social resources. That is, education, skills, and knowledge are directly related to lifestyles and behaviors, for example.

Similar to social class, socioeconomic status (SES) is a hierarchically related social position resulting from the unequal social and economic relationships between people and the social structure (Krieger et al. 1997). Social class and SES differ in that SES is usually conceptualized as economic social conditions, consisting of income, wealth, and education, though it is used in other ways as well. SES is linked to both childhood and adult social class positions and is important because it affects health in multiple ways. It is to the relationships between health and SES that this discussion now turns.

Socioeconomic Status and Implications for Health

Income, wealth, and education affect lifestyles, health behaviors, resources and knowledge, socialization opportunities, living conditions, life chances, power, and privilege (Williams 2005). These latter social resources extend beyond income, wealth, and education, but are nevertheless directly related. Education, for example, can influence having the resources and knowledge needed to engage in positive health behaviors such as not smoking, having regular medical exams, and exercising (Read and Gorman 2005).

Income, wealth, and education affect living conditions because neighborhoods are stratified by SES. Poor people live in areas with few good jobs, high crime rates, low property rates, and are exposed to environmental toxins (Williams and Collins 2001). Because of

residence, the poor also have limited health care access. From the moment of birth, there are health differences by SES (Williams 2005). Impoverished children are more likely to have worse health than their wealthier counterparts, and have fewer social resources available to them through their families. Children from advantaged, high SES families have access to more nutritious food, safe and clean living environments, better health care, good housing conditions, residential stability, and experience fewer chronic stressors than their poorer counterparts (Hatch 2005). Though education, income, and occupation can alleviate some of the effects of early disadvantages, many of the effects of these disadvantages persist into adulthood. For example, childhood SES affects cardiovascular disease in old age regardless of adult SES (O'Rand 2005).

SES is highly correlated with health (Benzeval and Judge 2001). High SES affects adult health by delaying morbidity and mortality until much later in the life course (Williams and Collins 1995). Low income individuals are associated with higher morbidity and mortality rates than their high income counterparts (Fiscella and Franks 2000). Income (DeVita 1996) and wealth (Eller 1994) inequalities have been increasing in the United States (Smeeding and Gottschalk 1996). Because SES is highly correlated with health, SES-related health inequalities may be increasing even though overall mortality rates are decreasing (Krieger et al. 1997).

SES also affects health through health insurance, as health insurance influences access to health care and treatment. Health insurance is costly—there are high monthly premiums and doctor and hospital co-payments can be expensive (Porell and Miltiades 2001). People without health insurance are most likely to be the working poor-- they cannot afford health insurance, are not covered by their employer, and do not qualify for Medicaid (Seccombe and Amey 1995). People without health insurance are less likely to visit the doctor than those with health insurance (Davis and Rowland 1990).

Health is related to insurance type (Zuvekas and Taliaferro 2003). Health differences by insurance type have been attributed to differences by SES because SES pre-determines health insurance type in old age (Hurd and McGarry 1997). That is, the ability to afford health insurance is based on a person's economic resources. Also, the quality of health care differs by type of health insurance. Some studies find that private and employer-provided insurance are linked to better quality care than public insurance (Zuvekas and Taliaferro 2003). Ross and Mirowsky (2000) do not find independent health benefits from private health insurance, but do find that health disadvantages are associated with public insurance, regardless of SES and baseline health.

Private and employer supplemental policies require yearly payments and doctor-visit deductibles. Older adults with private insurance tend to be healthier and have more wealth, income, and education than those without private insurance (Hurd and McGarry 1997). Private health insurance may provide better access to care than those without a supplemental insurance policy because it pays for many out-of-pocket costs. Older adults with private insurance are more likely to report having a regular doctor than those without private insurance (Hurd and McGarry 1997).

Costs for employer-provided insurance have been increasing in recent years. Since 1992, the costs associated with this type of insurance have risen about 75% for both family and single coverage (Bureau of Labor Statistics 2005). Employer insurance use has been decreasing in recent years, largely due to these rising costs (Zuvekas and Taliaferro 2003). Employer-provided insurance is a work benefit; this type of insurance is a consequence of having a "good" job. Like private insurance, employer insurance is associated with quality health care. Union members, white collar workers, and people making $15 an hour or more are more likely to have employer

benefits than their counterparts (Bureau of Labor Statistics 2005). Those with this type of insurance tend to have better health than those without this type of insurance or some supplemental health insurance (Hurd and McGarry 1997).

One type of public insurance is Medicare. Medicare is a relatively universal social insurance program that is available to all older adults who have worked in the formal economy and contributed to the program (Social Security Administration 2006). Medicare is also available to the disabled who have worked and contributed to the program, regardless of age. Most people in this study, because they are aged 65 years old or older, have Medicare insurance. Medicare covers a limited amount of prescription drug costs, but pays for neither dental nor long-term care. Therefore, even Medicare recipients have substantial out-of-pocket health costs.

Another type of public insurance is Medicaid. Poor people of all ages can receive Medicaid. Among poor elderly adults, Medicaid insurance coverage is provided in addition to Medicare insurance. Medicaid insurance is a means-tested social assistance program (Social Security Administration 2006) and may provide lower quality care than other types of insurance—though this differs by age of the recipient. For example, while Medicaid is associated with more prescription drug use and more doctor visits among young adults than those with other types of insurance, it is also associated with increasingly worse health over time, when compared to those who have no health insurance at all (Ross and Mirowsky 2000). Among older adults in nursing homes, quality of care may differ by type of insurance coverage. Institutionalized older adults with Medicaid insurance have lower quality care than institutionalized elderly adults using other types of insurance (Harrington Meyer 1994).

Older adults with Medicaid may have better access to prescription drugs, compared to their Medicare-only counterparts, because Medicaid reduces out-of-pocket drug costs (Ross and

Mirowsky 2002). However, the lifetime disadvantages associated with Medicaid use may negate any positive returns of prescription drug coverage. Older adults with Medicaid insurance tend to be in worse health than older adults with supplemental insurance (Hurd and McGarry 1997). Differential health for those with supplemental compared to Medicaid insurance may further indicate quality of care differences, or it may indicate a selection bias where low SES Medicaid recipients have higher morbidity and mortality rates. Economic status, and not health, may lead to differences by insurance type. If economic status at younger ages is a predictor of old age health insurance type, then health insurance type reflects SES rather than quality of care.

Gaps in the SES and Health Literature

This study addresses several gaps in the SES and health literature. First, SES health measures have been inconsistent and secondly, health measures have largely been one-dimensional. There are problems with income or education-only SES measures, for example, as income varies over the life course and education fails to capture the varied economic processes that occur throughout adulthood (Alwin and McCammon 2001). Additionally, wealth measures alone may not capture the economic status of older adults who have assets but little cash. Therefore, income, education, and wealth measures are all necessary for a more complete understanding of individual and household SES. Without these measures, the economic disparities between Black and Hispanic adults and Whites may be minimalized (Williams and Collins 1995).

Limited health measures are problematic in that they reveal one dimension or aspect of health, which may mask race, sex, and SES health inequalities (Krieger et al. 1997). Self-reported health measures, in addition to physical health measures, reveal a more holistic picture of health. For example, in self-reported health measures, men report worse health than women

(Deeg and Kriegsman 2003) though women have worse health than men in physical health measures. Sex differences in health by health measure are largely the effects of type of condition. Chronic conditions are more likely to affect women whereas acute conditions are more likely to affect men. Physical health measures are measuring women's higher morbidity rates whereas self-reported health measures are measuring men's higher mortality rates. Self-reported health is correlated with mortality for men, but not for women. Self-reported health reveals faster rates of health decline for minority group members than Whites and self-reported health is correlated with mortality for these groups (Farmer and Ferraro 2005). This study uses a physical measure of health, functional limitations, in addition to self-reported health, which may be a better way to capture race, sex, and SES health inequalities in old age. Figure 1 (above) models the relationships of variables to functional limitations whereas Figure 2 (above) models the relationships of variables to self-reported health.

Thirdly, static measures of SES do not capture SES fluctuations over time. Without time-varying measures of SES, generalizations about the relationship between SES and health over time cannot be made. This is important because SES fluctuates more for minority group members than for Whites (Williams 2005). Static examinations of the relationship between SES and health do not show the ways in which race and ethnicity shape health outcomes throughout the life course. Along with this, health may be related to the time the person was exposed to disadvantage. Early life course experiences such as childhood health and SES may have persistent effects on adult health outcomes (O'Rand 2006; Williams 1990). Thus, this study uses time-varying measures of income, wealth, and education (represented above by adult SES in Figures 1 and 2) and includes early disadvantages to measure early life course processes and

exposures to negative health events (represented by childhood health and childhood SES in Figure 1) to understand health in later life.

In addition, class-based theorists have examined SES-related health changes using cross-sectional data. While this methodology has its benefits, cross-sectional data cannot specify the dynamic ways in which race and SES affect health. Longitudinal studies are better able to account for SES fluctuations, and can better describe the ways in which health status in youth and early adulthood affect old age health outcomes by race and ethnicity (Krieger, Williams, and Moss 1997).

Finally, increasing income and wealth inequalities in the United States have focused health researchers on SES-based health inequalities. While SES is a powerful determinant of health, an economically-driven framework fails to conceptualize racial health disparities that are not due to SES. SES and race are interwoven systems of inequality but they are not interchangeable. The relationship between SES and race is complex and focusing on purely economic determinants of health may reduce understandings of the importance of race on health. Interventions and policies aimed at reducing racial disparities through SES alone may have limited effectiveness on health outcomes (Williams and Collins 1995). Racism affects the health Black and Hispanic adults. Whites and minority group members do not have the same life experiences. SES measures of health inequality cannot capture these racial differences in health. Much of the SES literature fails to account for racism and the ways in which it may affect health (Williams and Collins 1995).

Race and Ethnicity: A Conceptual Framework

Racism is defined as negative attitudes and beliefs about minority group members and differential treatment of minority group members on both an individual and an institutional level

(Williams 2005). As such, racism affects the daily lives of minority group members on an individual level, in daily interactions with other people where racism is perpetuated and maintained, and on a structural level, by restricting access to social resources. Race is a social construct where value is placed on Whiteness. As such, minority group members are disadvantaged relative to Whites. Being a member of a minority group is associated with oppression, exploitation, and economic and health inequalities.

Race has historically been used as a biological classification (Williams and Collins 1995) though many biological distinctions are flawed (Williams 1994). Few scientific criteria can meaningfully distinguish between differing racial and ethnic groups in a purely biological sense. This is not to say that there is no variation in the human population, but that racial and ethnic categories fail to capture this variation in meaningful ways (Williams 1999). For example, biological classifications explain less about racial health differences than SES inequalities, neighborhood, health policy, and racist practices (Spalter-Roth et al. 2005).

Biological categories reinforce an ideology of difference and inferiority that have been used to justify individual- and structural level discrimination (Williams 1999). Minority group disadvantage is apparent in historical, economic, political, legal, social, and cultural conditions (King and Williams 1995). Thus, biological race classifications have real social consequences, affecting access to valuable social resources--education, income, and wealth attainment. These disadvantages produce markedly different life experiences for minority group members when compared to Whites (Spalter-Roth et al. 2005). This study examines these disadvantages in relation to racism: viewing racism's affect on health in two ways: through SES and through differential health care treatment.

Race, Ethnicity, and SES as Intersecting Health Determinants

Like SES, race is related to differences in status, power, and access to social resources and it predicts health outcomes (Williams 1999). As such, race and SES are powerful determinants of health, intersecting in ways that shape life course experiences. For example, race affects SES by restricting access to education, income, and wealth which in turn affect residence, home values, jobs, health insurance, and childhood and adult health.

Educational attainment patterns reveal marked racial differences. Old Whites are the most likely of all racial and ethnic groups to have a high school education. About sixty percent of elderly Black adults, 70% of elderly Hispanic adults, and 40% of elderly Asian and Pacific Islanders do not have a high school degree, compared to about 30% of elderly White adults (Williams and Wilson 2001). There are racial and ethnic differences in higher education as well. Compared to 15% of elderly White adults, only 7% of elderly Black adults and 6% of elderly Hispanic adults have a college degree. Still, elderly Asian and Pacific Islanders are most likely to have a college degree. About 20%, of elderly Asian and Pacific Islanders have a college degree.

Besides racial differences in educational attainment, there are also racial differences in educational benefits. College-educated Black adults are four times more likely than their White counterparts to be unemployed (Dressler 1996). Similarly, though more educated Black adults have better health than their less educated Black counterparts, they have significantly worse health than Whites of the same educational level (Farmer and Ferraro 2005).

Educational attainment and differences in educational benefits affect job opportunities, which in turn affect salaries and availability of other benefits, including employer insurance. Black adults are more likely than Whites to work for low pay and have jobs without benefits or pensions (Farley 1996). Even after educational considerations, Black and Hispanic adults are

more likely than Whites to work in lower-status jobs that expose them to toxins (Williams and Collins 1995). Black and White adults are also paid differently for the same work (Farley 1996). When Whites and minority group members receive the same wages, minority group members do not have the same purchasing power as Whites. Black adults pay more than Whites for societal goods and services, including higher taxes on housing of similar value (Alexis, Haines, and Simon 1980; Williams 1991), higher costs for food, and higher prices for new cars (Ayres 1991).

These disadvantages in jobs, salaries, and health insurance benefits produce differential income and wealth accumulation by race. Black and Hispanic adults have less income and wealth throughout the life course and into old age than Whites do. Among those aged 70 years and older, White households have four times the wealth of Black households (U.S. Bureau of the Census 1996a). Within each income level, the net worth of Black and Hispanic adults is less than that of White adults. Wealth disparities are apparent in differential home ownership and equity where Black and Hispanic adults are less likely than Whites to own their own homes and the homes they own are worth less. These differences in income and wealth have health consequences—income and wealth can provide a buffer to economic emergencies such as a health crisis or a job loss.

Among Hispanic adults, Puerto Rican elderly are the most disadvantaged in income and wealth, largely because they lack the skills to find good jobs with salaries and health insurance benefits (Sandefur and Tienda 1988). Puerto Rican farm workers and unskilled laborers are over-represented in U.S. migration flows (Melendez 1994). Mexican American elders are also disadvantaged. Mexican American elders are the most likely of all Hispanic groups to work as migrant laborers. Migrant labor positions economically disadvantage these groups because these positions do not contribute to Social Security (National Council de la Raza 1992). Hispanic

adults are least likely of all racial and ethnic groups to receive Social Security and Medicare (U.S. Bureau of the Census 1996b).

Employment affects access to health insurance, through availability of insurance, and also by ability to purchase health insurance. Black and Hispanic adults are less likely than Whites to have employer-provided insurance, largely due to job type (Zuvekas and Taliaferro 2003). Even when health insurance is available through employment, health insurance is costly—involving high coverage rates and co-payments that many minority group members cannot afford (Williams and Collins 2001).

Individuals can purchase private health insurance if employer insurance is not offered, but this is the most expensive type of insurance. White adults are the most likely to have private insurance (Carrasquillo, Lantigua, and Shea 2000). Private insurance is associated with high quality care, when compared to other types of insurance, including Medicare and Medicaid. Black and Hispanic adults are more likely to have Medicaid insurance (Schneider et al. 2002).

Health insurance also affects access to medical services. Because of restricted access to health care via lower SES and health insurance, Black and Hispanic adults are less likely than Whites to have a regular source of care (Fiscella et al. 2002), even though they have more health problems than Whites (Rahman et al. 1994). Limited access to health care is associated with higher death rates at all ages (Ferraro, Farmer and Wybraniec 1997).

Race and SES affect health through neighborhood segregation as well. Black and Hispanic adults are more likely than Whites to live in impoverished, unsafe neighborhoods (Massey and Eggers 1990). Though middle-class Blacks would like to live in better neighborhoods often they cannot because of racial segregation and the out-migration of middle-

class Whites (Massey and Denton 2005). As a result of this segregation, many Blacks do not have the same access to community health resources (Williams 1999).

Disadvantages in income, wealth, education, jobs, salaries, and neighborhoods increase the likelihood of exposure to early disadvantages. Infant mortality rates are higher among Balck adults than White adults, and these racial differences persist even after SES considerations. For example, Black women with a college degree have higher infant mortality rates than White women with high school degree (Jackson 2005). Further, controlling for SES, Black and Hispanic adults are four times as likely as Whites to have poor health as children and Asian-Pacific islanders are four times as likely as Whites to have poor health as children (Williams 2005).

The discussion now turns to an analysis of the ways in which race affects health through health care treatment.

Differential Treatment in Health Care

The SES literature shows that the effects of SES on health cannot be overstated. In addition to SES, race differentially shapes health pathways. Race directly affects health through differential health care treatment. These treatment differences disadvantage Black and Hispanic adults (Hannan, van Ryn, and Burke 1999). Schnittker, Pescosolido and Croghan (2005) find that racial differences in treatment are not due to differential expectations of treatment by minority group members. Minority group members have are similar expectations and predispositions to treatment as Whites. Though fears of racism and discriminatory treatment exist, these fears are not responsible for treatment differences by race. Rather, racial differences in treatment are the result of differences in the treatment process with minority group members disadvantaged.

Even after considerations of health insurance and disease severity, racial differences in the receipt of care for a broad range of medical conditions remain (Harris, Andrews, and Elixhauser 1999). Black and Hispanic adults are less likely to receive a wide range of medical services than Whites of the same SES, despite their greater need for these services (Link and Phelan 1995; Williams and Collins 1995; Zsembik, Peek, and Peek 2000; Balsa and McGuire 2001). The literature shows that medical professionals do not treat their Black and White patients the same, and that these differences in treatment go beyond variations in SES. For example, even among Medicare beneficiaries, minority group members have more difficulty obtaining care and receive lower quality care than White adults (Schneider et al. 2002). There may even differences in pain management by race and ethnicity, with Hispanic adults receiving less analgesia than Whites, even after controls for pain severity (Todd, Lee, and Hoffman 1994).

Black and Hispanic adults are also more likely to receive inappropriate or lower quality care than Whites. In old age, Black adults are less likely than Whites to receive all of the most commonly performed procedures. For example, Black elderly adults are 3.6 times more likely than Whites to suffer an amputation of a lower limb due to diabetes, and Black elderly are 2.2 times more likely to have had testes removed due to cancer than their White counterparts (Williams and Collins 2001). Black elderly adults are less likely to be admitted for chest pains and are more likely to receive inappropriate management of congestive heart failure and pneumonia (Fiscella et al. 2002). Elderly Black and Hispanic adults are less likely than Whites to receive mammograms and influenza vaccinations. They are also more likely than Whites to suffer from diagnostic delays, have delays in initial treatment, and have poor medical management of chronic illnesses.

Finally, Whites and minority group members do not experience the same benefits to improvements in health care treatments. For example, the Black/White mortality differentials from coronary heart disease, cancer, diabetes, and cirrhosis of the liver were larger in the late 1990s than they were in 1950. Also, compared to White adults, Black adults have an elevated death rate for eight out of ten leading causes of death, and these racial health differences have not narrowed over time with technological improvements in care (Williams and Collins 2001). In 1998, the age-adjusted mortality rate for Black adults remained the same as in 1950--one and a half times as high as that of White adults.

Social Integration and the Role of Culture

Race may also affect health outcomes through social integration. Social integration is the number and frequency of social relationships and contacts (House, Landis, and Umberson 1988), and can be defined by a proximal network structure that indicates a level of social connectedness which enables an exchange of resources among individuals. Social integration has been studied in terms of social ties and social networks (Seeman 1996). Social networks are the social relationships that each individual maintains, including intimate and personal relationships with family and friends, and also formal relationships with other individuals and groups. Through social ties, individuals are integrated into their community and the larger society.

Socially integrated older adults have better physical health than adults who are not socially integrated (Bosworth and Schaie 1997). There are also mental health benefits to social integration (Krause 1997), and social integration is associated with greater longevity (Glass et al. 1999). Among older adults, social networks are also associated with decreased disability rates (Mendes de Leon et al. 2001) and less likelihood of Alzheimer's disease (Fratiglioni et al. 2000).

The positive effects of social integration on health are maintained even after considerations of SES, health status, and physical functioning (House, Robbins, and Metzner 1982).

Minority groups may differentially benefit from social integration because of a greater cultural emphasis on family and friends. While being a member of a minority group reflects power, status, and oppression, it also indicates certain family patterns, language, culture and traditions (Williams 2005; Williams and Collins 1995). Cultural differences are used to explain higher levels of social integration and more extended family structures within minority group communities (Gibson and Jackson 1987). High levels of social integration have been found in research on examining available helpers, frequency and perceived adequacy of help, type of help, and exchanges with adult children.

Among Black adults, higher levels of social integration have also been attributed to a historical sense of African cultural preservation, which has placed emphasis on familial and extended familial relationships (Sudarksa 1996). While this historical perspective recognizes change over time, it also recognizes the continued effects of these cultural values on current social relationships (Franklin 1988). Indeed, cultural differences in the size and composition of Black households persist even with considerations of SES (Farley and Allen 1987). Many studies agree with Aschenbrenner (1975), that slavery has created, and racism and oppression have maintained, a shared sense of family and racial solidarity among Black adults (see Chatters, Jayakody, and Taylor, 1994, for a good discussion of historical circumstances and the relationship between historical relationships and Black family structure).

Though some studies indicate that elderly Black adults have larger social networks than elderly Whites (Gibson and Jackson 1987), most investigators agree that elderly Black adults have smaller social networks (Barnes et al. 2004; Ajrouch et al. 2001). These smaller social

networks among Black adults are partly due to lower marital rates (Cantor, Brennan, and Sainz 1994) and shorter life expectancies (Ferraro and Farmer 1996) than Whites. Regardless, it is not likely the size of the social network that is most important to health: health benefits remain even with considerations of social network size and SES. These health benefits are largely due to two factors: the inclusion of fictive-kin, or unrelated persons, in the social network (Dilworth-Anderson and Burton 1999) and geographical proximity. Blacks are more likely than Whites to live near or with their children, and they are more likely to have relatives in the same city (Cantor et al. 1994).

Hispanic adults generally have dense, supportive, familial networks on which they rely for both practical and emotional support (Vega 1990). Like Black adults, Hispanic adults are more likely than Whites to be geographically close to their social networks and to have strong kinship ties among their family units (Sena-Rivera 1979). Also like Black adults, Cuban, and Puerto Rican adults are more likely than Whites and other Hispanic groups to include fictive kin in their close networks (Dilworth-Anderson and Burton 1999).

The social networks of Hispanic adults are related to historical factors such as immigration trends and history, and a cultural emphasis on the importance of family. Health benefits to social integration among Hispanics are also due to a greater reliance on familial relationships for health care needs. In particular, Mexican American elderly persons, compared to other Hispanic groups, have been found to rely on their family for health care more than the formal health care system (Whitfield and Hayward 2003). Vega and Kolody (1985) link this greater reliance on informal familial care to lower nursing home utilization rates among Mexican American elderly. These social networks may be important to health in other ways as well. For example, social integration may be responsible for more successful Hispanic adaptation to White

culture (Portes and Bach 1985). Successful adaptation via social integration may buffer the effects of workforce marginalization, relocation difficulties, and financial struggles (Vega 1990), all of which have an affect on health for Hispanic adults.

Of all immigrant groups, Asian Americans have been most successful in adapting to U.S. culture, and have experienced the most rapid social mobility (Min 1995). Though debated in the literature, various factors have been linked to their overall success, including embeddedness in social networks, filial piety, and family centrality. Social mobility and chain-migration patterns are common in their familial networks (Pian 1980). Asian American culture has been linked to high levels of intergenerational assistance and family solidarity. Lee, Parish, and Willis (1994) argue that Asian American families place importance on familial relationships that there is a common feeling of obligation to family members and their health care needs. For example, low nursing home utilization rates have been attributed to this greater reliance on the family for health care needs (Whitfield and Hayward 2003).

Health benefits to social integration among Asian Americans have been explained through high levels of social integration and differing cultural norms concerning collectivism and interdependence. These Asian cultural values contrast with Western philosophies centered on individualism and independence (Takahashi et al. 2002). Social integration is expected to benefit the health of Asian American adults due to their emphasis on the family, obligatory family care, and interdependent values.

Sex and Health

Women's SES is affected by marital status and marital history (Harrington Meyer 1996). Economically, the most important relationship for women in old age may be with their husbands. Economic benefits of marriage are largely from access to their husband's earnings, pensions, and

Social Security benefits. Old married women are less likely than other old women to live in poverty. There are racial differences in marital status that have important economic consequences. Black women are less likely than White women to be married (Cherlin 1992) and therefore are less likely to have access to a man's financial resources. However, as Willson (2003) shows, Black women gain fewer economic benefits from marriage than White women because Black men have lower earning power relative to White men.

Because SES is important to health throughout the life course, gender differences in SES are linked to poor health, with women being more disadvantaged. Women are less likely than men to work for pay in the formal economy. This is due to a variety of factors, including taking primary responsibility for the care of children and elderly relatives (U.S. Department of Labor 1991) and working in part-time jobs with little pay and no health benefits or pensions. Women are discriminated against in the workforce--when women are full-time workers, they earn less than men (Blau and Kahn 1992). This is largely because of sex segregation in the workplace, where women's work is devalued, largely because it is women's work (Reskin 1988). Women's intermittent work histories, part-time jobs, discrimination, and lower earnings translate into less income and wealth accumulation over the life course, reducing their Social Security benefits and financial resources in old age (Harrington Meyer 1996). Therefore, SES differences between men and women and women's greater reliance on marriage for economic stability stems from women's differential access to jobs, equal pay, and home responsibilities (Moen 2001).

Health differences between men and women are complex and paradoxical. Women have longer life expectancies than men, but have higher morbidity rates, suffering from more chronic illnesses and conditions than men (Read and Gorman 2005). Women are more likely to have anemia, thyroid conditions, gall bladder conditions, migraines, arthritis, and eczema (National

Center for Health Statistics 2003). Women are also more likely to be in pain and have more functional limitations (Smith and Kington 1997). In contrast, men are more likely to suffer from life-threatening acute conditions such as heart disease, cancer, cerebrovascular disease, emphysema, cirrhosis of the liver, kidney disease, and atherosclerosis (National Center for Health Statistics 2003).

Though this study is concerned with the ways in which social determinants of health differ by sex, gender differences have been explained in the literature through social, biological (Hazzard 1990) and behavioral (Verbrugge 1985) factors. While these factors undoubtedly affect health in complex ways (Rieker and Bird 2005), this research focuses on how differences in social position and access to protective social resources are associated with differential health pathways by sex (Moen 2001). That is, differences in job types, work histories, and caregiving duties contribute to women's lower socioeconomic status and poorer health in old age.

The Role of Race, SES, and Sex in this Study

Race and SES are conceptualized as social locations in this study. As such, they are indicators of access to social resources and life course opportunities. This study is largely concerned with the independent and intersectional effects of race and SES on health. Because differing health measures may capture more of the variance in health pathways by social location, this study uses both functional limitations and self-reported health to measure health (see Figures 1 and 2).

Black and Hispanic adults are disadvantaged in relation to Whites in many health indicators. Emerging literature suggests that race plays a more important role in health outcomes than the SES literature shows. Indeed, SES explains much of the differences in health between Blacks, Hispanics, and Whites, but racial differences in health remain even after considerations

of SES. For this reason, this study examines race and SES as interwoven but not interchangeable systems of inequality. This discussion now turns to the specific nature of these relationships and the ways in which differential health pathways are examined.

SES is conceptualized as income, wealth, and education in this study and is expected to have an independent effect on health, as shown in Figures 1 and 2 above. SES also affects health through health problems and health insurance. Low education, income, and wealth are associated with more health problems and poorer quality of care insurance which restricts access to care. SES is in turn affected by early disadvantage. Poor childhood health and low childhood SES (see Figure 1) are related to lower adult SES, and poorer adult health. Early disadvantages and health insurance do not operate through SES alone, however. Each of these are affected by race as well, as minority group members are more likely than Whites to do have these disadvantages in early life and are more likely to have poorer quality health insurance throughout the life course. In old age, this affects the ability to purchase additional health insurance, such as private insurance, to pay for care. These pathways can be seen in Figures 1 and 2. In these ways race and SES intersect to affect health.

As shown in Figure 1, health care treatment is expected to differ by race independently of SES. Black and Hispanic adults receive differential and inferior health care compared to Whites. The race literature has shown that differences in health treatment are largely the result of racism. Race also affects health independently through social integration, shown in Figures 1 and 2. Social integration, in contrast to health treatment, is expected to have a positive effect on minority group health due to historical circumstances and prevailing cultural emphases on interdependence and social relationships. This is not to say that Whites will not also benefit from social integration, but that minority group members will differentially benefit. Race is also

expected to have an independent effect on health through disability, as Black and Hispanic adults have more disability than Whites of like SES. This relationship is shown in Figure 2.

Sex, rather than gender, is used in this study there is no measure of gender in the Health and Retirement Study dataset. This study recognizes that there are differential health pathways by gender but cannot account for these. This study will examine health differences between men and women over time, as women have poorer health and more chronic health conditions than men in old age. As shown in Figures 1 and 2, sex is expected to independently affect health and also affect health through health problems. Marital status has an effect on women's SES, and this study controls marital status (though it is not presented in Figures 1 or 2).

Cumulative Advantage and Disadvantage

The existence of a relationship between race, SES, sex, and health is well documented. However, the interconnected pathways between these and health are not clear, and neither are the ways in which these affect health over time. In addition to accumulating over time, I propose that the effects of race, SES, and sex will be associated with widening health inequalities with age. Under the guiding framework of cumulative advantage theory, the positive effects of SES on health increases with age, along with the negative effects of minority group status, producing greater heterogeneity and inequality between Whites, other racial and ethnic group members, men and Blacks, Hispanics, and women in older ages compared to younger ages. The cumulative advantage perspective has been applied less to age-related widening inequalities in health than to widening inequalities by SES, and even less attention has been given to the effects of race on health over time. This study aims to add to the CAD health literature, examining the ways in which race, SES, and sex contribute to the accumulating and widening gap in health among older adults.

The background of CAD is discussed below, followed by a discussion of the ways in which CAD has been used to examining widening inequalities. Finally, the studies that have examined CAD in relation to health are discussed, and implications for future research and contributions of this study are given.

Background

The theory of cumulative advantage, first proposed by Merton (1968), argues that inequality is the result of the unequal distribution of resources related to productivity. Merton discusses how producers, academic scholars who publish in recognized journals and receive recognition for their accomplishments, are advantaged because their productive contributions are acknowledged and encouraged. In contrast to producers, non-producers, or academic scholars who are less published and receive little recognition and encouragement from their peers, are disadvantaged. The effects of recognition for scholarly articles accrue for producers while disadvantages accrue for non-producers, increasing and widening inequalities between these two groups over time.

Merton's ideas have since been integrated into the field of gerontology more generally by Dannefer (1987) and later O'Rand (1996). Merton's ideas are linked to cohort, institutional, and age-related structural processes. Applying Merton's ideas to individual and population aging has further developed the CAD theoretical framework. The CAD perspective is used to frame the relationship between inequalities and increasing heterogeneity among older adults (Dannefer 2003). In particular, this framework argues that advantages are the result of social location and opportunity. Whites are better positioned in society compared to many minority group members and Whites have more opportunities to accumulate crucial social resources. Advantaged Whites accrue resources to the detriment of disadvantaged minority group members. O'Rand (1996)

furthers the CAD framework in relation to the aging process, demonstrating how cumulative advantages and disadvantages produce accumulating and widening inequalities over time through restricted opportunities to education, income, and wealth.

Diversity in the life course experience received attention in the 1970s and 1980s when gerontologists began examining differences in aging experiences by race and gender (Dannefer 2003). With this increasing interest in the diverse life experiences of older adults, the CAD literature has increasingly paid attention to inequality. The CAD literature makes links between the diversity of the aging experience and race and SES and inequalities. In addition, the CAD literature has examined the ways in which this old age diversity is related to unequal accumulations of advantage or disadvantage over time.

Cumulative Advantage and Disadvantage and Health

The CAD perspective has been used to show that old age inequalities are not only the result of isolated individual circumstances but also an evolution and accumulation of collective circumstances and opportunities over time. This relationship may also apply to health. The following section discusses the ways in which the CAD perspective has been used in the health literature.

Evidence for Accumulating and Widening Health Disparities with Age

The evidence for an accumulation and widening of health inequalities through SES is varied. There is some evidence that the SES gap in health grows for most of the life course, but narrows amongst the oldest-old (House et al. 1994). Similarly, Newacheck et al. (1990) provides evidence that the SES gap in health widens until age 64 but then narrows with advancing age. In addition, there is some evidence that the effects of SES on health are largely the same after

middle age (Maddox and Clark 1992). Taubman and Rosen (1992) find that education predicts similar levels of health decline with each age group.

Using education and income to measure SES, Ross (1996) finds that there is a widening in the SES health gap with increasing age. Education is related to a widening in physical functioning and physical well-being measures but not self-reported health measures. In contrast, income is associated with a widening gap in health in all measures of health. Ross argues that due to the selection of her sample to include the healthiest non-institutionalized adults, she likely underestimates the growing SES and health gap in the population.

Health insurance has also been linked to health outcomes over time and is associated with fewer health risks (Cubbins and Parmer 2001). As discussed above, health insurance is related to income and work and may be an indicator of a well-paying job. As such, employment loss has detrimental effects on health through a loss in income and health insurance. The CAD literature has shown that employer-provided insurance is linked to better health over time (O'Rand and Hamil-Luker 2005).

Early disadvantages have also been linked to old age health outcomes (O'Rand and Hamil-Luker 2005). These early disadvantages are the result of differential educational and social opportunities, which are afforded largely to those of high SES (Dannefer 2003). Because these disadvantages occur early in the life course, their persistence into older ages supports the underlying accumulation premise of CAD. Early disadvantage can also be considered the beginning of a process of unfolding life course disadvantages that may be more likely to occur because of childhood hardships (Hatch 2005).

Studies focusing on the widening gap in health by SES have also found evidence for the persistence of race (Kahn and Fazio 2005). Racial differences in diabetes, stroke, and high blood

pressure persist over time even after SES and early disadvantage considerations. Though SES explains the race effect in both functional limitations and self-reported health, independent effects of race are found in fatal conditions. There are also racial differences in disability that are associated with diverging gaps in health over time, controlling for health, SES, and social factors, such as social integration (Kelley-Moore and Ferraro 2004). Black adults in particular have significantly more new health problems than Whites over time which may account for these differences.

To my knowledge, the relationships between race and health care treatment and social integration have not been examined within a CAD framework and have not been discussed as contributors to widening health outcomes. As discussed above, health care treatment and social integration are expected to have independent effects on health. I believe that the effects of differential health care treatment will increase the gap in health between Whites and many minority group members over time while the effects of differential benefits to social integration will decrease the gap in health between Whites and minority group members over time.

Women's higher incidence of health problems has been discussed within a CAD framework and women's lower income and wealth accumulations have been linked to higher morbidity rates (Mirowsky and Hu 1996). I expect women to be disadvantaged in health problems, and I expect there to be an independent effect of sex on health where the health gap between men and women will widen. Men are expected to be disadvantaged over time due to higher mortality rates whereas women are expected to be disadvantaged over time because of higher morbidity rates.

Race, SES, Sex and Accumulating and Widening Health Disparities in this Study

Examining old age health disparities within a CAD perspective provides an opportunity to understand how inequalities have accumulated while also recognizing that social location continues to structure health into the most advanced ages. CAD guides this research in several ways. First, the CAD literature has shown that health is multidimensional and that social location may affect the various health measures in differing ways. Because it is important to examine multiple health outcomes to capture this variation this study uses both functional limitations and self-reported health to capture race, SES, and sex health differences.

In addition, the CAD literature shows that SES fluctuations may be important to health and accumulations of disadvantage. This study uses income, wealth, and education as SES measures and accounts for changes over time. In this way, individual SES fluctuations and their relationship to health can be seen. As the CAD literature shows, it is also important to capture early hardships which may be independent of SES. Early disadvantages may affect adult health and adult SES in ways that cannot be measured though income and wealth. For these reasons, this study examines the effects of childhood health and childhood SES on old age health.

Finally, the CAD literature also shows that SES cannot explain health inequalities over time and that there is a persistent effect of race on health. This study examines the ways in which race may be linked to poorer health through differences in health problems, health insurance, health treatment, disability, and social integration. This study also accounts for sex differences in health over time and examines the ways in which sex is associated with widening the gap in health between men and women through health problems.

Research Questions and Hypotheses

The literature review has shaped the following research questions and corresponding hypotheses. Of particular interest are the ways in which race, SES, and sex are associated with widening health inequalities. This study's research questions are:

1. How are health problems, health insurance, and early disadvantages associated with widening health inequalities in old age?

2. Are there racial differences in the strength of association between health problems, disability, health insurance, and widening health inequalities?

3. How is race associated with widening inequalities in health in old age? In particular, how do differences in health treatment and social integration affect minority health?

4. Is sex associated with accumulating and widening health inequalities?

Hypotheses

Figures 1 and 2 (above) show hypothesized relationships between variables, though not all relationships are tested in this study. Figures 1 and 2 show that functional limitations and self-reported health are expected to differ by race, SES, and sex. Functional limitations and self-reported health are differing measures of health—note that pathways to good or poor health differ by each measure.

SES affects health problems, health insurance, childhood SES and childhood health. Health problems are expected to be associated with more functional limitations and higher odds of poor self-reported health. This relationship between health problems, functional limitations, and self-reported health is expected to be cumulative and associated with widening inequalities in advanced ages. The effects of health insurance on functional limitations are expected to differ by type of health insurance. Medicare and Medicaid are expected to be associated with more

functional limitations, accumulating and widening the gap in functional limitations over time. In contrast, employer-provided and private health insurance are expected to be associated with fewer functional limitations over time and into advanced ages. Early disadvantages, poor childhood health and low childhood SES, are expected to be associated with more functional limitations over time and into advanced ages, widening the functional limitations gap in old age between those with early disadvantages and those without.

Race and SES affect health problems, health insurance, and disability. Health problems are expected to differ by race, with Black and Hispanic adults having more health problems, compared to their White counterparts. Health problems will be associated with accumulating and widening functional limitations and higher odds of poor self-reported health over time and into advanced ages. Disability is used in the self-reported health model only. Disability is expected to differ by race, with Black and Hispanic adults having higher instances of disability. Disability will disadvantage Black and Hispanic adults over time and into advanced ages, compared to Whites and other racial and ethnic minority group members.

Health insurance benefits are also expected to differ by race. Black and Hispanic adults with employer-provided and private insurance are expected to have fewer functional limitations than their White and other racial and ethnic counterparts with these types of insurance. White and other racial and ethnic group members with Medicare insurance will have fewer functional limitations than Black and Hispanic adults with Medicare insurance. White and other racial and ethnic minority group members with Medicaid insurance will have more functional limitations than Black and Hispanic adults with Medicaid insurance. In this sense, there will be racial differences in benefits to health insurance.

Race is expected to affect benefits to health care treatment and social integration. Both types of health care treatment, doctor visits and hospital and nursing home stays, will be associated with more functional limitations for Black and Hispanic adults compared to Whites and other racial and ethnic minority group members. These two types of treatment will be associated with more functional limitations for Black and Hispanic adults over time and will be associated with widening health disparities in advanced ages. Social integration is expected to be associated with fewer functional limitations and higher odds of good self-reported health for all older adults. However, socially integrated Black, Hispanic, and other racial and ethnic minority group members are expected to differentially benefit from social integration and have fewer functional limitations and better self-reported health than their socially integrated White counterparts. The effects of social integration are expected to be cumulative over time.

It is expected that sex will have an independent effect on health at age 65 and the effects of sex on health will accumulate and widen over time. Women will be largely disadvantaged in the functional limitations model whereas men will be disadvantaged in the self-reported health model. There will also be sex differences in health through health problems. In the functional limitations model (Figure 1), and self-reported health model (Figure 2) women are expected to have more health problems than men. More health problems will be associated with more functional limitations and higher odds of poor self-reported health for women. The relationship between health problems and functional limitations and self-reported health is expected to accumulate and widen the gap in health between men and women over time and into advanced ages.

More specific hypotheses are detailed in the following chapter where the method and analytic strategy are discussed in greater depth.

Chapter 3
Methodology

This study uses data from the Health and Retirement Study (HRS) and RAND HRS to examine the effects of race, SES, and sex on two dependent measures of health--functional limitations and self-reported health, through hierarchical linear modeling techniques.

The Health and Retirement Study

The HRS and RAND HRS are available as public datasets, downloadable at the University of Michigan website (www.umich.edu/~hrswww/), and funded by the National Institute on Aging. The RAND HRS made the HRS data more accessible by combining HRS waves and providing conventional variable names—however, the RAND HRS did not combine every variable of the HRS. Thus, this study uses both the RAND HRS and the HRS. Using the combined waves of HRS, the RAND HRS and HRS includes over 22,000 men and women, over-sampling Hispanics, Blacks, and residents of Florida and includes sampling weights to make the sample nationally representative to all older adults.

The HRS and the RAND HRS are longitudinal, multistage probability samples of households, in which at least one member of the household, born between 1931 and 1941, was first interviewed in 1992 and every two years subsequently. The RAND HRS sample contains the study of Assets and Health Dynamics among the oldest old (AHEAD); people born before 1924 were initially included in a separate study. This cohort was first interviewed in 1993 and subsequently in 1995, 1998, 2000, and 2002. Also included is the Children of Depression (CODA) cohort, born from 1924 to 1930. This cohort was first interviewed in 1998 and subsequently every two years. The War Baby (WB) cohort, born between 1942 and 1947, was also first interviewed in 1998 and every two years subsequently. In addition to respondents from eligible birth years, staff interviewed the spouse or partner of the respondents, and there were

proxy respondents for some years. There are some young adults in the sample, but only those aged 51 years old and over are used in this present study. In addition to age restrictions, sampling weights are also used to make the study representative of non-institutionalized older adults in the United States. In combination, these reduce the sample size from over 22,000 people to 8,448 adults aged 51 and over in 1992.

As of 2005, eight waves of data are available. This present study uses wave years 1992, 1993, 1994, 1995, 1996, 1998, 2000, and 2002 in their final releases. The RAND HRS made some changes to the HRS when waves were combined. RAND HRS integrated year 1993 into the 1994 sample, except where there are overlaps in the AHEAD sample. For these overlaps, respondents were added to the 1992 wave, and for year 1995, respondents were integrated into the 1996 sample.

The HRS has records of income and asset accumulation, including household and respondent incomes, retirement accounts, stocks, and housing ownership and worth. The HRS survey has information on current and previous health conditions and diseases including high blood pressure, diabetes, cancer and heart disease. It also has information on the elderly adult's health care treatment including doctor, hospital, and nursing home stays. Included in the survey are questions about type of insurance coverage, including no insurance coverage, Medicare, Medicaid, private, and employer-provided insurance. Disability is measured through questions on paid work activities. The survey also records friend(s) and non-household living relative(s) that reside in the respondent's neighborhood.

Measures

Health is multi-dimensional. This study uses self-reported health and function limitations measures to examine the ways in which race, SES, and sex affect health and the ways in which

race, SES, and sex are associated with accumulating and diverging health inequalities in old age. Self-reports of health are subjective assessments of health whereas functional limitations measure physical aspects of health.

Dependent Variables: Descriptive Statistics

Functional limitations are measured continuously as an index of five Activities of Daily Living (ADL) and five additional functioning questions. The index ranges from 0-10, where 10 indicates the most functional difficulties. ADL items include: trouble walking across a room, bathing, eating, dressing, and getting in and out of bed. Additional functioning items include: walking several blocks, getting up from a chair, climbing one flight of stairs, kneeling, stooping or crouching, and extending arms above shoulder level. Table 1 shows the scaled ADL and additional question score reliabilities, means, and standard deviations across waves. The mean number of functional limitations increases with each wave year and the alpha reliability score is high for all wave years. All of the following tables and graphs represent weighted sample values.

Table 1

Functional Limitations by Year: Descriptive Statistics

Year	*M*	*SD*	α	*N*
1992	.68	1.38	.85	8274
1994	1.18	1.70	.82	7293
1996	1.28	1.89	.84	6988
1998	1.37	1.93	.83	6606
2000	1.42	1.97	.84	6168
2002	1.56	1.99	.83	5893

Self-reported health is treated as an ordinal variable in this study. Respondents are asked "In general, how would you rate your health status?" In this measure, 1=poor health, 2=fair health, 3=good health, 4=very good health, and 5=excellent health. Table 2 shows the means and standard deviations of self-reported health by year.

Table 2

Self-Reported Health by Year: Descriptive Statistics

Year	*M*	*SD*	*N*
1992	3.46	1.19	8442
1994	3.37	1.17	7778
1996	3.41	1.14	7239
1998	3.19	1.14	6872
2000	3.29	1.12	6455
2002	3.23	1.10	6143

There is no consistent pattern in self-reported health by year. On average, respondents report between good and very good health.

Level 1 Independent Variables: Descriptive Statistics

Total wealth is a continuous, time-varying measure. As such, it reflects changes in wealth over time. Total wealth is calculated by the sum of all wealth, including all assets, including houses and vehicles, minus the sum of all debt, including mortgages. Wealth means, standard deviations, and ranges by survey year are shown in Table 3. The log of wealth is used for ease of interpretation. Negative wealth values are handled in SPSS by first calculating the log of the absolute value and then multiplying formerly negative values by -1.

Table 3

Wealth[a] by Year: Descriptive Statistics (N=8,448)

Wealth	*M*	*SD*	*Range*
1992	5.37	5.68	-5.84 to 6.94
1994	5.42	5.72	-6.68 to 7.17
1996	5.48	5.81	-5.68 to 7.20
1998	5.57	6.22	-5.62 to 7.93
2000	5.62	6.11	-5.55 to 7.73
2002	5.62	6.04	-5.51 to 7.62

[a] Wealth values are logged.

On average, wealth increases with each survey year, though average wealth is the same in years 2000 and 2002. The standard deviations of wealth increase and peak in the year 1998, then drop in years 2000 and 2002.

The log of income is also used in this study. Income is measured by total household income including earnings, pensions, and Social Security. Table 4 shows income by year.

Table 4

Income[a] by Year: Descriptive Statistics (N=8.448)

Income	*M*	*SD*	*Range*
1992	4.69	4.72	0 to 6.11
1994	4.72	4.91	0 to 6.51
1996	4.75	4.92	0 to 7.49
1998	4.76	4.97	0 to 6.60
2000	4.78	5.03	0 to 6.73
2002	4.76	5.04	0 to 6.87

[a] Income values are logged.

On average, income increases until 2000, then decreases. The standard deviation of income increases with each year. In the following equations, both income and total wealth are represented by *Wealth* even though they remain distinct in the analysis.

Health care treatment is measured by reports of medical services used. Medical services include overnight hospital and nursing home stays and doctor visits. Doctor visits are separate from hospital and nursing home stays in the analysis because they measure different treatment types, but are represented by *Treatment* in the following equations for ease of discussion.

Hospital and nursing home treatments are more likely to be utilized during periods of poor health whereas doctor visits are more likely to be utilized for the treatment of health problems and preventive health care. Respondents in this study are not institutionalized; hospital and nursing home stays are likely not indicative of long-term care needs. Respondents with hospital and nursing home overnight stays are likely utilizing these treatments for rehabilitative care, and after which they return to the community.

Hospital and nursing home stays are coded so that 0=no stays, 1=a stay in a nursing home or a hospital in the reference period, and 2=a stay in both a hospital and a nursing home in the reference period. Doctor visits is a dichotomous variable, with 0= no doctor visit within the reference period and 1=a doctor visit within the reference period. For these treatment variables, the reference period for Wave 1, year 1992, is the past 12 months, whereas the reference period for all other waves is between surveys. The proportions or means, and standard deviations of these treatment variables are shown in Table 5.

Table 5

Hospital and Nursing Home Stays and Doctor Visits by Year: Descriptive Statistics (N=8,448)

Year	*Hospital and Nursing Stays*		*Doctor Visits*	
	Proportion	*SD*	*M*	*SD*
1992	.11	.32	.79	.41
1994	.19	.40	.89	.31
1996	.21	.42	.92	.28
1998	.23	.44	.92	.26
2000	.24	.45	.93	.25
2002	.28	.48	.94	.24

Table 5 shows that the proportion of respondents utilizing a hospital or nursing home stay increases with each wave year. Doctor visits also increase with each year, though means are the same in years 1996 and 1998.

Health insurance is measured by reports of no insurance, employer-provided insurance, private insurance, VA/CHAMPUS insurance, Medicare insurance, and Medicaid insurance. Governmental health is comprised of Medicare, Medicare/Medicaid, or VA/CHAMPUS. Employer-provided insurance is measured by respondent or spousal insurance coverage through a current or former employer. Private insurance is any other type of health insurance. Health insurance types are not mutually exclusive--respondents may combine several types of insurance.

Health insurance types are coded as 0=not covered and 1=covered. In the following equations, *Insurance* represents all of these types of insurance for ease of discussion, but they remain distinct in analyses. Table 6 shows sample differences in insurance types, noting means, standard deviations, and number of respondents answering health insurance questions by year. There are variations in sample size by year due to sample fluctuations, respondents moving in

and out of the sample, and some respondents not answering health insurance questions in the survey year.

Table 6

Health Insurance Coverage by Year: Descriptive Statistics

Health Insurance coverage	*Medicare*	*Medicaid*	*VA/CHAMPUS*	*Employer*	*Private*	*No Insurance*
1992						
M	.08	.03	.05	.71	.14	.11
SD	.27	.18	.22	.45	.35	.32
N	8315	8316	8316	8312	8178	8442
1994						
M	.12	.04	.05	.71	.18	.09
SD	.33	.20	.22	.45	.38	.29
N	7759	7758	7757	7613	7736	8442
1996						
M	.21	.05	.04	.64	.14	.08
SD	.40	.22	.21	.48	.34	.26
N	7207	7201	7211	6889	7198	8442
1998						
M	.33	.06	.04	.60	.16	.06
SD	.47	.23	.19	.49	.37	.24
N	6854	6849	6859	6596	6849	8442
2000						
M	.47	.06	.03	.58	.20	.04
SD	.50	.24	.18	.49	.40	.20
N	6435	6438	6443	5432	6427	8442
2002						
M	.63	.07	.06	.53	.19	.03
SD	.48	.25	.25	.50	.39	.17
N	6134	6124	6140	6099	6096	8442

As Table 6 shows, employer-provided and private insurance are used mostly in beginning years, decreasing with each year, though employer-provided insurance use remains high throughout. The most consistent increases occur with Medicare recipients, though those reporting continued coverage through employer-provided insurance continues to be substantial. Medicare insurance coverage increases with each year because more respondents are old enough

to be eligible. The number of respondents with no insurance coverage decreases with each year. On average, use of Medicaid insurance increases with each wave year, as more poor older adults use this type of insurance. VA/CHAMPUS insurance coverage does not vary much with each year.

Social integration measures are not consistent across waves because the HRS was not designed to measure aspects of social support. Nevertheless, this study's measure of social integration consists of 1) having at least one friend in the respondent's neighborhood and 2) having at least one non-household relative living in the respondent's neighborhood. If the respondent has no good friends in the neighborhood, social integration is coded 0. At least one good friend in the respondent's neighborhood is coded 1. Likewise, at least one relative in the respondent's neighborhood is coded 0 and at least one relative in the neighborhood is coded 1. In this study, having a non-household relative or good friend living in the neighborhood implies a close proximity of potential support to the respondent. In this sense, these measures indicate a form of support nearby if needed.

Table 7 shows the mean and standard deviation of having a friend or a relative in the neighborhood. Even though these variables remain separate in the analysis, they are represented by *Social Integration* in the equations.

Table 7

Friends and Relatives in Neighborhood by Year: Descriptive Statistics (N=8,448)

Year	*Friends*		*Relatives*	
	M	*SD*	*M*	*SD*
1992	.70	.46	.34	.47
1994	.69	.47	.34	.47
1996	.68	.47	.29	.45
1998	.67	.47	.29	.45
2000	.68	.47	.30	.46
2002	.71	.45	.31	.46

On average having a friend in the neighborhood remains stable throughout the survey years. Having a relative in the neighborhood decreases 1992-1994, stabilizes from 1996-1998 and then increases from 2000-2002, though this increase is small.

Doctor-diagnosed health problems may predict both functional limitations and self-reported health. Of particular interest is whether respondents have been told by their doctor that they have high blood pressure or hypertension, diabetes, cancer, or lung disease. These conditions range from 0=no health problems to 4=all health problems. In 1992, respondents were asked to recall these health problems from the past year. In survey years 1994-2002, the reference period for respondent recall is between survey years. Table 8 shows the mean and standard deviation of health problems by survey year.

Table 8

Doctor-Diagnosed Health Problems by Year: Descriptive Statistics (N=8,448)

Year	*M*	*SD*	*N*
1992	.55	.70	8448
1994	.63	.75	7766
1996	.67	.76	7224
1998	.74	.79	6851
2000	.83	.82	6431
2002	.95	.85	6113

As Table 8 shows, on average, doctor-diagnosed health problems steadily increase from wave year 1992 to wave year 2002.

Disability is a dichotomous variable, measured by having a health impairment or problem that affects one's ability to do paid work. This measure is asked across all survey waves. Disability is used only in the analysis of self-reported health because it is too highly correlated with functional limitations and because it has been found to be a significant predictor of self-reported health, especially for Black and Hispanic adults (Ferraro and Kelley-Moore 2001). Table 9 shows the means and standard deviations of this variable per survey year.

Table 9

Disability by Year: Descriptive Statistics (N=8,448)

Year	*M*	*SD*	*N*
1992	.21	.41	8432
1994	.26	.44	7684
1996	.27	.44	7143
1998	.27	.45	6857
2000	.28	.45	6433
2002	.29	.45	6128

As Table 9 shows, disability increases with age, on average, though this increase is small, and is stable from years 1996 to 1998.

Marital status in this analysis is used as a control variable. It is coded dichotomously; 0 = not married, 1 = married. This measure is asked across all waves and is time-varying, capturing changes in marital status with each wave year. Table 10 shows the mean and standard deviation for marital status.

Table 10

Marital Status by Year: Descriptive Statistics (N=8,448)

Year	*M*	*SD*	*N*
1992	.78	.41	8381
1994	.77	.42	7745
1996	.76	.43	7237
1998	.74	.44	6874
2000	.73	.45	6459
2002	.71	.45	6146

As Table 10 shows, respondents are less likely to be married with each survey year, on average, though this decrease is small.

Level 2 Independent Variables: Descriptive Statistics

The HRS survey masks race into four categories, White/Caucasian, Black/African American, Hispanic, and other race and ethnicity. Race is coded dichotomously where Hispanic=1, all other racial/ethnic groups =0; Black=1, all other racial/ethnic groups=0; other race/ethnic group members=1, all others =0; Whites=1, all other racial/ethnic groups=0. Sex is coded 1=female, 0=male. Table 11 shows the distribution of men and women by race and ethnicity in the sample, all survey waves. Sex and race distributions in the sample do not total 8,448 due to missing sex and race data in some years.

Table 11

Respondent Race and Sex: Descriptive Statistics 1992-2002

Race and Ethnicity	Gender		
	Male	Female	Total
White	3,212	3,589	6,801
Black	508	432	940
Hispanic	268	260	528
Other Race and Ethnicity	85	89	174
Total	4,073	4,370	8,443

Childhood health and childhood SES are used at Level 2 along with race and sex to examine the ways in which early disadvantages affect later life health outcomes. Childhood

health is measured through the respondent's rating of their health from birth to age 16. Health as a child ranges from 0-4 where 0= poor, 1= fair, 2= good, 3=very good, and 4=excellent health. Childhood SES is measured by a rating of their family's financial status from birth to age 16. Childhood SES ranges from 0-2 where 0= poor, 1= about average, and 2= pretty well-off financially. The mean for childhood health is 3.17, or between very good and excellent health, and the standard deviation is .99. The mean for childhood SES is 1.26, or between about average and pretty well-off financially, and the standard deviation is .55.

Education is a control variable in this analysis. In the HRS, education is measured from 0 to 17, representing years of education, where 17 also represents 17+ years of education. Table 12 shows the number, percent, and cumulative percent of the sample's educational attainment.

Table 12

Years of Education: Frequencies and Percents of Sample (N=8,442)

Number of Years	*Frequency*	*Percent*	*Cumulative Percent*
0	40	.5	.5
1	13	.2	.6
2	30	.4	1.0
3	67	.8	1.8
4	50	.6	2.4
5	74	.9	3.2
6	135	1.6	4.8
7	137	1.6	6.5
8	414	4.9	11.4
9	315	3.7	15.1
10	505	6.0	21.1
11	449	5.3	26.4
12	3078	36.5	62.8
13	515	6.1	68.9
14	768	9.1	78.0
15	270	3.2	81.2
16	728	8.6	89.8
17/17+	857	10.2	100

Over 26% of the respondents in the sample report less than a high school education, over 36% of respondents report having a high school education. A little over 37% of the respondents in the sample have more than a high school education.

Hierarchical Linear Modeling

HLM6, hierarchical linear modeling (HLM) software is used to examine the effects of race, SES, sex, and age on functional limitations and self-reported health using the HRS and RAND HRS merged data. HLM uses repeated measures of individuals over time to examine longitudinal individual and patterned changes, or repeated observations nested within persons (Raudenbush and Bryk 2002). In this study, there are repeated observations of a panel of adults aged 51 years and over in a 10-year period. Hierarchical linear modeling is an analytic technique used when combining individual level and aggregate data, allowing for cross-level comparisons. At Level 1, each individual's trajectory of change is represented as a function of person-specific parameters, plus random error, e_{ti} (see below). Level 2 describes the variation in these individual growth parameters across a population of persons. Level 1 uses time-varying factors to estimate an individual trajectory whereas Level 2 captures interactions between the Level 1 and Level 2 variables. Recall that these analyses use sampling weights to make the sample nationally representative of non-institutionalized older adults in the United States. The Level 1 equation is:

$$Y_{ti} = \pi_{0i} + \pi_{1i}\, a_{ti} + e_{ti}$$

In this equation, it is assumed that Y_{ti}, the observed status at time *t* for individual *i,* is a function of a systematic growth trajectory and random error (Raudenbush and Bryk 2002). In this study, *i* represents 1….*n* survey respondents. π_{0i}, the intercept parameter, is the status of person *i* at a_{ti}=0. π_{1i} is the growth rate for person *i* over time and represents the expected change during a fixed unit of time. The error term, e_{ti} represents a unique effect associated with person *i.* E_{ti} is assumed to be normally distributed with a mean of zero.

In the Level 1 equation, an independent variable may "centered" (Raudenbush and Bryk 2002). Centering ensures that the meaning of the outcome variable is clearly understood, as the

intercept and slopes in the Level 1 model become outcome variables at Level 2. In this study, age is centered on the group mean, age 65, for a clearer intercept interpretation. In this case, π_{0i}, the intercept, is the unadjusted mean for *i* (Raudenbush and Bryk 2002). Centering is accomplished by subtracting 65 from the ages of the respondents. After centering, π_{0i} is the expected functional limitation or self-reported health score at age 65 for subject *i.*

In the Level 1 equation, the nature of the relationship between old age and health is determined by testing both the linear and quadratic model. A quadratic relationship between age and health is tested by incorporating a quadratic term, accomplished by squaring *Age65.* The linear equation model is:

$$Y_{ti} = \pi_{0i} + \pi_{1i}\,(Age65) + e_{ti}$$

The quadratic equation model is:

$$Y_{ti} = \pi_{0i} + \pi_{1i}\,(Age\ 65) + \pi_{2i}\,(Age65^2) + e_{ti}$$

In the *Functional Limitations* model, π_{1i} is the expected linear growth rate for functional limitations while π_{2i} is the expected quadratic growth rate for functional limitations. After defining whether the model is linear or quadratic, time-varying variables are added to the Level 1 equation. It is through these time-varying variables added to Level 1 that growth modeling is accomplished in HLM. Time-varying variables use each time point to compute information on the growth trajectory. For example, using *Wealth* in the equation below, HLM examines the respondent's total worth in 1992, 1994, 1996, 1998, 2000, and 2002. Each variable is recognized as varying over time, including dependent variables.

The dependent variable F*unctional Limitations* is used below for simplicity. Any differential interpretations needed for *Self-Reported Health* are explained in the discussion. The Level 1 equation for *Functional Limitations* is:

$$Y_{ti} = \pi_{0i} + \pi_{1i}\,(Age65) + \pi_{2i}\,(Age65Sq) + \pi_{3i}\,(Wealth) + \pi_{4i}\,(Insurance) + \pi_{5i}\,(Social\ Integration) + \pi_{6i}\,(Treatment) + \pi_{7i}\,(Health\ Problems) + \pi_{8i}\,(Marital\ Status) + e_{ti}$$

The intercept, $\pi_{0i,}$ is the expected functional limitation score, meaning the status of person *i* at age 65 when all predictors=0. $\pi_{1i,}$ $\pi_{2i,}$ $\pi_{3i,}$ $\pi_{4i,}$ $\pi_{5i,}$ $\pi_{6i,}$ $\pi_{7i,}$ and π_{8i} represent the slopes of *Age65, Age65Sq, Wealth, Insurance, Social Integration, Treatment, Health Problems*, and *Marital Status,* or the growth rate of person *i* over the data collection period. For *Self-Reported Health* analyses, *Disability* is used as a predictor in Level 1 and *Insurance* and *Treatment* are taken out of the model; they are not hypothesized to affect self-reported health scores.

In the above equation, the error term is e_{ti}, *Age65* is age centered around the age of 65, $Age65^2$ is *Age65* squared, and *Wealth* assumes both wealth and income measures, but these remain separate in analyses, and *Insurance* is type of health care insurance; Medicare, Medicare/Medicaid, VA/CHAMPUS, private insurance, and employer-provided coverage. *Social Integration* is a measure of friends and relatives in the neighborhood where the respondent lives, *Treatment* is doctor visits, hospital and nursing home stays, *Health Problems* is a scale of doctor-diagnosed high blood pressure or hypertension, diabetes, lung disease, and cancer, and *Marital Status* is married or not married. These variables are all time-varying, as represented in this Level 1 equation. Note that *Insurance* represents five different health insurance types, *Social Integration* represents both friends and relatives in the respondent's neighborhood, *Wealth*

represents total wealth and also income, and *Treatment* represents two differing types of health care treatment.

The next step is to use these variables as interaction terms with the predictors in Level 2. In Level 2, independent variables and Level 1 intercepts are represented by an equation. Level 2 assumes that the growth parameters, or each individual's observed development, conceived of as a function of an individual growth trajectory plus random error--vary across individuals (Raudenbush and Bryk 2002). In this study, this variation will be explained by race, sex, childhood health, and childhood SES, depending on hypotheses. *Race* is Black, White, Hispanic, or other. *Childhood Health* is respondent's reported health from birth to age 16, and *Childhood SES* is the respondent's family financial status from birth to age 16. *Education* is the respondent's educational level from 0 years of education to 17 or more years of education.

There are 8 equations in Level 2 that correspond to the Level 1 growth equations (in *Functional Limitations*). The Level 1 equation variables and corresponding Level 2 equations (shown in parentheses) are: $\pi_{0i} = B_{00} + r_{0i}$ *(Intercept);* $\pi_{1i} = B_{10} + r_{1i}$ *(Age65);* $\pi_{2i} = B_{20} + r_{2i}$ *(Age65²);* $\pi_{3i} = B_{30} + r_{3i}$ *(Wealth);* $\pi_{4i} = B_{40} + r_{4i}$ *(Insurance);* $\pi_{5i} = B_{50} + r_{5i}$ *(Social Integration);* $\pi_{6i} = B_{60} + r_{6i}$ *(Treatment);* $\pi_{7i} = B_{70} + r_{7i}$ *(Health Problems);* $\pi_{8i} = B_{80} + r_{8i}$ *(Marital Status).* Note that π_{0i} is the intercept for the individual model in Level 1. Variables added to this equation will examine the interaction of π_{0i} and individual-level predictors. The π_{1i} equation will examine interactions with *Age*, π_{3i} will examine interactions with *Wealth,* and so forth. In HLM, the error terms, $r_{0i}, r_{1i}, r_{2i}, r_{3i}, r_{4i}, r_{5i}, r_{6i}, r_{7i}$ and r_{8i} randomly vary. Insignificant error terms are fixed during analysis in HLM.

The individual-level predictors, namely race, sex, childhood health and childhood SES, are added to the Level 2 equations. These individual-level predictors are modeled as interaction terms with Level 1 variables, as indicated by research questions and hypotheses. Only race, sex, and education are used in the *Self-Reported Health* model because these are expected to be important predictors of self-reported health. Many of the interactions tested will be further analyzed over time (multiplying *Age65* by the Level 1 variable) and in advanced ages (multiplying $Age65^2$ by the Level 1 variable). For example, to examine the effect of health insurance on functional limitations over time and in advanced ages by sex with controls, the Level 1 equation is:

$$Y_{ti} = \pi_{0i} + \pi_{1i}(Age65) + \pi_{2i}(Age65^2) + \pi_{3i}(Wealth) + \pi_{4i}(Insurance) + \pi_{5i}(Insurance)(Age65) + \pi_{6i}(Insurance)(Age65^2) + \pi_{7i}(Social\ Integration) + \pi_{8i}(Treatment) + \pi_{9i}(Health\ Problems) + \pi_{10i}(Marital\ Status) + e_{ti}$$

…with the corresponding Level 2 equation:

$$\pi_{ti} = B_{0i}(Sex) + r_{ti}$$

Functional Limitations Equations and Hypotheses

The functional limitations model, shown in Figure 1, is analyzed through the following Level 1 and Level 2 equations:

Level 1

$$Y_{ti} = \pi_{0i} + \pi_{1i}(Age65) + \pi_{2i}(Age65^2) + \pi_{3i}(Wealth) + \pi_{4i}(Insurance) + \pi_{5i}(Social\ Integration) + \pi_{6i}(Treatment) + \pi_{7i}(Health\ Problems) + \pi_{8i}(Marital\ Status) + e_{ti}$$

H1: Individuals 65 years old will have more functional limitations than their younger counterparts and fewer functional limitations than their older counterparts.
H2: With increasing age, functional limitations will accelerate.
H3: Wealth and income are associated with fewer functional limitations.
H4: Employer, VA, and private health insurance are associated with fewer functional limitations whereas Medicare and Medicaid use are associated with more functional limitations, though Medicare beneficiaries will have fewer functional limitations than Medicaid beneficiaries.

H5: Social integration will be associated with fewer functional limitations.
H6: Health care treatment will be associated with more functional limitations.
H7: Health problems are associated with more functional limitations.
H8: Marriage will be associated with fewer functional limitations.

Level 2

$$\pi_{0i} = B_{00}(Race) + B_{01}(Sex) + B_{02}(Child\ Health) + B_{03}(Child\ SES) + B_{04}(Education) + r_{0i}$$

H9: Black and Hispanic adults, women, respondents with poor childhood health, respondents with low childhood SES, and respondents with fewer years of education will have more functional limitations than Whites, other racial and ethnic group members, men, respondents in good health as children, respondents with high childhood SES, and respondents with more years of education, controlling for income, wealth, health insurance access, social integration, marital status, health care treatment, and health problems.

$$\pi_{1i} = B_{10}(Race) + B_{11}(Sex) + B_{12}(Child\ Health) + B_{13}(Child\ SES) + r_{1i}$$

H10: The effect of age on functional limitations will differ for Black and Hispanic adults, women, and respondents with poor childhood health and low childhood SES. These groups will have more functional limitations over time controlling for income, wealth, health insurance access, marital status, social integration, health care treatment, and health problems. In contrast, Whites, other racial and ethnic group members, men, those with good childhood health and high childhood SES will have fewer functional limitations over time.

$$\pi_{2i} = B_{20}(Race) + B_{21}(Sex) + B_{22}(Child\ Health) + B_{23}(Child\ SES) + r_{2i}$$

H11: Black and Hispanic adults, women, respondents with poor childhood health, and respondents with low childhood SES, will differ in terms of the strength of association between age and functional limitations, compared to Whites, other racial and ethnic group members, men, respondents with good childhood health, and respondents with high childhood SES, experiencing accelerated growth rates in functional limitations at earlier ages. With age, the gap in functional limitations between these groups will widen. At advanced ages this trend will be weakened for Black adults, reflecting the selective survival of the most robust Black elderly.

$$\pi_{3i} = r_{3i}$$

H12: *No interactions with wealth or income are tested.*

$$Y_{4i} = \pi_{0i} + \pi_{1i}(Age65) + \pi_{2i}(Age65^2) + \pi_{3i}(Wealth) + \pi_{4i}(Insurance) + \pi_{5i}(Insurance)(Age65) + \pi_{6i}(Insurance)(Age65^2) + \pi_{7i}(Social\ Integration) + \pi_{8i}(Treatment) + \pi_{9i}(Health\ Problems) + \pi_{10i}(Marital\ Status) + e_{ti}$$

$$\pi_{4i} = B_{40}(Race) + r_{4i}$$

H13: Black and Hispanic adults will benefit differently from Whites and other racial and ethnic group members in terms of the strength of association between employer-provided and private insurance. Black and Hispanic adults with employer-provided and private insurance will have fewer functional limitations than Whites and other racial and ethnic minority group members with these types of insurance. Whites and other racial and ethnic minority group members with Medicare insurance will have fewer limitations than Black and Hispanic adults with Medicare insurance. Whites and other racial and ethnic group members with Medicaid insurance will have more functional limitations than Blacks and Hispanics with Medicaid insurance. There will be significant racial and ethnic differences in functional limitations by insurance controlling for income, wealth, social integration, marital status, health care treatment, and health problems.

$$Y_{5i} = \pi_{0i} + \pi_{1i}(Age65) + \pi_{2i}(Age65^2) + \pi_{3i}(Wealth) + \pi_{4i}(Insurance) + \pi_{5i}(Social\ Integration) + \pi_{6i}(Social\ Integration)(Age65) + \pi_{7i}(Treatment) + \pi_{8i}(Health\ Problems) + \pi_{9i}(Marital\ Status) + e_{ti}$$

$$\pi_{5i} = B_{50}(Race) + r_{5i}$$

H14: Black, Hispanic, and other racial and ethnic group members will differ from Whites in terms of the strength of association between social integration and functional limitations, controlling for age, income, wealth, type of health insurance, health care treatment, marital status, and health problems. Socially integrated Blacks, Hispanics, and other racial and ethnic group members will have fewer functional limitations than socially integrated Whites, and the effects of social integration on functional limitations will accumulate over time.

$$Y_{6i} = \pi_{0i} + \pi_{1i}(Age65) + \pi_{2i}(Age65^2) + \pi_{3i}(Wealth) + \pi_{4i}(Insurance) + \pi_{5i}(Social\ Integration) + \pi_{6i}(Treatment) + \pi_{7i}(Treatment)(Age65) + \pi_{8i}(Treatment)(Age65^2) + \pi_{9i}(Health\ Problems) + \pi_{10i}(Marital\ Status) + e_{ti}$$

$$\pi_{6i} = B_{60}(Race) + r_{6i}$$

H15: Black and Hispanic adults will differ from Whites and other racial and ethnic group members in terms of the strength of association between health care treatment and functional limitations, controlling for age, income, wealth, type of health insurance, social integration, marital status, and health problems. Treated Black and Hispanic adults will have more functional limitations than treated Whites and these differential effects of health treatment will accumulate and widen the gap in functional limitations over time by race and ethnicity.

$$Y_{7i} = \pi_{0i} + \pi_{1i}\,(Age65) + \pi_{2i}\,(Age65^2) + \pi_{3i}\,(Wealth) + \pi_{4i}\,(Insurance) + \pi_{5i}\,(Social\ Integration) + \pi_{6i}\,(Treatment) + \pi_{7i}\,(Health\ Problems) + \pi_{8i}\,(Health\ Problems)(Age65) + \pi_{9i}\,(Health\ Problems)(Age65^2) + \pi_{10i}\,(Marital\ Status) + e_{ti}$$

$$\pi_{7i} = B_{70}(Race) + B_{71}(Sex) + B_{72}(Child\ Health) + B_{73}(Child\ SES) + r_{7i}$$

H16: Black and Hispanic adults, women, respondents with poor childhood health, and respondents with low childhood SES will differ from Whites, men, respondents with good childhood health, respondents with high childhood SES, and other racial and ethnic minority group members in terms of the strength of association between health problems and functional limitations, controlling for age, income, wealth, health insurance, social integration, marital status, and health care treatment. Health problems among Blacks, Hispanics, women, respondents with poor childhood health, and respondents with low childhood SES will be associated with more functional limitations, and these differences will accumulate and widen the gap in health between these groups over time.

$$\pi_{8i} = r_{8i}$$

H17: *No interactions are tested with marital status*.

Ordinal-Level Dependent Variables in HLM

Statistical inferences about the fixed Level 2 coefficients in HLM are based on the assumption that random effects at each level are normally distributed. This assumption is violated when an ordinal dependent variable is used, so ordinal dependent variables are treated differently in HLM. In order to predict *Self-Reported Health* an ordinal HLM model will be used. This model recognizes that categories are ordered, specifying associations between explanatory variables and the ordinal outcome (Raudenbush and Bryk 2002), and modeling the probabilities of responses at each level. The logistic regression model that HLM uses to calculate proportionality is:

$$\eta_{mi} = \Theta_m + BX_i$$

The model has an intercept, Θ_m , for each category *m,* and a common slope *B*. When the expected log-odds for two cases are compared, one with X = X_1 and the second with X = X_2, the expected difference in log-odds between these is represented by the equation:

$$\eta_{m1} - \eta_{m2} = B(X_1 - X_2)$$

The expected difference in log-odds between cases differing on *X* does not depend on a particular category, *m* (Raudenbush and Bryk 2002). The proportional-odds model assumes that *X* affects the odds ratio the same way for each category *m*. The model also assumes that for *X*, the difference in log-odds between any two cumulative logits depends on the respective intercepts, not *X.* Recall that *Disability* has been added to this Level 1 model to predict *Self-Reported Health* and that health insurance type and health care treatment are not used in the *Self-Reported Health* model nor are childhood SES or health used as Level 2 predictors.

Self-Reported Health Equations and Hypotheses

The self-reported health model, shown in Figure 2, is analyzed through the following Level 1 and Level 2 equations:

$$Y_{ti} = \pi_{0i} + \pi_{1i}(Age65) + \pi_{2i}(Age65^2) + \pi_{3i}(Wealth) + \pi_{4i}(Social\ Integration) + \pi_{5i}(Health\ Problems) + \pi_{6i}(Disability) + \pi_{7i}(Marital\ Status) + e_{ti}$$

H1: Individuals 65 years old will be more likely to report poor health.
H2: Age will increase the likelihood of poor health responses.
H3: Wealth and income will decrease the likelihood of poor health responses.
H4: Social integration will decrease the likelihood of poor health responses.
H5: Health problems will increase the likelihood of poor health responses.
H6: Disability will increase the likelihood of poor health responses.
H7: Marriage will decrease the likelihood of poor health responses.

Level 2

$$\pi_{0i} = B_{00}(Race) + B_{01}(Sex) + B_{02}(Education) + r_{0i}$$

H8: Black and Hispanic adults, men, and respondents with fewer years of education will be more likely than Whites, other racial and ethnic minority group members, women, and respondents with more years of education to have poor self-reported health at age 65,

controlling for income, wealth, social integration, marital status, disability, and health problems.

$$\pi_{1i} = B_{10}(Race) + B_{11}(Sex) + r_{1i}$$

H9: The effect of age on self-reported health will differ for Black and Hispanic adults and men. The effect of age on these groups will be cumulative; they will be more likely to report poor health over time compared to Whites, other racial and ethnic group members, and women, controlling for income, wealth, social integration, marital status, disability, and health problems.

$$\pi_{2i} = B_{20}(Race) + B_{21}(Sex) + r_{2i}$$

H10: The effect of age on self-reported health will differ for Black and Hispanic adults and men at advanced ages. These groups will be more likely to report poor health at advanced ages, experiencing accelerated rates of poor health compared to Whites, other racial and ethnic group members, and women, controlling for income, wealth, age, disability, social integration, marital status, and health problems.

$$\pi_{3i} = r_{3i}$$

H11: *No interactions will be tested with wealth and income.*

$$Y_{4i} = \pi_{0i} + \pi_{1i}(Age65) + \pi_{2i}(Age65^2) + \pi_{3i}(Wealth) + \pi_{4i}(Social\ Integration) + \pi_{5i}(Social\ Integration)(Age65) + \pi_{6i}(Health\ Problems) + \pi_{7i}(Disability) + \pi_{8i}(Marital\ Status) + e_{ti}$$

$$\pi_{4i} = B_{40}(Race) + r_{4i}$$

H12: Black, Hispanic, and other racial and ethnic group members will differentially benefit from social integration when compared to Whites. Socially integrated Blacks, Hispanics, and other racial and ethnic minority group members will be less likely to report poor health compared to socially integrated Whites, controlling for age, income, wealth, disability, marital status, and health problems.

$$Y_{5i} = \pi_{0i} + \pi_{1i}(Age65) + \pi_{2i}(Age65^2) + \pi_{3i}(Wealth) + \pi_{4i}(Social\ Integration) + \pi_{5i}(Health\ Problems) + \pi_{6i}(Health\ Problems)(Age65) + \pi_{7i}(Health\ Problems)(Age65^2) + \pi_{8i}(Disability) + \pi_{9i}(Marital\ Status) + e_{ti}$$

$$\pi_{5i} = B_{50}(Race) + B_{51}(Sex) + r_{5i}$$

H13: The strength of association between health problems and self-reported health will differ for Black and Hispanic adults and women compared to Whites, other racial and ethnic minority group members, and men. Health problems will be associated with worse

self-reports of health for Whites, other racial and ethnic minority group members, and men than Blacks, Hispanics, and women. These effects of will accumulate and widen over time controlling for age, income, wealth, social integration, marital status, and disability.

$$\pi_{6i} = B_{60}(Race) + r_{6i}$$

H14: The strength of association between disability and self-reported health will differ for Black and Hispanic adults compared to Whites and other racial and ethnic minority group members. For Whites and other racial and ethnic minority group members, disability will be associated with an increased likelihood of poor health responses controlling for age, income, wealth, social integration, marital status, and health problems.

$$\pi_{7i} = r_{7i}$$

H15: *No interactions will be tested with marital status.*

The results of the analyses in HLM are interpreted as if no missing data were present (Raudenbush and Bryk 2002). HLM handles missing data by using maximum likelihood estimation in conjunction with growth analysis. HLM recognizes that repeated observations are nested within the person; each respondent has a different repeated measures design (Raudenbush and Bryk 2002). For example, in this study, the number of time points for each respondent may vary, but if the respondent is interviewed once, they remain in the analysis. HLM does not require the same collection design for each individual, and compares each individual trajectory around the group mean. In this way, HLM increases the precision of growth estimates by keeping all cases rather than discarding cases with incomplete data.

Model fit and significance in HLM are determined through deviance statistics, chi-square, and p-values, which are given for each of the equations in the output, on both Level 1 and Level 2. The deviance test is a multi-parameter likelihood ratio test for the variance-covariance components that compares the deviance statistic of a restricted model with a more

general alternative (Raudenbush and Bryk 2002). The deviance test is based on the difference between the deviance statistics of the two models, which has a chi-square distribution with degrees of freedom equal to the difference in the number of parameters estimated in the models being compared.

Examining Accumulating and Widening Health Disparities

Using the conceptualization of CAD given in an earlier section, the following discussion details the ways in which this study will examine and test CAD processes. The process of accumulating and widening health disparities is examined in this study in four ways: through multi-level HLM analyses using longitudinal data; conceptualizing race, SES, and sex as social locations associated with accumulating (age interactions) and widening (age^2 interactions) health disparities; using two health measures to capture multiple dimensions of health; and incorporating measures of early disadvantage.

HLM, as a statistical technique, has advantages over regression techniques in that HLM allows for individual and observational health changes to be seen while also accounting for nested data. Some CAD studies do not use time-varying techniques that can examine these health changes over time (see Barrett 2003) or do not control for data nested within persons (see Ross and Wu 1996). Some CAD studies have used longitudinal frameworks to examine health processes (see O'Rand and Hamil-Luker 2005), while others have used only two waves of data (Reitzes and Mutran 2006). Other CAD studies have examined temporal processes within cross-sectional designs (see Barrett 2003; Kahn and Fazio 2005). Examining health within a longitudinal framework allows for a specification of health outcomes and causal health links. Cross-sectional designs cannot make causal inferences and lack the ability to trace health pathways over time. CAD studies have examined health pathways over time using various

measures, including education and employment (O'Rand and Hamil-Luker 2005; Barrett 2003), education, income, and marital status (Ross and Wu 1996), and income and perceived financial well-being (Barrett 2003).

CAD studies have used race, SES, and gender to conceptualize disadvantages (Kahn and Fazio 2005) though some studies have used these largely as controls, depending on their focus (Barrett 2003; O'Rand and Hamil-Luker 2005; Ross and Wu 1996). When CAD processes have been examined specifically within a race lens, accumulating and widening racial disadvantages in health problems, disease, mental health, functional limitations (Kahn and Fazio 2005), and racism have been examined (House and Williams 2000). This current study examines disadvantages by social location, and contributes to the literature by conceptualizing the ways in which race, SES, and sex affect health through various pathways, including health problems, health care treatment, social integration, and health insurance. Accumulating and widening health inequalities are also examined in this study through health problems, health care treatment, and health insurance. Statistically, HLM tests for accumulating and widening inequalities with age and age^2 interaction terms (for a more detailed discussion of this process, see the Hierarchical Linear Modeling Section above).

The cumulative advantage and disadvantage process may differ depending on type of health measure. CAD studies have used various health measures to detail health pathways (see Barrett 2003; Ross and Wu 1996). This study examines CAD processes within two health measures: functional limitations and self-reported health. Functional limitations have been shown to be a good predictor of physical health. Self-reported health has been shown to be a good predictor of overall well-being (Mossy and Shapiro 1982), and is an especially good measure for the health of minority group members and men.

Early disadvantages have also been shown to structure health pathways throughout the life course and affect old age health (O'Rand and Hamil-Luker 2005). Early disadvantages such as childhood health and childhood poverty can cause differential expose to life course risks which can lead to an accumulation of further disadvantages in adulthood. Early disadvantages are indicators of CAD if their effects persist or are associated with accumulating and widening disadvantages. This study examines childhood health and childhood SES with age interaction terms to test the accumulating and widening effects of early disadvantage on health in old age.

Chapter 4
Results

Disadvantages in health are expected to accrue for old Black and Hispanic adults, and these accumulating disadvantages are expected to widen the gap in health over time. Women and men are expected to differ in health, with women largely disadvantaged in functional limitations, and men reporting poorer health. First, bivariate tables are presented to show relationships between variables and to demonstrate accruing disadvantages. Then, HLM analyses are used to examine the relationship between variables over time and into advanced ages, or to test accruing and widening inequalities over time. Table 13 shows functional limitations and self-reported health means and standard deviations by sex per year. Table 14 shows functional limitations and self-reported health means and standard deviations by race and ethnicity per year.

Table 13

Functional Limitations and Self-Reported Health by Sex[a] and Year: Descriptive Statistics (N=8,448)

	Functional Limitations		*Self-Reported Health*	
	M	*SD*	*M*	*SD*
1992				
Male	0.60***	1.33	3.45	1.19
Female	0.77	1.42	3.46	1.19
1994				
Male	1.02***	1.63	3.37	1.18
Female	1.35	1.77	3.37	1.16
1996				
Male	1.11***	1.79	3.40	1.13
Female	1.46	1.97	3.41	1.15
1998				
Male	1.21***	1.83	3.18	1.13
Female	1.53	2.02	3.20	1.14
2000				
Male	1.23***	1.87	3.27	1.11
Female	1.60	2.06	3.30	1.14
2002				
Male	1.38***	1.89	3.23	1.10
Female	1.74	2.06	3.24	1.10

[a] Females are the reference category.
***p<.001

As Table 13 shows, functional limitations increase, on average, from survey years 1992-2002. There are significant sex differences in functional limitations with women reporting more functional limitations than men with each year. Self-reported health has a different pattern than functional limitations, not clearly increasing or decreasing with each year. Contrary to expectations, there are no significant differences in self-reported health by sex in bivariate analyses.

Table 14

Functional Limitations and Self-Reported Health by Race[a], Ethnicity, and Year: Descriptive Statistics (N=8,448)

	Functional Limitations		*Self-Reported Health*	
	M	*SD*	*M*	*SD*
1992				
White	.62	1.30	3.56	1.15
Black	.94***	1.73	2.97***	1.18
Hispanic	.97***	1.23	2.96***	1.26
Other Race/Ethnicity	.65	1.35	3.42	1.25
1994				
White	1.08	1.57	3.48	1.13
Black	1.62***	2.17	2.89***	1.17
Hispanic	1.77***	1.20	2.77***	1.20
Other Race/Ethnicity	1.08	1.80	3.41*	1.27
1996				
White	1.20	1.77	3.50	1.11
Black	1.78***	2.36	3.00***	1.15
Hispanic	1.65**	1.18	2.85***	1.18
Other Race/Ethnicity	1.09	1.92	3.45	1.27
1998				
White	1.28	1.83	3.28	1.15
Black	1.85***	2.39	2.77***	1.13
Hispanic	1.78**	1.14	2.69***	1.13
Other Race/Ethnicity	1.34	2.13	3.15	1.15
2000				
White	1.33	1.86	3.38	1.10
Black	1.96***	2.45	2.81***	1.13
Hispanic	1.85***	1.16	2.78***	1.16
Other Race/Ethnicity	1.23	2.14	3.30	1.15
2002				
White	1.47	1.88	3.32	1.08
Black	2.04***	2.44	2.81***	1.09
Hispanic	2.09***	1.10	2.70***	1.06
Other Race/Ethnicity	1.27	2.05	3.20	1.09

[a]Whites are the reference category.
*p<.05. **p<.01. ***p<.001

As Table 14 shows, functional limitations are lowest among Whites, compared to Black and Hispanic adults. There are no significant differences in functional limitations between

Whites and other racial and ethnic minority group members. Self-reported health means also differ by race, with Black and Hispanic adults having lower means than Whites. Hispanic adults have the lowest self-reported health means for all years, followed by Black adults. Other racial and ethnic minority group member self-reported health means do not differ significantly from White self-reported health means except in 1994, where other racial and ethnic minority group members have lower self-reported health means than Whites.

Independent Variables: Level 1

In the following analyses, the log of income and wealth are used. Negative values of income and wealth are handled in SPSS by multiplying -1 to negative values after the log is calculated. Table 15 shows logged income and wealth means by sex and Table 16 shows logged income and wealth means by race.

Table 15

Mean Total Wealth and Income[a] by Sex[b] and Year (N=8,448)

	Total Wealth	*Income*
1992		
Male	5.40**	4.72***
Female	5.34	4.64
1994		
Male	5.46**	4.78***
Female	5.39	4.66
1996		
Male	5.55**	4.80***
Female	5.45	4.69
1998		
Male	5.61	4.82***
Female	5.53	4.63
2000		
Male	5.66*	4.83***
Female	5.58	4.71
2002		
Male	5.66*	4.81***
Female	5.59	4.71

[a]Wealth and income values are logged.
[b]Females are the reference category.
*p<.05. **p<.01. ***p<.001

As Table 15 shows, older men have more wealth than women, on average, and this relationship is consistent with each year though both men and women's wealth increases. In 1998 there are no significant differences in wealth by sex. There are also sex differences in income, on average. Old men have significantly higher average incomes than old women across all years.

Table 16

Mean Wealth and Income[a] by Race, Ethnicity[b], and Year (N=8,448)

	Total Wealth	*Income*
1992		
White	5.43	4.72
Black	4.85***	4.50***
Hispanic	4.98***	4.44***
Other Race/Ethnicity	5.28	4.71
1994		
White	5.49	4.76
Black	4.91***	4.49***
Hispanic	4.94***	4.43***
Other Race/Ethnicity	5.36	4.67
1996		
White	5.54	4.79
Black	4.94***	4.52***
Hispanic	4.93***	4.46***
Other Race/Ethnicity	5.37	4.72
1998		
White	5.63	4.80
Black	4.96***	4.50***
Hispanic	4.99**	4.45***
Other Race/Ethnicity	5.39	4.73
2000		
White	5.68	4.82
Black	5.00***	4.52***
Hispanic	5.06***	4.46***
Other Race/Ethnicity	5.57	4.80
2002		
White	5.68	4.80
Black	5.05***	4.52***
Hispanic	5.07***	4.45***
Other Race/Ethnicity	5.55	4.76

[a]Wealth and income values are logged.
[b]Whites are the reference category.
*p<.05. **p<.01. ***p<.001

Compared to White adults, Black adults have the lowest average wealth, followed by Hispanic adults, though the pattern for Hispanic adults is less consistent than that of Black

adults. Hispanic adults have more wealth than Black adults in 1992 and 1994, but lower than Black adults in 1996, and then higher again for the following years. There are no significant differences in wealth for other racial and ethnic minority group members, compared to Whites.

Table 16 shows that income also differs by race and ethnicity. Compared to Whites, Black and Hispanic adults have lower average incomes, with Hispanic adults most disadvantaged in income. There are no significant differences in income for other racial and ethnic minority group members, compared to Whites.

Table 17

Type of Health Insurance by Race, Ethnicity[a], and Year: Descriptive Statistics (N=8,448)

	Employer		*Medicare*		*Medicaid*		*VA/CHAMPUS*		*Private*		*No Insurance*	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1992												
White	.75	.43	.08	.02	.14	.16	.36	.26	.05	.22	.09	.28
Black	.59***	.49	.10**	.10	.30***	.10***	.30	.30	.06	.24	.17***	.38
Hispanic	.43***	.50	.11**	.09	.29***	.06***	.24	.31	.03**	.16	.32***	.47
Other Race	.60**	.50	.08	.03	.17	.06	.24	.27	.06	.25	.19**	.39
1994												
White	.75	.43	.12	.03	.16	.19	.39	.32	.05	.22	.07	.26
Black	.59***	.49	.16***	.11	.31***	.14**	.18	.47	.06	.23	.13***	.34
Hispanic	.46***	.50	.14	.15	.36***	.07***	.25	.44	.03**	.16	.22***	.42
Other Race	.63*	.48	.12	.08	.27**	.07	.25	.33	.08	.27	.13*	.34
1996												
White	.68	.47	.20	.03	.18	.15	.35	.40	.05	.21	.06	.24
Black	.52***	.50	.25**	.13	.34***	.08***	.27	.43	.04	.19	.11***	.32
Hispanic	.38***	.49	.22	.15	.36***	.08**	.28	.41	.02**	.14	.20***	.40
Other Race	.59	.49	.21	.07	.26	.08	.28	.41	.06	.24	.10	.31
1998												
White	.63	.48	.33	.03	.18	.18	.39	.47	.04	.20	.05	.21
Black	.47***	.50	.36	.16	.36***	.08***	.28	.49	.04	.20	.09***	.29
Hispanic	.35***	.47	.32	.16	.37***	.09***	.28	.47	.02**	.13	.17***	.38
Other Race	.52	.50	.32	.08	.27	.09	.28	.47	.06	.24	.08	.27
2000												
White	.60	.49	.47	.04	.18	.22	.41	.50	.03	.18	.03	.18
Black	.47***	.50	.48	.17	.37***	.08***	.28	.50	.04	.19	.06***	.24
Hispanic	.36***	.48	.42	.20	.40***	.08***	.28	.50	.02	.13	.12***	.33
Other Race	.58	.50	.42	.06	.24	.08	.28	.50	.04	.20	.06	.24
2002												
White	.56	.50	.63	.04	.20	.21	.41	.49	.07	.20	.02	.15
Black	.42***	.49	.64	.17	.37***	.09***	.29	.48	.06	.20	.04**	.20
Hispanic	.30***	.46	.56**	.23	.42***	.07***	.26	.50	.04	.13	.10***	.30
Other Race	.51	.50	.62	.10	.30	.07	.26	.49	.08	.24	.03	.16

[a]Whites are the reference category.
*p<.05. **p<.01. ***p<.001

Health care insurance types differ by race, as shown in Table 17. White adults are more likely to have employer-provided insurance across all years, compared to Black and Hispanic adults, followed people in the other racial and ethnic groups. There are no significant differences between White and employer-provided insurance for other racial and ethnic group members from 1996-2002. Black and Hispanic adults are also more likely than Whites to have Medicare insurance over time. Black and Hispanic adults are also more likely to have Medicaid insurance than Whites, across all years. VA/CHAMPUS insurance shows less of a consistent pattern, and there are fewer people on this type of insurance. There are no significant racial differences in VA/CHAMPUS insurance.

Private health insurance coverage differs by race with White adults are more likely to have private health insurance than Hispanic adults, though this relationship is not significant from 2000-20002. Whites are less likely than Blacks, Hispanics, and people in the other racial and ethnic category to lack health insurance in 1992-1994. From 1996-2002 Whites are less likely than Black and Hispanic adults to lack health insurance.

Table 18

Doctor Visits and Hospital and Nursing Home Treatments by Race, Ethnicity[a], and Year: Descriptive Statistics (N=8,448)

	Doctor Visits		*Hospital and Nursing Home Stays*	
	M	*SD*	*M*	*SD*
1992				
White	.80	.40	.10	.31
Black	.83**	.38	.15***	.36
Hispanic	.71***	.46	.12	.32
Other Race	.76	.43	.12	.33
1994				
White	.89	.31	.18	.39
Black	.91	.29	.23**	.42
Hispanic	.87	.34	.21	.41
Other Race	.91	.29	.17	.37
1996				
White	.92	.28	.20	.41
Black	.93	.26	.24*	.44
Hispanic	.87***	.34	.22	.43
Other Race	.91	.29	.16	.36
1998				
White	.93	.26	.23	.44
Black	.93	.25	.25	.45
Hispanic	.87***	.34	.26	.47
Other Race	.89	.31	.20	.41
2000				
White	.94	.24	.24	.45
Black	.94	.24	.30***	.49
Hispanic	.91*	.29	.23	.45
Other Race	.92	.28	.22	.44
2002				
White	.94	.23	.28	.48
Black	.94	.23	.27	.49
Hispanic	.90**	.30	.29	.49
Other Race	.91	.29	.23	.44

[a]Whites are the reference category.
*p<.05. **p<.01. ***p<.001

Treatment utilization also differs by race and ethnicity, as shown in Table 18. There are significant differences in doctor visits between Blacks and Hispanics compared to Whites in

1992. Hispanic adults are less likely than Whites to visit the doctor whereas Black adults are more likely than Whites to visit the doctor. There are no significant racial differences in doctor visits in 1994. From 1996-2002, Hispanic adults are significantly less likely to visit the doctor compared to their White counterparts.

As shown in Table 18, hospital and nursing home treatment differs between Whites and Blacks from 1992 to 1996, and in 2000, with Black adults more likely than White adults to stay overnight in a hospital and nursing home. There are no significant racial differences in hospital and nursing home treatment in 1998 or 2002.

Table 19

Presence of Friends and Relatives in Respondent's Neighborhood by Race, Ethnicity[a], and Year: Descriptive Statistics (N=8,448)

	Presence of Friends		*Presence of Relatives*	
	M	*SD*	*M*	*SD*
1992				
White	.70	.46	.33	.47
Black	.69	.46	.37**	.48
Hispanic	.73	.44	.44***	.50
Other Race/Ethnicity	.65	.48	.36	.48
1994				
White	.68	.47	.33	.47
Black	.68	.47	.38*	.49
Hispanic	.74	.44	.39	.49
Other Race/Ethnicity	.72	.45	.36	.48
1996				
White	.69	.47	.29	.45
Black	.64**	.48	.32*	.47
Hispanic	.63*	.48	.26	.44
Other Race/Ethnicity	.66	.48	.28	.45
1998				
White	.68	.47	.29	.45
Black	.64	.48	.32	.47
Hispanic	.62*	.49	.28	.45
Other Race/Ethnicity	.68	.49	.33	.47
2000				
White	.68	.47	.29	.45
Black	.66	.48	.31	.46
Hispanic	.65	.48	.30	.46
Other Race/Ethnicity	.65	.48	.38*	.49
2002				
White	.72	.45	.30	.46
Black	.67**	.47	.35*	.48
Hispanic	.67	.47	.31	.46
Other Race/Ethnicity	.67	.47	.32	.47

*p<.05. **p<.01. ***p<.001
[a]Whites are the reference category.

Table 19 shows the mean and standard deviation of having friends and relatives in the neighborhood by race and ethnicity and year. There are no significant racial differences in

having friends in the neighborhood by race until 1996. In 1996, Black and Hispanic adults are less likely than Whites to have friends in the neighborhood. In 1998 this trend continues for Hispanic adults, but not for Black adults. In 2000 there are no significant racial or ethnic differences in having friends in the neighborhood. In 2002, Black adults are less likely than Whites to have friends in the neighborhood.

The racial and ethnic pattern of having relatives in the neighborhood differs from that of having friends in the neighborhood. In 1992 Black and Hispanic adults are more likely than Whites to have relatives in the neighborhood. This trend continues for Black adults in 1994 and 1996, but not for Hispanic adults. There are no racial or ethnic differences in having relatives in the neighborhood. In 2000, other racial and ethnic minority group members are more likely than Whites to have relatives in the neighborhood. In 2002, Black adults are more likely than Whites to have relatives in the neighborhood.

Independent Variables: Level 2

Table 20 shows the relationship between childhood SES and health by sex, race and ethnicity.

Table 20

Mean Childhood SES and Childhood Health by Sex[a], Race, and Ethnicity[b] (N=8,448)

	Childhood Health	*Childhood SES*
Sex		
Male	3.19	.71**
Female	3.15	.56
Race		
White	3.21	.76
Black	3.00***	.60***
Hispanic	2.91***	.63***
Other Race/Ethnicity	3.08	.79

*p<.05. **p<.01. ***p<.001
[a]Females are the reference category.
[b]Whites are the reference category.

As Table 20 shows, there are no sex differences in childhood health. However, there are sex differences in childhood SES, with men being more likely than women to have high childhood SES. There are racial and ethnic differences in childhood health. As expected, Black and Hispanic adults have worse childhood health compared to Whites. There are also racial and ethnic differences in childhood SES. Also as expected, Black and Hispanic adults have lower childhood SES than Whites.

Multivariate Analysis

First, the overall growth and acceleration of functional limitations with age are discussed (Model 1) followed by a discussion of the effects of age, wealth and income, health problems, health care treatment, health insurance, marital status, and social integration on functional health (Model 2) with some covariates examined over time and for acceleration (Model 3). Next, Level 2 predictors are used to predict the Level 1 intercept. The Level 2 predictors are race, sex, education, and childhood SES and childhood health (Model 4). Finally, these Level 2 predictors interact with Level 1 predictors, as discussed in the Hierarchical Linear Modeling section above

(Model 5). All models and associated variance statistics are shown in Table 21. Variance statistics show the proportion of variance explained in the model. Decreasing variance statistics from one model to the next show that the newer model is better-fitting than the previous model. In Model 5, health problems are examined first, followed health care treatment, and then health insurance.

Development of the self-reported health model follows that of the functional limitations model. In this model, self-reported health is the dependent variable. Self-reported health is analyzed according to the specifications given in the Hierarchical Linear Modeling section above. The self-reported health analysis begins with the growth and acceleration model, Model 1. Next, the Level 1 covariates--income, wealth, health problems, disability, social integration, and marital status are added to Level 1 (Model 2). Model 3 is an extension of Model 2, with the addition of age and age² interaction terms in Level 1 for health problems, social integration, and marital status. Next, Level 2 predictors, race and sex (and education for the intercept model), are examined according to hypotheses (Model 4). In Model 5, Level 2 predictors are first interacted with health problems, according to hypotheses, and then in Model 6, the full model is developed, including the age interaction terms.

Model 1: Age-Related Growth and Acceleration in Functional Limitations

In Model 1, both linear and quadratic models are examined to determine best model fit. Adding age squared to the equation significantly improves model fit: the deviance of age centered on age 65 is 214,731.50 with 4 degrees of freedom whereas the deviance of age and age squared is 213,593.26 with 7 degrees of freedom. A variance-covariance test shows that the quadratic model is significant at the <.001 level. This shows that there is a curvilinear relationship between age and functional limitations, or that there is a widening in functional

limitations with age. This model is the basis for further treatment of the model and the equation for this model is:

$$Y_{tj} = \pi_{0i} + \pi_{1i}\,(Age\ 65) + \pi_{2i}\,(Age65^2) + e_{ti}$$

Model 1 shows the average effect of age on functional limitations. As Table 21 (below) shows, at age 65 the average number of functional limitations is 1.491, with a standard error of .02 and a significant T-ratio of 83.32. The mean growth rate is .075 with a standard error of .00 and a significant T-ratio of 58.37. The mean acceleration is .001 with a standard error of .000 and a significant T-ratio of 11.97. There are variations in functional limitations among individuals and there are individual growth rate differences. The acceleration random effect was not significant and was left out of the equation.

With age, functional limitations increase and accelerate. For example, by age 75 the average growth rate is .095 functional limitations per observation period [growth rate at age $t = \pi_{1i} + 2\pi_{2i}\,(a_{ti} - L)$ or .075 + 2(.001) (75-65) = .095]. By age 85 the average growth rate is 0.115 functional limitations per observation period.

Figure 3

Curvilinear Growth Relationship between Age and Functional Limitations 1992-2002

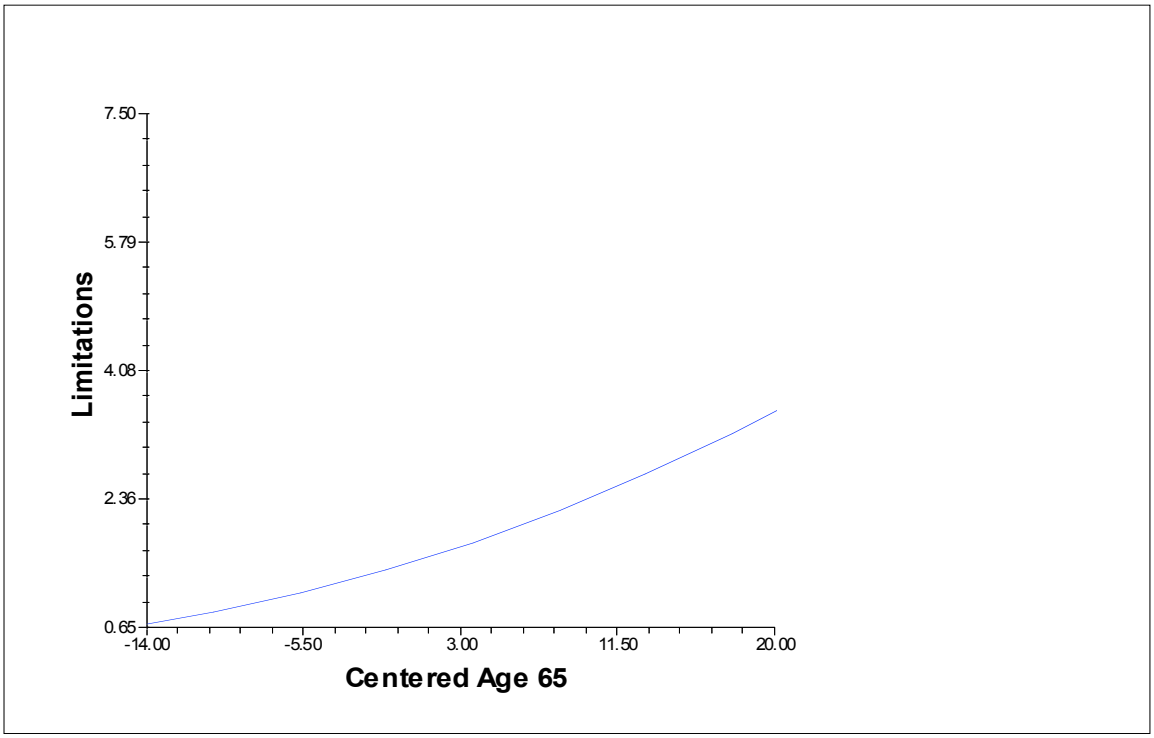


Figure 3 shows this relationship between age and functional limitations over time. Note that in the graph age 65 is a centered variable and should be interpreted as age 65=0. Therefore, on Figure 3, -14 represents people aged 51 and 20 represents people aged 85.

Table 21

Functional Limitations Curvilinear Growth Models 1-7; Unstandardized Coefficients and Standard Errors: 1992-2002

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*
Mean Limitations at age 65, *β00*	1.49***	1.90***	2.05***	2.90***	2.94***	2.96***	2.91***
	(0.02)	(0.08)	(0.08)	(0.10)	(0.10)	(0.10)	(0.10)
Female				0.32***	0.22***	0.22***	0.25***
				(0.03)	(0.03)	(0.00)	(0.03)
Child Health				-0.14***	-0.14***	-0.14***	-0.14***
				(0.01)	(0.01)	(0.01)	(0.01)
Child SES				-0.09***	-0.05	-0.05	-0.05
				(0.02)	(0.03)	(0.03)	(0.02)
Black				-0.01	-0.14**	-0.29***	-0.18*
				(0.04)	(0.05)	(0.07)	(0.08)
Hispanic				-0.15**	-0.25***	-0.25***	-0.24***
				(0.05)	(0.06)	(0.06)	(0.06)
Other Race				0.02	0.03	0.03	0.03
				(0.10)	(0.10)	(0.10)	(0.10)
Education				-0.07***	-0.07***	-0.07***	-0.07***
				(0.00)	(0.00)	(0.00)	(0.00)
Mean Growth Rate (Age 65), *β10*	0.08***	0.04***	0.04***	0.04***	0.04***	0.04***	0.04***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Female					___	___	0.01***
							(0.00)
Black							
Hispanic							
Other Race							
Education							
Acceleration (Age 65²), *β20*	0.00***	0.00***	-0.00*	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*
Wealth (LN)	___	-0.07***	-0.07***	-0.06***	-0.06***	-0.06***	-0.05***
		(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)
Income (LN)	___	-0.12***	-0.11***	-0.07***	-0.07***	-0.07***	-0.07***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
No Insurance	___	0.03	___	___	___	___	___
		(0.04)					
VA Insurance	___	-0.03	___	___	___	___	___
		(0.04)					
Medicaid	___	0.75***	0.69***	0.66***	0.65***	0.64***	0.63***
		(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.06)
Medicaid x Age65			-0.00				
			(0.01)				
Medicaid x Age65²			0.00				
			(0.00)				
Medicare	___	0.08***	0.06**	0.06**	0.06**	0.06**	0.07**
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Medicare x Age65			-0.07***	-0.07***	-0.07***	-0.07***	-0.07***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Medicare x Age65²			0.00***	0.01***	0.00***	0.00***	0.00***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Employer Insurance	___	-0.17***	-0.23***	-0.16***	-0.16***	-0.16***	-0.14***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Employer x Black			___	___	___	___	-0.13*
							(0.05)
Employer x Hispanic							___
Employer x Other Race							___

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*
Employer x Age65			0.01**	0.01**	0.01***	0.01*	0.01**
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Employer x Age65 x Black			___	___	___	___	0.01*
							(0.00)
Employer x Age65 x Hispanic							___
Employer x Age65 x Other Race							___
Employer x Age65²			0.00*	0.00			0.00
			(0.00)	(0.00)			(0.00)
Private Insurance	___	-0.09***	-0.16***	-0.07**	-0.06**	-0.06**	-0.06**
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Private Insurance x Age65			-0.00				
			(0.00)				
Private Insurance x Age65²			0.00				
			(0.00)				
Doctor Visits	___	0.15***	0.13***	0.17***	0.17***	0.15***	0.15***
		(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Doctor x Black		___	___	___	___	0.14*	0.15*
						(0.06)	(0.06)
Doctor x Hispanic							___
Doctor x Other Race							___
Doctor Visits x Age65			-0.00				
			(0.00)				
Doctor Visits x Age65²			0.00				
			(0.00)				

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*
Hospital/Nursing Home Stay	___	0.49***	0.38***	0.39***	0.39***	0.35***	0.35***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Hospital/Nursing x Black		___	___	___	___	0.29***	0.28***
						(0.06)	(0.06)
Hospital/Nursing x Hispanic							___
Hospital/Nursing x Other Race							___
Hospital/Nursing x Age65			0.01*	0.01*	0.01*	0.01**	0.01**
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hospital/Nursing x Age65²			0.00***	0.00***	0.00***	0.00***	0.00***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Health Problems	___	0.39***	0.40***	0.39***	0.33***	0.34***	0.36***
		(0.02)	(0.02)	(0.01)	(0.03)	(0.03)	(0.03)
Health Problems x Female			___	___	0.12***	0.12***	0.09**
					(0.03)	(0.03)	(0.03)
Health Problems x Hispanic			___	___	0.14*	0.14*	0.14**
					(0.06)	(0.06)	(0.04)
Health Problems x Child SES			___	___	-0.06*	-0.06*	-0.06**
					(0.03)	(0.03)	(0.03)
Health Problems x Black					0.14**	0.09*	0.07
					(0.04)	(0.04)	(0.04)
Health Problems x Other Race							___
Health Problems x Age65			0.01***	0.01***	0.01***	0.01***	0.01***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Health Problems x Age65²			-0.000*	-0.00**	-0.00**	-0.00**	-0.00**
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Married	___	-0.06*	-0.05*	-0.02	-0.02	-0.02	-0.01
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*
Friends	___	-0.13*** (0.01)	-0.12*** (0.02)	-0.12*** (0.01)	-0.12* (0.01)	-0.12*** (0.02)	-0.12*** (0.02)
Friends x Age 65			-0.01*** (0.00)	-0.01*** (0.00)	-0.01* (0.00)	-0.01* (0.00)	-0.01*** (0.00)
Relatives	___	0.06** (0.02)	0.05** (0.02)	0.04* (0.01)	0.04* (0.02)	0.04* (0.02)	0.04* (0.02)
Relatives x Age 65			0.00 (0.00)				
Random Effect				*Variance*			
Initial Status, r*0i*	2.88***	2.09***	2.04***	1.96***	1.95***	1.95***	1.95***
Growth Rate, r1i	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Level 1 Error, eti	1.24	1.24	1.23	1.23	1.23	1.23	1.23

*p<.05. **p<.01. ***p<.001
Note: Whites are the reference category.

Model 2: Time-Varying Covariates Added to Level 1

Model 2 adds wealth and income, health care treatment, health problems, health insurance, marital status, and social integration. As VA/CHAMPUS insurance and the no insurance category were not significant, they were taken out of later models. Time-varying covariates added to Level 1 explain more of the variance in functional limitations than the growth and acceleration of age in Model 1. This is shown by the decrease in unexplained variance from Model 1 to Model 2 reported in Table 21 (2.88 in Model 1 versus 2.09 in Model 2).

As shown in Table 21, mean limitations at age 65 increase in Model 2 with the addition of covariates at Level 1. The mean growth rate in functional limitations decreases from Model 1 to Model 2, though the acceleration in functional limitations remains about the same. Level 1 hypotheses are largely supported in Model 2. Income and wealth are negatively associated with functional limitations.

Medicare and Medicaid insurance are positively associated with functional limitations. The association between Medicaid insurance and functional limitations is stronger than the association between Medicare insurance and functional limitations. Because Medicaid insurance is insurance for the poor of all ages, older adults on Medicaid are poorer than those using other types of insurance. Medicare is associated with more functional limitations because older adults are using this type of insurance, and increasing age increases the likelihood of more functional limitations.

Employer-provided and private insurance are associated with fewer functional limitations. Of these two types of insurance, employer-provided insurance is most strongly associated with fewer functional limitations. This may be because employer-provider insurance

is associated with other benefits, such as a good job, which may also reflect other characteristics—education and income, for example. The positive relationship between functional limitations and private insurance largely reflect SES as well. Those that can afford this type of insurance have higher SES and better health than those who cannot. Lack of health insurance is not associated functional limitations. This may be because most respondents have Medicare insurance and over time, the number of respondents with no insurance decreases (see Table 6). VA insurance is also not significant.

As model 2 shows, the relationship between functional limitations and social integration differs by type of social integration. As expected, having a friend in the respondent's neighborhood is associated with fewer functional limitations. However, having a relative in the respondent's neighborhood is associated with more functional limitations. This latter finding may be because friends in the respondent's neighborhood represent original communities whereas relatives in the respondent's neighborhood reflect a move. Respondents may move to be closer to a relative, such as an adult child, with declining health.

As expected, health care treatment is associated with more functional limitations, though there are differences between doctor visits and hospital and nursing home stays. Hospital and nursing home stays are associated with more functional limitations than doctor visits. This may be because hospital and nursing home stays, though temporary for the non-institutionalized respondents in this sample, reflect health conditions that are associated with recovery time whereas doctor visits reflect some health concerns or preventative care. As expected, health problems are strongly associated with more functional limitations. Marriage is associated with fewer functional limitations as well.

In sum, Model 2 explains more variation than Model 1 does through the additions of Level 1 covariates. The results of Model 2 largely support hypotheses, with one notable exception. The relationships between income, wealth, and functional limitations are in expected directions; income and wealth are negatively associated with functional limitations. Also as expected, Medicare and Medicaid insurance are positively associated with functional limitations while employer and private insurance are negatively associated with functional limitations. Doctor visits, hospital and nursing home stays, and health problems, are positively associated with functional limitations. Also as expected, being married and having a friend in the neighborhood are negatively associated with functional limitations. Unexpectedly, having a relative in the neighborhood is positively associated with functional limitations.

Model 3: Age-Interactions Added to Level 1

Model 3 in Table 21 examines the effects of health insurance, social integration, health care treatment, and health problems over time and into advanced ages, according to the hypotheses detailed in the Hierarchical Linear Modeling section above. Model 3 explains more model variance than Model 2, shown in the variance decrease from 2.09 to 2.04.

Mean functional limitations at age 65 increase with the addition of health care treatment, health problems, and health insurance over time. The growth rate (mean growth rate in Table 21) remains the same in Models 2 and 3 but acceleration (acceleration in Table 21) is no longer significant. This is most likely due to the small effect of acceleration in Model 2 and the significance of the acceleration in health problems, health care treatment, and health insurance in Model 3.

The effect of wealth and income on functional limitations decreases slightly from Model 2 to Model 3, but both continue to be significantly associated with fewer functional limitations.

Having Medicare insurance continues to be associated with more functional limitations, as does having Medicaid insurance, though both of these effects are lessened in Model 3. Medicare insurance is still associated with fewer functional limitations than Medicaid insurance. Medicaid insurance was expected to be associated with accumulating and widening functional limitations over time, but this model provides no evidence for this.

Medicare insurance is associated with more functional limitations, and there is a significant cumulative effect, though the association between Medicare insurance and functional limitations weakens over time. This weakening over time is most likely due to the inclusion of more elderly adults qualifying for and using Medicare as opposed to disabled younger adults in using Medicare at earlier time points. Note that in advanced ages this weakening trend is reversed, and Medicare insurance is again associated with more functional limitations over time. This may be due to the worsening health in advanced ages.

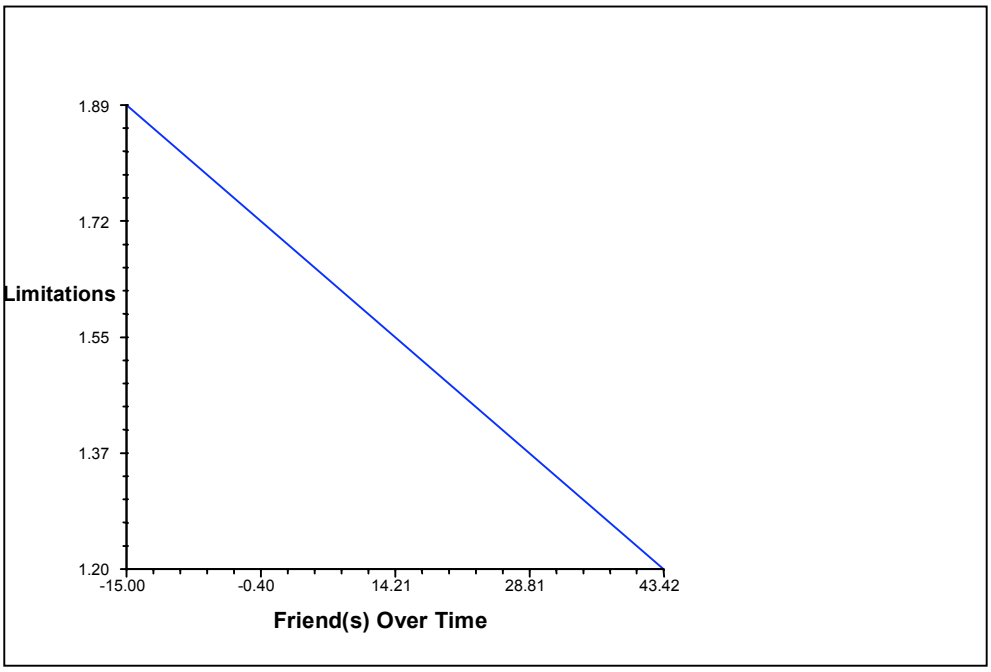
Private insurance continues to be associated with fewer functional limitations in Model 3, and its effect on functional limitations continues to be weaker than the effect of employer-provided insurance on functional limitations. It was hypothesized that private insurance would be associated with accumulating and widening health inequalities, but these effects were not found. A respondent's SES affects their ability to purchase private insurance. Employer-provided insurance continues to be associated with fewer functional limitations—and its effect is stronger in Model 3 than in Model 2 with age interactions. The effect of employer insurance on functional limitations is significant over time and in advanced ages, though over time, the relationship between employer-provided insurance and functional limitations weakens, but strengthens again in advanced ages (though this effect is negligible). These results may be due to worsening health with age.

Doctor visits continue to be associated with more functional limitations, though this effect is weaker in Model 3 than in Model 2, and doctor visits are not significant over time. Hospital and nursing home stays also continue to be associated with more functional limitations, and their effects on functional limitations are cumulative over time into advanced ages. Though this latter widening is significant and positive, its effect on functional limitations is negligible. These findings may reflect persistent health problems that are not treated with brief stays in a hospital or nursing home. These conditions may be chronic or acute—either way, this type of treatment does not reduce functional limitations.

As expected, health problems continue to be associated with more functional limitations in Model 3 (as in Model 2), and gain strength in their association with functional limitations with the addition of age interaction terms. Health problems are associated with more functional limitations over time and diverging effects into advanced ages, though this latter effect weakens. In advanced ages, the effect of health problems on functional limitations is weakened; though this effect is significant, it is negligible. Marriage continues to be associated with fewer functional limitations in Model 3, though its effect is not as strong as in Model 2.

Figure 4

The Relationship between Friends in the Neighborhood and Functional Limitations over Time



Having a friend in the neighborhood is associated with fewer functional limitations and this effect accumulates over time, as shown in Figure 4. In Figure 4, age and friends interact to specify the relationship between friends over time. In Figure 4, age is centered on age 65, meaning that -15 represents having at least one friend in the neighborhood at age 50 while 14.21 represents having at least one friend in the neighborhood around age 79, and so forth. Having a relative in the neighborhood continues to be associated with more functional limitations, though there is no significant relationship between relatives in the neighborhood on functional limitations over time.

In sum, Model 3 examines some Level 1 covariates over time for accumulating and widening effects. This model shows that some Level 1 covariates are associated with increasing or decreasing functional limitations over time and into advanced ages, though not all hypotheses are supported. Medicare, for example, is positively associated with functional limitations, as

expected, but unexpectedly, this relationship weakens over time. In advanced ages, the relationship between Medicare insurance and functional limitations again weakens. That is, the relationship between Medicare insurance and functional limitations is not as strong over time, but is positively associated with functional limitations in advanced ages. Thus, there is no cumulative relationship between Medicare insurance and functional limitations over time.

As expected, employer insurance is negatively associated with functional limitations, but unexpectedly, this effect weakens over time. That is, the relationship between employer insurance and functional limitations changes over time--employer insurance is positively associated with functional limitations. In advanced ages, employer insurance is positively associated with functional limitations. Unexpectedly, private insurance is not associated with functional limitations over time and there is no associated widening effect. Also unexpectedly, there is no relationship between doctor visits over time or into advanced ages.

As predicted, the relationship between hospital and nursing home stays and functional limitations is positive and hospital and nursing home stays are positively associated with functional limitations over time and in advanced ages. The relationship between functional limitations and hospital and nursing home stays is the only evidence for cumulative disadvantage, associated with an accumulating and widening in functional limitations over time.

It was expected that health problems would be positively associated with functional limitations over time, and there is evidence for this. However, there is no evidence for a widening in functional limitations due to health problems. In fact, in advanced ages, the relationship between health problems and functional limitations weakens. As expected, there is a negative relationship between friends and functional limitations over time.

Model 4: Level 2 Main Effects Added

Model 4 in Table 21 examines the relationship between Level 2 main effects and the Level 1 intercept. Race, sex, childhood SES, childhood health, and education are used to predict the intercept in Level 1. As Table 21 shows, Model 4 improves model fit, significantly reducing deviance in Model 3. The deviance in Model 4 is significantly improved from 211,164.38 to 210,488.56 in Model 4 (results of a chi-square test--not shown), and Model 4 explains significantly more variance than Model 3 (2.04 in Model 3 to 1.96 in Model 4).

With the introduction of Level 2 predictors, mean limitations at age 65 significantly increase from 2.054 to 2.901. Being a woman is positively associated with functional limitations at age 65. As expected, childhood health, childhood SES, and education are negatively associated with functional limitations at age 65. Also as predicted, there are racial and ethnic differences in mean functional limitations at age 65. Controlling for income, wealth, health insurance, health care treatment, health problems, and marital status, Hispanic adults have fewer functional limitations at age 65 than White adults. This finding may reflect a nativity effect where older Hispanic immigrants are in better health than their native-born counterparts (Angel and Angel 1998). There are no significant differences in the health of Black adults or other racial and ethnic minority group members relative to White adults at age 65.

The effects of race, education, sex, and childhood health and SES are seen throughout this model. Examining the mean growth rate and acceleration terms in Table 21, functional limitations continue to be associated with accumulation, but functional limitations are no longer associated with acceleration (they are not widening over time). The addition of education decreases the strength of the relationship between income and wealth and functional limitations in this model.

Having Medicaid insurance is still associated with more functional limitations, and this association is stronger than the effect of Medicare insurance on functional limitations. The strength of the association between employer-insurance and functional limitations decreases slightly but continues to be associated with fewer functional limitations over time. Private insurance continues to be associated with fewer functional limitations though the strength of the association weakens in Model 4 with the additions of Level 2 main effects.

From Model 3 to Model 4, the strength of the association between doctor visits and hospital and nursing home stays increases slightly. Both continue to be associated with more functional limitations, and hospital and nursing home stays continue to be more strongly associated with functional limitations than doctor visits. The effect of health problems on functional limitations remains largely unchanged in this model.

With race, sex, education, childhood health and SES additions, marital status is no longer a significant predictor of functional limitations. The relationship between friends in the respondent's neighborhood and functional limitations is strengthened with the addition of main effects, and friends continue to be associated with fewer functional limitations over time. With main effect additions, the strength of the association between a relative(s) in the neighborhood and functional limitations decreases slightly.

In sum, Model 4 improves the fit of Model 3 though the addition of Level 2 predictors. As expected, women have more functional limitations than men and good childhood health, high childhood SES, and education, are negatively associated with functional limitations. Hispanic adults have fewer functional limitations compared to their counterparts at age 65 and there is no relationship between being Black and being of the other racial and ethnic group category and functional limitations at age 65.

Models 5-7: Level 1 and Level 2 Interactions

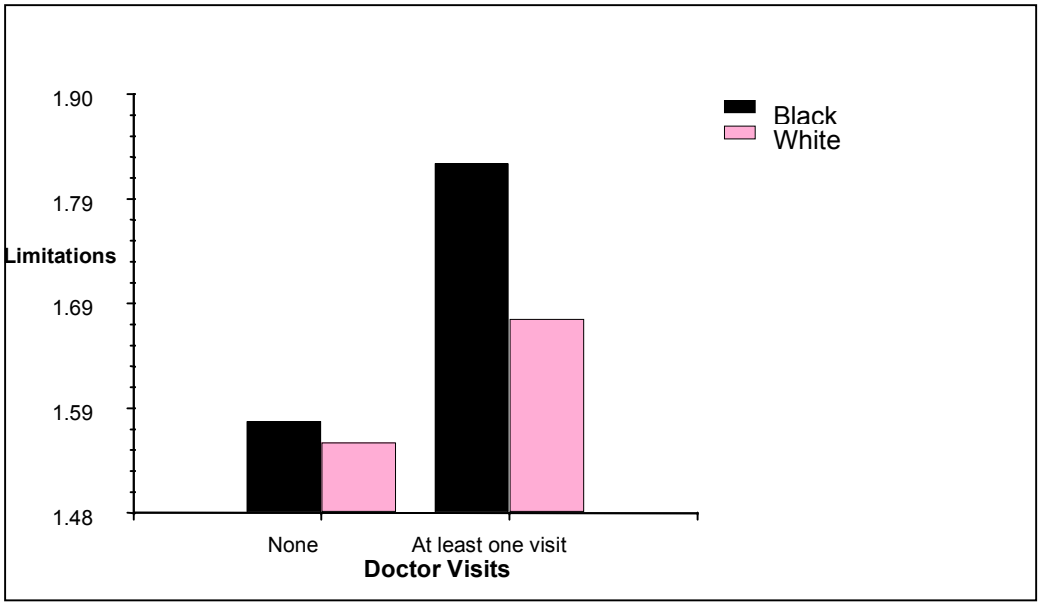
Model 5 examines the interactions between the Level 2 variables--race, sex, childhood SES, childhood health, and education--with Level 1 slopes. First, Level 2 predictors interact with health problems, according to the hypotheses detailed in the Hierarchical Linear Modeling section (Model 5). Next, Level 2 predictors interact with health care treatment variables, according to hypotheses discussed above (Model 6). Finally, Level 2 predictors interact with the rest of the model, according to hypotheses (Model 7). From variance reports in Table 21, Model 7 has the best model fit of all models, and significantly explains the most variance in functional limitations. Overall, variance is reduced from 2.88 in Model 1 to 1.95 in Model 7.

Hispanics, Blacks, and women with health problems are associated with more functional limitations than Whites and men, respectively. There are no significant differences in health problems between other racial and ethnic group members and Whites. Childhood SES is negatively associated with health problems, but there is no relationship between childhood health and health problems. There is also no relationship between race, sex, or early disadvantage and health problems over time. However, health problems do accumulate over time and are associated with more functional limitations.

In sum, Model 5 shows the relationship between health problems and sex, race and ethnicity, and early disadvantage. As expected, women, Hispanic, and Black adults with health problems are positively associated with functional limitations. Also, childhood SES is negatively associated with health problems. While it was expected that childhood health would be negatively associated with health problems, there is no evidence for this. Also unexpectedly, there is no relationship between sex, race and ethnicity, or childhood SES and childhood health over time and into advanced ages.

Figure 5

The Relationship between Doctor Visits and Functional Limitations by Race



As shown in Figure 5, Black adults who have visited the doctor have significantly more functional limitations than their White counterparts (Model 6). There are no other relationships between race and ethnicity and doctor visits. Even with considerations of SES, health problems, insurance, and social integration, these racial differences emerge in treatment. This may be because medical professionals do not treat their Black patients similarly or because Black adults do not have access to the same quality care as other racial groups.

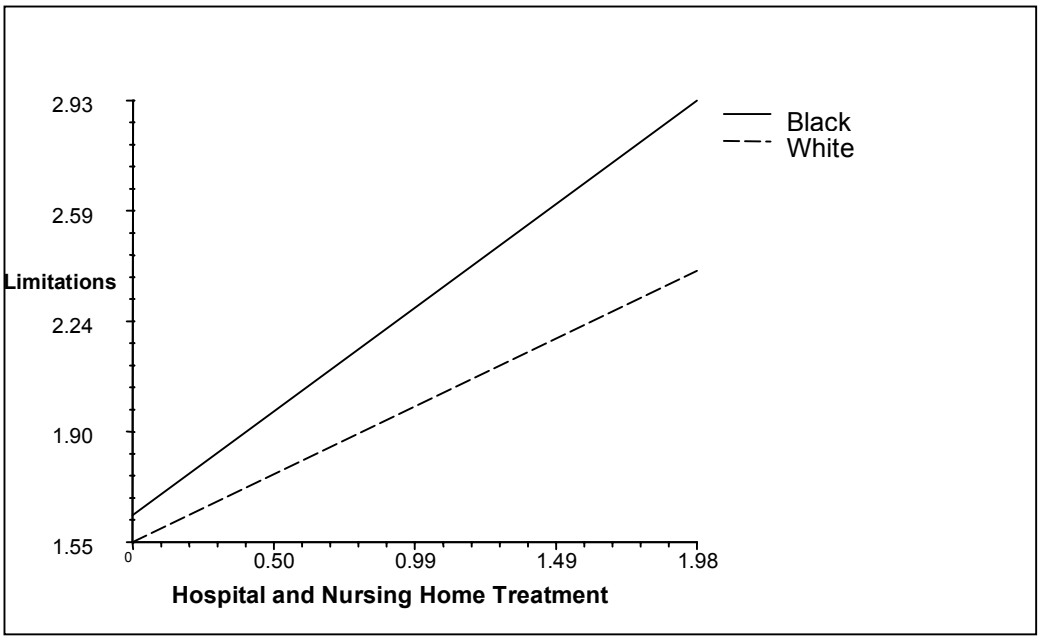
Differential benefits to doctor visits by race may also be the result of racial differences in help-seeking behaviors. Black and Hispanic adults may be more reluctant to visit the doctor, waiting longer to seek treatment for their health conditions. Multivariate regression analyses were conducted to further examine the ways in which race and ethnicity may affect doctor visits (results not shown). In these analyses, doctor visits are used as the dependent variable, and sex, age, education, household income, wealth, health insurance, high blood pressure, diabetes, cancer, lung disease, heart problems, stroke, psychological problems, and arthritis are controls.

Multivariate regression results reveal racial differences in doctor visits in 1992. In 1992, Black adults were more likely to visit the doctor than all other racial groups. From 1994 to 2002, however, there are no racial or ethnic differences in doctor visits. These regression analyses support assertions of similar help-seeking behaviors among Whites, Blacks, Hispanics, and other racial and ethnic minority group members, with the exception being among Black adults in year 1992. Racial differences in health care treatment are thus not likely due to racial differences in help-seeking behaviors.

Similarly, Black adults who have stayed in a hospital or nursing home have more functional limitations than all other racial groups, even after SES, health insurance, health problem, and social integration considerations. There are no other relationships between race and ethnicity and hospital and nursing home stays. These hospital and nursing home stays for Blacks adults may indicate recovery from a health condition. These findings may also show that Black adults benefit differently than all other racial groups from hospital or nursing home stays. Again, this may reveal the racist treatment of medical professionals—they are not treating their Black patients in the same ways—or it may instead reveal racial differences in access to quality hospital and nursing care.

Figure 6

The Relationship between Hospital and Nursing Home Stays and Functional Limitations by Race



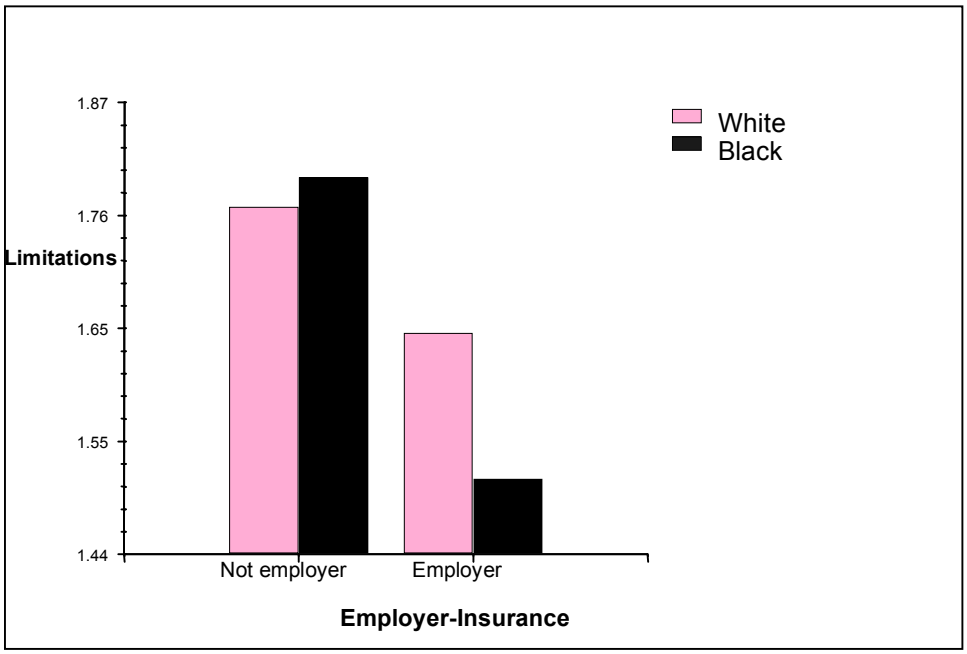
As shown in Figure 6, the effects of hospital and nursing home stays on functional limitations are cumulative and associated with a small widening in advanced ages for Black adults compared to their White counterparts (graphed from Model 6). There are no racial differences in hospital and nursing home treatment over time and in advanced ages, however.

In sum, Model 6 shows the relationship between health care treatment and race and ethnicity. This model shows that Black adults who visit the doctor are associated with more functional limitations than all other racial groups. In addition, Black adults with hospital and nursing home treatment are associated with more functional limitations than all other racial groups. Though there is no relationship between race and hospital and nursing home treatment over time or into advanced ages, hospital and nursing home treatment is positively associated

with more functional limitations over time and there is a small but significant widening effect into advanced ages.

Figure 7

The Relationship between Functional Limitations and Employer-Provided Insurance by Race



Model 7 shows that there are differential benefits to employer health insurance by race. As Figure 7 shows, Black adults with employer-provided insurance have significantly fewer functional limitations than their White counterparts. Black adults are also more likely than Whites to have debilitating health conditions and problems, and these health differences may partially explain racial differences in benefits to insurance. Black adults may also benefit more from employer insurance than all other racial groups because employer insurance provides access to care that Black adults would otherwise not have. Over time, health benefits from employer insurance weaken, especially for Black adults, possibly reflecting poorer overall health among this racial group compared to all other racial groups. The significant interaction between

being Black and having employer insurance causes the relationship between health problems and Black to become non-significant, suggesting that this racial difference in health problems was largely the result of differential benefits to health insurance. There are no other racial or ethnic differences in benefit to employer-provided health insurance.

The interaction between age and sex in Model 7 show sex differences in functional limitations over time, with women more disadvantaged. This sex difference in functional limitations over time may be due to women's higher instance of chronic health conditions. Chronic conditions affect women's ability to function, including walk a block, get out of bed, and so forth.

In sum, Model 7 shows no significant racial or ethnic differences in the relationship between functional limitations and Medicare, Medicaid, or private insurance. There is evidence that Black adults with employer insurance are associated with fewer functional limitations compared to their counterparts with employer insurance. Over time, this relationship between employer insurance and functional limitations weakens, especially for Black adults. In addition, this model shows a relationship between functional limitations and sex over time, with women disadvantaged relative to their male counterparts.

There are several noteworthy findings in the functional limitations model. First, the relationships between variables are in the expected direction with one exception--having a relative in the neighborhood is associated with more functional limitations. However, it was expected that the relationship between social integration and functional limitations would differ for Blacks, Hispanics, and other racial and ethnic minority group members, and there is no evidence for this. There is also no support for racial differences in benefits to Medicare, Medicaid, and private insurance types, as was expected. Employer provided insurance is

associated with fewer functional limitations, however, especially for Black and Hispanic adults. Though this relationship between employer provided insurance and functional limitations is not cumulative or associated with a widening of disadvantage by race or ethnicity, the effects of employer insurance on functional limitations are cumulative and are associated with widening the gap in functional limitations for those without this type of insurance.

In addition, this study finds no evidence for an independent growth or acceleration in functional limitations due to race or ethnicity. There is also no support for accumulating and widening disadvantages in relation to childhood health and childhood SES. It was expected that doctor visits would be positively associated with functional limitations over time and into advanced ages, but this hypothesis was not supported. However, hospital and nursing home stays are positively associated with functional limitations and this trend continues over time and into advanced ages. It was predicted that both types of treatment would be associated with accumulating and widening racial and ethnic disadvantages and there is no evidence for this, though Black adults who visit the doctor are associated with more functional limitations than their White counterparts.

Many of the hypotheses that are not supported are related to the CAD perspective. The only evidence for CAD in this functional limitations model is the relationship between sex and functional limitations over time. Compared to being a man, being a woman is associated with more functional limitations, and this trend is consistent over time.

This study now turns to an analysis of self-reported health, proceeding as outlined in the Hierarchical Linear Modeling section.

Model 1: Age-Related Growth and Acceleration in Self-Reported Health

Model 1 in Table 22 examines the relationship between age and self-reported health. As with functional limitations, both linear and quadratic models are examined to determine best model fit. Age 65 and age 65^2 are significant, indicating a quadratic relationship between age and self-reported health. Because the random acceleration effect is not significant it is left out of the model. The intercept is the expected log-odds of having poor health relative to having fair, good, very good, or excellent health for a 65 year-old respondent. It is adjusted for between-individual heterogeneity in observations across time points. The conditional expected log-odds is -4.08 corresponding to an odds of 0.02. Respondents have 0.02 lower odds of giving a poor health response to giving any other response at age 65.

The expected log-odds for a 65 year-old respondent to report poor health or fair health relative to good health is -4.08 + 2.35 = -1.73, or an odds of -5.64, where 2.36 is the corresponding threshold for this response. This means that 65 year-old respondents have 1.73 lower odds of giving a poor health or fair health response to giving a good health response. The threshold is used to calculate probabilities of giving a response in any other health category. Here, the threshold is the difference in the log odds of reporting poor health or fair health relative to good health, holding constant the explanatory variables and the random effects. Throughout the ordinal variable analysis, the threshold is reported for calculations of the expected log-odds of one category of health relative to another category of health for ease of interpretation. The expected log-odds of a respondent reporting fair health or good health relative to very good health is -4.08 + 4.76 = -.68, or an odds of -1.97, where 4.76 is the corresponding threshold for this response. The expected log-odds for a respondent to report good health or very good health relative to excellent health is -4.08 + 7.40 = 3.32, or an odds of 27.66, where 7.40 is the

corresponding threshold for this response. Interpreting these findings meaningfully, then, the average 65 year-old respondent has lower odds of giving a poor health response relative to giving any other response.

As Model 1 in Table 22 shows, the lower odds of reporting poor health weaken over time. In other words, with increasing age, respondents have higher odds of reporting poor health. Though self-reported health worsens over time, this effect also weakens in advanced ages; advanced old age has less of an effect on poor health responses. This weakening amongst the oldest-old may be reflective of healthier adults reaching the oldest ages (selective survival) or an indication that age alone is not a good predictor of self-reported health. As Table 22 shows, there is a significant amount of variance (5.83) yet to be explained in this model.

Table 22

Self-Reported Health[a] Curvilinear Growth Models 1-6; Unstandardized Coefficients and Odds-Ratios[b]: 1992-2002

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
SR Health Intercept at Age65, *β00*	-4.08***	-3.31***	-3.34***	-2.25***	-2.26***	-2.26***
	(0.02)	(0.04)	(0.04)	(0.11)	(0.10)	(0.10)
Female	___	___	___	-0.11**	-0.11**	-0.11**
				(0.90)	(0.90)	(0.90)
Education	___	___	___	-0.17***	-0.17***	-0.17***
				(0.84)	(0.84)	(0.84)
Black	___	___	___	0.43***	0.57***	0.57***
				(1.54)	(1.78)	(1.78)
Hispanic	___	___	___	0.47***	0.61***	0.59***
				(1.61)	(1.84)	(1.80)
Other Race	___	___	___	0.24*	0.24*	0.31*
				(1.27)	(1.27)	(1.36)
Mean Growth Rate (Age 65), *β10*	0.07***	0.03***	0.05***	0.05***	0.05***	0.06***
	(1.07)	(1.03)	(1.05)	(1.05)	(1.05)	(1.05)
Hispanic						-0.04***
						(0.96)
Other Race						-0.03*
						(0.97)
Black						-0.03***
						(0.97)
Mean Acceleration (Age 65²), *β20*	-0.00*	0.00	0.00	-0.00*	-0.00*	-0.00**
	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)
Wealth (LN)	___	-0.13***	-0.13***	-0.08***	-0.08***	-0.08***
		(0.88)	(0.88)	(0.92)	(0.92)	(0.92)
Income (LN)	___	-0.36***	-0.35***	-0.20***	-0.19***	-0.19***
		(0.70)	(0.71)	(0.82)	(0.82)	(0.83)
Married	___	0.03	___	___	___	___
		(1.03)				

Fixed Effects	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
Disability	___	1.70*** (5.41)	1.70*** (5.40)	1.67*** (5.33)	1.67*** (5.33)	1.67*** (5.32)
Friends	___	-0.07** (0.93)	-0.06* (0.94)	-0.06* (0.94)	-0.06* (0.94)	-0.06** (0.94)
Friends x Age 65		___	-0.01** (0.99)	-0.01** (0.99)	-0.01** (0.99)	-0.01** (0.99)
Relatives	___	0.08** (1.08)	0.08** (1.08)	0.03 (1.03)	0.03 (1.03)	0.03 (1.03)
Relatives x Age 65			-0.00 (1.00)	___	___	___
Health Problems	___	0.96*** (2.60)	0.97*** (2.64)	0.94*** (2.57)	0.97*** (2.64)	0.96*** (2.62)
Hispanic					-0.16** (.85)	-0.08** (0.92)
Black					-0.11* (.99)	-0.10* (0.91)
Other Race						___
Health Problems x Age 65			-0.27*** (0.97)	-0.03*** (0.97)	-0.03*** (0.98)	-0.03*** (0.97)
Black					-0.01** (.99)	-0.00** (0.00)
Hispanic						___
Other Race						
Health Problems x Age 65²			0.00*** (1.00)	0.00*** (1.00)	0.00*** (1.00)	0.00*** (1.00)
Random Effect				*Variance*		
Intercept, r*0i*	5.83***	2.95***	2.95***	2.68***	2.68***	2.68***
Growth Rate, r1i	0.07***	0.00***	0.00***	0.00***	0.00***	0.00***

*p<.05. **p<.01. ***p<.001
[a]Poor health category is the comparison.
[b]Odds-ratios are in parentheses.

Model 2: Time-Varying Covariates Added to Level 1

To explain more of this variance in Model 1, wealth, income, health problems, marital status, disability, and social integration are added as Level 1 covariates. The results of these are shown in Table 22, Model 2. The intercept is the expected log-odds of a poor response relative to any other response for a 65 year-old respondent controlling for income, wealth, health problems, disability, marital status, and social integration. It is adjusted for the between-individual heterogeneity in observations across time points. The conditional expected log-odds is -3.31 corresponding to an odds of 0.04. This respondent has 0.04 lower odds of giving a poor health response relative to giving any other response. These odds can be further interpreted based on the threshold figure. The expected log-odds for a respondent to report poor health or fair health relative to good health is -3.31 + 2.47 = -0.84, or an odds of -2.32, where 2.47 is the corresponding threshold for this response. The expected log-odds for a respondent to report fair health or good health relative to very good health is -3.31 + 4.95 = 1.64, or an odds of 5.16, where 4.95 is the corresponding threshold for this response. The expected log-odds for a respondent to report good health or very good health relative to excellent health is -3.31 + 7.54 = 4.23, or an odds of 68.71, where 7.54 is the corresponding threshold for this response. With the inclusion of covariates at Level 1, the growth rate decreases from 0.07 to 0.03 and there is no longer a significant independent acceleration.

The study hypotheses are supported in this model. Holding constant other variables, wealth is associated with lower odds of reporting poor health. That is, a unit increase in wealth decreases the log odds of being in poor health relative to better health by .13, corresponding to an odds ratio of .88. Similarly, holding constant the other variables, a unit increase in income

decreases the log odds of a poor health response to any other response by .36, corresponding to an odds ratio of .70.

Unlike the functional limitations analysis, there is no significant relationship between marital status and self reported health. Because of this, marital status is taken out of later models. As expected, disability is associated with significantly higher odds of having poor health. The relationship between disability and self-reported health shows that some aspects of physical health are important predictors of self-reported health. The relationship between social integration and self reports of health parallel the relationship between social integration and functional limitations. Having a friend in the neighborhood decreases the odds of a having poor health by 0.93. In contrast, having a relative in the neighborhood increases the odds of having poor health by 1.08.

Also as in the functional limitations analysis, health problems are associated with worse health. That is, health problems are associated with higher odds of a poor health report. Holding constant the other variables, a unit increase in health problems increases the log odds of a poor health response by .96, corresponding to an odds ratio of 2.60. As shown in Table 22, Model 2 explains significantly more model variance than Model 1—decreasing the variance to be explained from 5.83 to 2.95.

In sum, Model 2 parallels the functional limitations model—having health problems and having relatives in the neighborhood are associated with higher odds of poor health whereas having friends in the neighborhood and income and wealth are associated with lower odds of poor health. This model also adds disability; disability is associated with higher odds of poor health.

Model 3: Age-Interactions Added to Level 1

Model 3 examines the relationship between health problems and social integration over time and into advanced ages, according to the self-reported health hypotheses detailed in the Hierarchical Linear Modeling section. The intercept depicts the expected log-odds of a poor response relative to any other response for a 65 year-old respondent controlling for income, wealth, health problems, disability, marital status, and social integration. In Model 3, the intercept log-odds is -3.34, which is a slight increase from Model 2. As shown in Table 22, this log-odds corresponds to an odds of 0.04. The additions of Level 1 time-varying covariates have little effect on the other variables in the model, including the growth rate, income, wealth, and disability.

Consistent with functional limitations analyses, having a friend in the neighborhood is associated with lower odds of having poor health and this effect is cumulative. Over time, a respondent who has a friend in the neighborhood has .99 lower odds of having poor health relative to better health. Having a relative in the neighborhood continues to be associated with higher odds of having poor health. In contrast to the relationship between having a friend in the neighborhood, the effects of having a relative in the neighborhood do not accumulate over time.

Health problems continue to be associated with higher odds of poor health responses. Respondents with health problems have 2.64 higher odds of giving a poor health response relative to any other response. However, the relationship between self-reported health and health problems weakens over time. In advanced ages, health problems are again associated with higher odds of a poor health response, though this effect is small. Overall, the additions of these Level 1 time-varying covariates in Model 3 explain little of the variance. As shown in Table 22, the

variance explained in Model 3 remains unchanged (compared to the variance explained in Model 2).

In sum, Model 3 shows that there is a cumulative relationship with having friends in the neighborhood and health over time. Health problems are associated with higher odds of a poor health response, but this relationship is weakened over time. In advanced ages, this trend also weakens, and health problems are again associated with higher odds of a poor health response.

Model 4: Level 2 Main Effects Added

Level 2 main effects explain significantly more model variance; 2.68 in Model 4 versus 2.95 in Model 3. Model 4 results largely support hypotheses. As predicted, Black and Hispanic adults, compared to all other racial groups, have higher odds of a poor health response relative to any other response at age 65. Other racial and ethnic group members also have higher odds of a poor health response relative to all other racial groups. This may be because self-reports of health are measuring overall health in addition to physical health, and other racial and ethnic minority group members are disadvantaged in health in other ways. For example, this study focuses on disadvantages related to racism—self-reported health measures may capture the results of racism on health for many minority group members. This finding could also be related to the ways in which physical health is measured in this model. This model measures physical health through health problems only, and there may be other aspects of physical health not fully captured in this measure.

As predicted, women have 0.90 lower odds of a poor health response relative to any other health response at age 65 compared to their male counterparts. Again, this may be largely due to this health measure. Recall that health reports have been shown to be highly correlated with mortality for men and minority group members. As expected, education is associated with lower

odds of a poor health response. With each year of education, respondents have 0.84 lower odds of a poor health response at age 65.

The Level 1 covariates in Model 4 remain largely unchanged with the addition of Level 2 predictors, though there are some notable exceptions. The strength of the association between wealth and income and self-reported health is weaker in this model. Recall that this also occurred in the functional limitations model when education was added at Level 2. Education is probably accounting for some of this variance. The strength of the association between disability and self-reported health also weakens in this model. In addition, having a relative in the neighborhood is no longer associated with worsening health over time. Also, the strength of the association between health problems and self-reported health is slightly reduced, and the effect of health problems on self-reported health over time is significantly reduced.

To conclude, Model 4 shows that self-reported health varies by sex and race and ethnicity. That is, men are more likely than women to have poor health. This is in direct contrast to functional limitation model findings where women have more functional limitations than men. Black, Hispanic, and other racial and ethnic minority group members have higher odds of poor self-reported health at age 65.

Models 5-6: Level 1 and Level 2 Interactions

As in the functional limitations model, the final self-reported health model is developed in stages. This model development is shown in Table 22. First, the relationships between sex, race, and health problems are examined in Model 5. No sex differences were found, but there are racial and ethnic differences in the strength of the association between health problems and self-reported health. Health problems increase the odds of poor health, but less so for Black and Hispanic adults. There is no relationship between health problems and other racial and ethnic

minority group members. This finding may indicate that Black and Hispanic adults' higher odds of poor health may be the result of more than health problems. Over time, the relationship between health problems and self-reported health weakens for everyone, but especially for Black adults. At advanced ages, the cumulative effect of health problems on self-reported weakens, and health problems are again associated with higher odds of poor health reports, though this effect is small.

Race and ethnicity interactions with social integration variables were also examined. It was hypothesized that socially integrated Black, Hispanic, and other racial and ethnic group members would have lower odds of poor health, but there is no evidence for this. This study has found no evidence for racial and ethnic differences in benefits to social integration. Instead, having a friend in the neighborhood is associated with lower odds of poor health for all older adults.

Finally, the effects of race and sex on health are examined over time and in advanced ages (Model 6). The final model shows evidence for a weakening in the relationship between self-reported health over time for Black, Hispanic, and other racial and ethnic group members. Black, Hispanic, and other racial and ethnic group members have higher odds of a poor health response at age 65, but this relationship weakens for these groups, compared to Whites, over time. In advanced ages, there are no differences in health reports by race.

In sum, these final models show that there are initial disadvantages by race and ethnicity, with Black, Hispanics, and other racial and ethnic group members more likely than Whites to have poor health. However, over time, these initial disadvantages weaken, providing no evidence for cumulative disadvantage. There are also initial disadvantages at age 65 by sex, with men more likely to have poor health than women. This disadvantage does not continue over time,

however, and again provides no evidence for cumulative disadvantage. Health problems are associated with higher odds of poor health, but less so for Hispanic and Black adults, so again there is no evidence for CAD.

Chapter 5
Discussion and Conclusions

The purpose of this study is to examine the relationship between race, SES, sex and accumulating and diverging health inequalities over time using a cumulative advantage lens. This study demonstrates interconnected race and SES pathways while also showing some of the ways in which race influences health independently of SES. Understanding the ways in which race, SES, and sex shape health outcomes over time and into advanced ages can better inform policy and intervention strategies aimed at reducing health inequalities. This study's main findings are organized around research questions and discussed in greater detail below.

Socioeconomic Status

This study's first research question addresses the ways in which SES affects health through health problems, childhood SES, childhood health, and health insurance. It was expected that health problems would be associated with more functional limitations and higher odds of poor self-reported health, and that this relationship between health problems, functional limitations, and self-reported health would be cumulative and associated with widening inequalities in advanced ages. Also, the effects of health insurance on functional limitations were expected to differ by type of health insurance. Medicare and Medicaid were expected to be associated with more functional limitations, accumulating and widening the gap in functional limitations over time. In contrast, employer-provided and private health insurance were expected to be associated with fewer functional limitations over time and into advanced ages. Early disadvantages, poor childhood health and low childhood SES, were expected to be associated with more functional limitations over time and into advanced ages, widening the functional limitations gap in old age between those with early disadvantages and those without. This study

found no evidence for accumulating and widening disparities in childhood health, childhood SES, or health insurance. The only evidence for accumulation among these is through health problems. Health problems are associated with accumulating disadvantages in functional limitations over time.

The relationship between health and SES, or income, wealth, and education, is complex. For example, Williams (2005) discusses how income, wealth, and education affect lifestyles, health behaviors, resources and knowledge, socialization opportunities, living conditions, life chances, power, and privilege. As Hatch (2005) discusses, SES affects health in early ages, and children from high SES families are more likely to have nutritious food, safe and clean living environments, better health care, good housing conditions, residential stability, and experience fewer chronic stressors than their poorer counterparts.

Children's early disadvantages, resulting from low familial SES, have been linked to later life disadvantages, including poorer adult health and lower adult SES. O'Rand (2005) shows how early SES disadvantages in childhood affect cardiovascular disease in old age regardless of adult SES. This current study supports some of this literature by showing that high SES in childhood is associated with fewer health problems in old age. In this sense, the effects of high childhood SES are persistent into old age and operate through health problems. This current study also shows that good health in childhood is associated with fewer functional limitations at age 65, even after considerations of adult SES and current health problems. Good childhood health affects health even into old age.

SES also affects health through health insurance. As Hurd and McGarry (1997) show, SES pre-determines health insurance type in old age. Also, the quality of health care differs by type of health insurance. Private and employer-provided insurance are linked to better quality

care than public insurance (Zuvekas and Taliaferro 2003). This current study supports these findings, showing that private and employer-provided insurance are associated with fewer functional limitations than other insurance types. Ross and Mirowsky (2000) find that health disadvantages are associated with public insurance, regardless of current SES and baseline health. This current study supports this literature as well, finding that Medicare and especially Medicaid insurance are associated with more functional limitations than other types of insurance.

In sum, this study's first research question addresses the ways in which SES affects health through health problems, childhood SES, childhood health, and health insurance. This study finds that all of these do affect functional limitations (and health problems affect self-reported health) and that these affect functional limitations and self-reported health in the expected directions. However, the only evidence found for cumulative advantage and disadvantage is through health problems and childhood health and childhood SES. Health problems are associated with accumulating disadvantages, and good childhood health and high childhood SES continue to have persistent effects on health in old age. Therefore, evidence for cumulative advantage and disadvantage through these factors is limited. This discussion now turns to the ways in which the cumulative disadvantage perspective may be supported through race and SES intersections.

Race and Socioeconomic Status

This study's second research question addresses the ways in which race and SES intersections affect health through health problems, health insurance, and disability. Health problems were expected to differ by race, with Black and Hispanic adults having more health problems, compared to their White counterparts. Health problems were expected to be associated with accumulating and widening functional limitations and higher odds of poor self-reported

health over time and into advanced ages. Disability was used in the self-reported health model only. Disability was expected to differ by race, with Black and Hispanic adults having higher instances of disability. Disability was expected to disadvantage Black and Hispanic adults over time and into advanced ages, compared to Whites and other racial and ethnic minority group members.

Health insurance benefits were also expected to differ by race. Black and Hispanic adults with employer-provided and private insurance were expected to have fewer functional limitations than their White and other racial and ethnic counterparts with these types of insurance. White and other racial and ethnic group members with Medicare insurance were expected to have fewer functional limitations than Black and Hispanic adults with Medicare insurance. White and other racial and ethnic minority group members with Medicaid insurance were expected to have more functional limitations than Black and Hispanic adults with Medicaid insurance. This study finds evidence for racial and ethnic disadvantage in functional limitations through health problems, but no racial or ethnic disadvantages through disability or health insurance were found. As discussed in the previous section, the only evidence for accumulation among these is through health problems. Though Hispanic adults are disadvantaged in health problems relative to all other racial groups, there is no cumulative effect on functional limitations by race.

This study's findings support the race and SES literature in that race and SES intersect to affect health in multiple ways (Farmer and Ferraro 2005). Though Geronimus et al. (2000) finds racial differences in disability, this current study finds that people with disability have higher odds of poor self-reported health, but no racial differences were found in the relationship between disability and self-reported health. This current study does find racial disadvantages for

minority group members through health problems and health insurance. Hispanic adults with health problems have more functional limitations than all other racial groups. This finding is consistent with previous literature linking Hispanic adults to more health problems. Specifically, this literature shows that Hispanic adults have higher rates of diabetes, cirrhosis of the liver, and AIDS than Whites (National Center for Health Statistics 1998).

In this current study, Black adults with health problems also have significantly more functional limitations, though this relationship disappears when racial differences in benefit to employer insurance are added. Black adults with employer insurance have fewer functional limitations than all other racial groups. This finding is consistent with the literature. As Zuvekas and Taliaferro (2003) discuss, Black adults are less likely than Whites to have employer-provided insurance, largely due to job type (Zuvekas and Taliaferro 2003). Black adults with jobs that provide employer insurance may be financially better-off than their counterparts.

In this study, race and SES intersections in self-reported health were also found through health problems. Though health problems are associated with poor health, this effect is reduced for Black and Hispanic adults. This suggests that the self-reported health of Black, Hispanic, and other racial and ethnic minority group members is capturing other aspects of health that may not be dependent on physical health. This interpretation is consistent with Farmer and Ferraro (2005), who discuss self-reported health, in contrast to physical health measures, as a more holistic health measure. This finding may also result from other physical health problems that are not being captured in the self-reported health model. This current study also finds that other racial and ethnic minority group members have poor self-reported health at age 65. In bivariate results, however, other racial and ethnic minority group members are financially comparable to Whites and have better overall health than Whites. Again, this suggests that other racial and

ethnic minority group members' self-reported health is not dependent on SES or health problems, and that self-reported health is capturing other aspects of health for these groups, or that physical health measures used here do not account for other physical health problems.

Significant interactions between race and SES are found in this study through health problems and health insurance. Health problems are associated with more functional limitations, especially for Hispanic adults, and Black adults with employer insurance have fewer functional limitations. However, this study finds no evidence for racial differences in disability, and the cumulative advantage perspective is unsupported. This discussion now turns to the ways in which the cumulative disadvantage perspective may be supported through race.

Race

Race was expected to affect benefits to social integration and health care treatment. Social integration was expected to be associated with fewer functional limitations and higher odds of good self-reported health for all older adults. However, socially integrated Black, Hispanic, and other racial and ethnic minority group members were expected to differentially benefit from social integration and have fewer functional limitations and better self-reported health than their socially integrated White counterparts. The effects of social integration were expected to be cumulative over time.

Both types of health care treatment, doctor visits and hospital and nursing home stays, were expected to be associated with more functional limitations for Black and Hispanic adults compared to Whites and other racial and ethnic minority group members. These two types of treatment were expected to be associated with more functional limitations for Black and Hispanic adults over time and be associated with widening health disparities in advanced ages.

Thus, to further specify the relationship between race and health in old age, this study examined racial differences in benefits to social integration. Consistent with Bosworth and Schaie (1997), this current study shows that socially integrated older adults have better physical and self-reported health when compared to adults not as socially integrated. In contrast, this current study finds that relatives in the neighborhood have more functional limitations and worse self-reported health than their counterparts. This may be because worsening health is associated with a move to be nearer an adult child. However, this current study finds no racial or ethnic differences found in benefits to social integration, despite other research that links social integration to better health for minority group members. For example, Gibson and Jackson (1987) find that social integration has health benefits for minority group members. This current study may not have found these social integration benefits for minority group members because I could not examine the quality of social integration, only the proximity. Studies that examine the relationship between the quality of social integration, health, and minority group status within a CAD framework are needed.

This study also addresses the relationship between health care treatment and race. This finding supports Hannan, van Ryn, and Burke (1999), who also show that there are differential benefits to health care treatment by race. This current study finds that Black adults who visit the doctor have worse health than all other racial groups who visit the doctor. Schnittker, Pescosolido and Croghan (2005) find that Black and White adults have similar expectations to treatment, and it is not treatment expectations or differences in treatment seeking behaviors that are causing these racial differences. Preliminary regression analyses in this study support Schnittker, Pescosolido and Coghan's (2005) findings, showing that Black adults do not differ from White adults in doctor visits.

Benefits to hospital and nursing home treatments also differ by race. In this study, Black adults who have stayed in the hospital and nursing home overnight have significantly more functional limitations than all other racial groups who have stayed in the hospital and nursing home overnight, and the strength of this association is stronger for hospital and nursing home stays than for doctor visits. This may be because doctor visits indicate preventative treatments and check-ups, whereas hospital and nursing home treatments may indicate more serious conditions that require more extensive care. The effects of hospital and nursing home treatments accumulate over time and are associated with widening inequalities in advanced ages. This sample includes only non-institutionalized older adults, so the differential benefits to treatment by race found in this study may underestimate the widening health gap between Blacks and all other racial groups.

In sum, social integration hypotheses were not supported—with regard to race and the relationship between having a relative in the neighborhood and functional limitations. However, there are cumulative advantages associated with having a friend in the neighborhood over time. As expected, there were racial differences in benefits to treatment. However, cumulative disadvantage expectations go largely unsupported in that there were no specific racial differences in benefits to treatment over time. Though hospital and nursing home stays are associated with disadvantages over time and into advanced ages, these disadvantages are for everyone.

Sex

It was expected that sex would have an independent effect on health at age 65 and that the effects of sex on health would accumulate and widen over time. Women were expected to be disadvantaged in functional limitations and men were expected to be disadvantaged in the self-reported health model. It was also expected that there would be sex differences in health,

operating through health problems. Women were expected to have more health problems than men and this was expected to be associated with more functional limitations and poor self-reported health. In addition, it was expected that women's health problems would be associated with accumulating and widening health disadvantages over time and into advanced ages.

This study finds sex differences in functional limitations and self-reported health. As expected, women with health problems have more functional limitations than their male counterparts. In addition, women without health problems have more functional limitations than men and these accumulate over time. These findings support Read and Gorman's (2005) research showing that women have greater susceptibility to chronic conditions, negatively affecting women's ability to function.

As expected, self-reported health also differs by sex. Women are less likely than men to have poor self-reported health at age 65. This study's finding is consistent with research from Deeg and Kriegsman (2003) who show that men have worse self-reported health than women, despite women's higher incidence of functional limitations. Functional limitations and self-reported health models are examining different aspects of health. Men's high mortality rates are captured in health reports whereas women's higher instance of illness and disease are captured in functional limitations.

In sum, women have more functional limitations than men, but men have worse self-reported health than women. These findings are important because they point to the paradoxical nature of sex health differences. Research shows that women are more likely than men to have anemia, thyroid conditions, gall bladder conditions, migraines, arthritis, and eczema (National Center for Health Statistics 2003), and this study's functional limitations model captures these health differences between men and women. In contrast, men are more likely to suffer from life-

threatening acute conditions such as heart disease, cancer, cerebrovascular disease, emphysema, cirrhosis of the liver, kidney disease, and atherosclerosis (National Center for Health Statistics 2003), and this study's self-reported health model captures these health differences between men and women. Sex differences in this study support the cumulative advantage perspective; women's functional limitations accrue over time, adversely affecting their health.

Cumulative Advantage and Disadvantage

Using the cumulative advantage and disadvantage perspective, this study frames old age health inequalities as the result of isolated individual circumstances and an evolution and accumulation of collective circumstances and opportunities over time (O'Rand 1996). The cumulative advantage framework has mostly been used to show how cumulative advantages and disadvantages produce accumulating and widening inequalities through restricted opportunities to education, income, and wealth (Hatch 2005).

This study also demonstrates how race, ethnicity, and sex differentially structure health pathways. Though most CAD hypotheses related to race, ethnicity, and SES were not supported, clear cumulative disadvantages by sex were found. In this study, women begin old age with more functional limitations than their male counterparts, and this trend grows over time. This finding may support Mirowsky and Hu's (1996) research, which links women's higher incidence of health problems to women's lower income and wealth accumulations.

This current study also supports findings from O'Rand and Hamil-Luker (2005), showing how employer-provided insurance is associated with better health over time. In addition, this current study provides evidence for accumulating effects on health through health problems and for accumulating and widening effects on health through hospital and nursing home stays.

Other employer-provided insurance findings in this study are also encouraging, and provide areas for future research. Though race and ethnicity are not associated with accumulating advantages in employer-provided insurance over time, there are racial differences in benefits to employer-provided insurance. That is, Black adults with employer-provided insurance have fewer functional limitations. The use of future Health and Retirement Study waves may reveal accumulating advantages for Black adults through employer insurance. That is, longer study time periods may allow for more accumulation where racial and ethnic differences over time can be revealed. Of course, the use of more waves may also provide further evidence that there is no such accumulation of advantages for Black adults through employer-provided insurance.

Findings related to hospital and nursing home stays and health problems in functional limitations analyses are also encouraging. Though race and ethnicity were not associated with accumulating advantages or disadvantages in hospital and nursing home stays over time in this study, there are racial differences in each of these. Black adults with hospital and nursing home stays have more functional limitations than their counterparts, and women and Hispanic adults with health problems have more functional limitations. Again, the use of future Health and Retirement Study waves may reveal accumulating disadvantages for Black adults through hospital and nursing home stays, and accumulating disadvantages for women and Hispanic adults through health problems, and is worthy of exploration.

This study expected childhood health and childhood SES to be associated with accumulating and widening disadvantages over time, but these hypotheses were not supported. However, there is evidence that the effects of early disadvantages have a persistent effect on health in old age, supporting findings from O'Rand and Hami-Luker (2005). In this current study, respondents with good childhood health have fewer functional limitations than their counterparts

at age 65 and respondents with high childhood SES have fewer health problems than their counterparts. These findings also support Dannefer (2003) who discusses how the persistent effects of early disadvantages on old age health result from differential educational and social opportunities. Because early disadvantages occur early in the life course, the persistence of childhood health and childhood SES on old age health supports the underlying accumulation premise of the cumulative advantage and disadvantage perspective. Early disadvantages are the beginnings of a process of unfolding life course disadvantages that are likely to occur because of childhood hardships (Hatch 2005).

Health Pathways and Race, SES, and Sex: Conclusions

By focusing on old age health disparities and framing these within a cumulative advantage lens, this study speaks to some gaps in the health literature, further detailing social determinants of health, outlining future research needs, and providing implications for policy and intervention. These findings further the understanding of the relationship between social determinants and health by indicating how health pathways are structured by race and ethnicity, SES, and sex in old age.

In addition, this study addresses the SES and race old age health literatures. Though each perspective examines the relationship between race and SES, they disagree on the ways in which each shape health outcomes. The SES literature argues that the effects of race on health operate mainly through class mechanisms, whereas the race literature argues that there is an independent effect of race on health regardless of SES. This study supports each of these perspectives, but more clearly identifies with the race and health literature, finding persistent racial health inequalities in old age regardless of SES. Thus, the major contributions of this study are the cumulative advantage findings discussed above, and the independent effects of race and ethnicity

on functional limitations and self-reported health. Race and ethnicity negatively affect health through health care treatment and health problems, but positively affect health through employer-provided insurance. Racial and ethnic differences in treatment, health, and insurance, are apparent even after considerations of age, sex, SES, early disadvantage, other types of health insurance, social integration, and disability. Racial and ethnic health differences in old age in this study show that racial health disparities cannot be conceptualized entirely within an SES framework, which underestimates the persistent effects of race on health.

This study additionally contributes to the literature in three ways: it conceptualizes old age as a unique site through which continued exposure to life course disadvantages and accumulating inequalities can be examined; it accounts for individual and patterned change over time; and it conceptualizes health in two ways to better capture health differences and trace differential pathways to good and poor health by race, SES, and sex. This research evidences a continued need for and examination of race in the health literature that specifically focuses on locating health outcomes within a social context. That is, the historical representation of racial and ethnic categories reflects the creation of social and economic disadvantages that are consequential to health outcomes for Black and Hispanic adults, and these health outcomes cannot be explained entirely through SES mechanisms.

Socioeconomic Status. As Williams (2005) discusses, SES affects living conditions and structures health literally from birth. This study supports this research, showing how early disadvantages such as poor childhood health and low childhood SES continue to affect health in old age. As Hatch (2005) discusses, children whose families have more economic resources available to them are more likely than their counterparts to live in safe neighborhoods, eat nutritious food, have good health, and good health care. O'Rand's (2005) findings show how

some early disadvantages are mediated by future education, income, and wealth attainments, but not all. That is, O'Rand (2005) finds that childhood SES affects cardiovascular disease risk regardless of SES in old age. Hayward et al. (2000) also finds a relationship between childhood SES and other continuing health disadvantages in adulthood. This current study adds to this research by further showing the ways in which childhood SES affects health. That is, this current study shows that people with high childhood SES have fewer incidences of high blood pressure, diabetes, cancer and heart disease, and thus fewer functional limitations, in old age.

This study did not specifically examine the relationship between early disadvantages and race, previous research has shown that Black and Hispanic adults are more susceptible to early disadvantages than Whites are, Black and Hispanic adults are more likely than Whites to experience early disadvantage (Williams 2005). White families have more income and wealth than Black and Hispanic families (U.S. Bureau of the Census 1996a). Hence, the health consequences of early disadvantages may be more severe for minority group members than Whites, and some of the racial disadvantages in health may be operating through childhood factors. Future research could examine the relationship between race and early disadvantage over time within this context.

Though more research is needed to determine the ways in which interventions and policies could reduce the effects of early disadvantage on health, this research shows a relationship between early familial experiences of poverty and adult health. While addressing poverty would provide long-term population health benefits, this is not an easy task. An influx of well-paying jobs into disadvantaged communities could substantially reduce the burden of low SES for disadvantaged families.

Although there are programs that already target low-income, disadvantaged families, these programs have not done enough to address racial differences in early disadvantage. For example, Head Start, a program that begun in 1965, targets disadvantaged children of preschool age (Garces, Thomas, and Currie 2002). Head Start is designed to help disadvantaged children by providing a positive environment for learning at early ages. Head Start has been successful in increasing the likelihood that its recipients will graduate from high school and go on to college. However there are racial differences in these successes, with Blacks disadvantaged relative to Whites (Garces et al. 2002). Black children do not benefit as Whites do from such programs, though it is unclear why. Future studies that can address these racial differences in benefits to such programs would be beneficial in reducing racial differences in susceptibility to and consequences of early disadvantages. I recognize that there are other programs which also seek to mitigate the effects of poverty on children and families, such as the Special Supplemental Nutritional Program for Women, Infants, and Children (WIC). WIC has improved the health and quality of life of pregnant women and their children.

The findings from this current study also suggest that universal health care would be beneficial to disadvantaged families, reducing the effect of early disadvantages by increasing access to needed medical care. Targeting early disadvantages would also have long-term financial benefits, reducing health care costs for individuals, insurance companies, and entitlement programs.

Education, income, and wealth clearly effect health. Though the importance of education, income, and wealth on health have been widely documented (Benzeval and Judge 2001; Fiscella and Franks 2000), this study demonstrates that the effects of adult SES on health continue, regardless of other health pathways. The continuing relationship between health, income, and

wealth in old age is particularly disconcerting given the increasing income and wealth gap in the United States (Danziger and Gottschalk 1993). Increasing SES inequalities will negatively affect health outcomes, and SES may be responsible for future gaps in health between the advantaged and disadvantaged.

The direct effects of SES aside, SES also affects susceptibility to health problems and disability. High SES delays morbidity and mortality until later in life (Williams and Collins 1995). This study provides support for these SES-related health pathways through health problems. Health problems are associated with more functional limitations, and health problems and disability are associated with increased odds of poor self-reported health. Because SES is highly correlated with health problems, interventions and policies focusing on alleviating SES inequalities have three potential benefits: relieving some of the pain and suffering associated with illness and disease, reducing out-of-pocket health care costs for elderly adults, and reducing the costs of Medicare and Medicaid insurance.

Out-of-pocket health care costs are substantial. The annual out-of-pocket health care expenditure for older adults is around $300 billion, and projected to increase by 25% by 2030 (Center for Disease Control and Prevention 1999). Costs for old age insurance programs are high as well, and are projected to increase with the aging of Baby Boomers and increased life expectancy (Lewis 1998). While there are multiple ways to reduce health care costs, alleviating health problems would improve quality of life, increase the amount of income available to older adults, and decrease old age entitlement program costs.

In addition, universal health insurance coverage enabling more preventative care for underserved populations may help identify individual risks sooner and have an effect on overall population disease rates (Woolhandler and Himmelstein 1988). High prescription drug costs

have recently been targeted through an optional prescription drug benefit (Centers for Medicare and Medicaid Services 2005). By reducing costs of prescription drugs, this program could positively affect health through improved access to needed medications. Though the specific effects of this coverage on health remain to be seen, studies suggest that annual dollar limits or caps on prescriptions deter beneficiaries from using essential medications (Tseng et al. 2004).

Along these lines, SES affects ability to purchase health insurance (Porell and Miltiades 2001). Private insurance coverage is related to high SES (Hurd and McGarry 1997) as is employer-insurance, because employer-insurance is indicative of a good job (Zuvekas and Taliaferro 2003). Union members, white collar workers, and people making $15 an hour or more are more likely to have employer benefits than their counterparts (Bureau of Labor Statistics 2005). This study shows that these health insurance types continue to differentiate health pathways in old age and that having private and employer insurance is associated with fewer functional limitations. Though this study could not examine quality of care differences by insurance type, previous research has shown that there are differences. For example, Ross and Mirowsky (2000) show that poorer health among Medicare and Medicaid beneficiaries cannot be completely attributed to worse initial health and lower SES, and attribute these differences to public health insurance.

Rising costs may deter many adults from purchasing private insurance, reducing the number of adults who receive these insurance benefits. In addition, employer insurance is less likely to be offered today than in the past (Thorpe and Florence 1999), and when it is offered, it is expensive (Zuvekas and Taliaferro 2003). The health implications of costly insurance and less availability of employer insurance for older adults could be detrimental.

Race and Socioeconomic Status. Black adults may be most affected by declining trends in employer insurance. Blacks are less likely than Whites to have this type of insurance because of their lower educational attainment and benefits to education (Zuvekas and Taliaferro 2003). Therefore, Black adults with employer insurance are probably more advantaged in education and income than their Black counterparts. The current study suggests that an increase in well-paying jobs with benefits would greatly improve the health of the older adult population, and Black adults in particular. Local and federal encouragement of employer-based health insurance programs for workers would address health inequalities due to insurance type, making employer insurance more available to everyone. Incentives could take the form of tax breaks for employers, partial governmental sponsorship of plans, or mandatory employer health care coverage for all workers. Again, these recommendations would not easily be implemented. Health insurance is costly, and employers have not been willing to take on this burden on their own.

This current study shows that health problems differ by race and ethnicity, that Hispanics with health problems have more functional limitations than their counterparts. That is, high blood pressure, diabetes, cancer and heart disease affect Hispanic adults more than all other racial groups. This may be because Hispanic adults have more new health problems, and this is negatively affecting the health of Hispanic adults over time in this study. The findings from this current study corroborates work from Geronimus et al. (2000), who find higher morbidity rates among Hispanic adults relative to their White counterparts. The ways in which high blood pressure, diabetes, cancer and heart disease differentially affect functional limitations by race over time needs further research.

Race. This study shows that although Black and Hispanic adults with health problems have more functional limitations than all other racial groups, self-reported health is not as affected by health problems for Black and Hispanic adults. Racial differences in self-reported health may indicate that other aspects of health are being captured. For example, minority group members may be basing self-reported health on racism. There is no direct measure of racism in this study, though other studies have found a relationship between self-reported health and racism. For example, Bowen-Reid and Harrell (2002) discuss how racism affects the self-reported health of Black adults. They show that it is the persistent exposure to the chronic stress of racism that is related to poor self-reported health among Black adults. Other research has linked internalized racism to unfavorable self-evaluations (see Williams and Williams-Morris 2000, for a review of this argument). The relationship between racism and self-reported health is an important area to explore in future research, especially because self-reported health is highly correlated with mortality, especially for minority group members (Farmer and Ferraro 2005).

Examining other indicators of racial disadvantage reveal marked inequalities between Black and Hispanic adults relative to Whites and other racial and ethnic group members. There are significant differences in benefits of health care treatment by race. Black adults who visit the doctor or have a nursing home or hospital stay have more functional limitations than their Hispanic, White, or other racial and ethnic group member counterparts. These racial differences in benefits to treatment have several explanations. Schneider et al. (2002) has shown that Black and White patients are not treated the same by medical professionals. Also, Schnittker et al. (2005) finds that once minority group members begin treatment, the process is not the same for Black and White adults. Even after considerations of health insurance and disease severity, there are racial differences in the receipt of care for a broad range of medical conditions (Harris,

Andrews, and Elixhauser 1999) with Black adults less likely than Whites to receive all of the most commonly performed procedures (Williams and Collins 2001).

Medical professionals could be made more aware of these racial differences in treatment with training. In particular, medical professionals need to be better informed of the ways in which minority group members are treated differently than Whites in the medical system. Medical professionals should be better trained on how racism interferes with proper care for diseases and conditions, and how this detrimentally affects the health of minority group members in old age. It is unlikely that medical professionals will be granted race sensitivity training, given the recent cutbacks in Title VII funding (The American Geriatrics Society 2006). Cuts in Title VII, which fund geriatric training programs, have already been associated with a decrease in geriatric healthcare providers. Restoring Title VII geriatrics funds in the 2007 federal budget would positively affect the health of older adults, and with additional funding for training, racial disparities in health care treatment may also be reduced.

Sex. As shown in this study, women begin old age with more functional limitations than men. Women's poorer health in old age has been documented in the literature and attributed to their susceptibility to chronic versus acute conditions (Read and Gorman 2005). Chronic conditions are detrimental to health because they are long-term, incurable, can be painful, and often interrupt the ability to do everyday tasks. This study shows that women's health worsens over time. Though women have more health care needs and expenses, they have less income and wealth in old age than men due to a lifetime of inequalities in work histories, jobs, caregiving responsibilities, and pay (U.S. Department of Labor 1991; Beck, Horan, and Tolbert 1980; Blau and Kahn 1992). SES inequalities put women at a distinct disadvantage in old age and affect their ability to pay for needed health care.

The self-reported health findings in this study show that men are at a health disadvantage relative to their female counterparts. Sex differences in self-reported health are particularly important, as self-reported health is highly correlated with mortality, especially for men (Johnson and Wolinsky 1994). This finding can be explained through men's propensity to have acute and life-threatening versus chronic conditions, conditions that are more accurately captured through self-reports of health (Deeg and Kriegsman 2003). These sex differences in health by health measure underscore the complexity of health and the need for multiple health measures to capture variance in health over time.

Limitations

There are several limitations in this study. The social integration measures in this study are not ideal because the HRS is not designed to examine social support and relationships. Therefore, there may be differential racial benefits to social integration that this study could not effectively detect. More detailed measures of social integration may reveal these differences.

Also, this study also does not account for non-economic indicators of social class that may affect health. Future studies could focus on the effects of lifestyle, health knowledge, preventative and risky behaviors, and residence, for example. Studies focusing on area of residence and the implications of people's neighborhoods on their lifestyles and health behaviors may be able to show the ways in which residence is associated with differential health pathways through access to medical resources, transportation, and jobs. There are important racial differences in residence. Neighborhoods are highly segregated by race. Racial segregation may affect the health of Black and Hispanic adults by negatively altering or influencing their health behaviors. For example, Black adults are more likely to live in high crime neighborhoods which discourage healthy behaviors, such as exercise.

In addition, this study focused on social determinants of health, though pathways to good and poor health are likely shaped through other mechanisms as well. Studies that can link biological, psychological, or physiological health pathways to social health determinants are needed. These inter-disciplinary health models can better examine biological susceptibility to certain diseases and conditions, obesity, nutrition, anxiety, and depression for example, and may explain more health variance over time.

Like many health studies, this one did not control for attrition. It is unlikely that this affected the results of this study for several reasons. First, HLM reliably accounts for missing data over time in nested data (Raudenbush and Bryk 2002). Second, the HRS time-frame is relatively short and is not likely substantially affected by respondent attrition. Not controlling for attrition in this study provided greater statistical power in the HLM analyses. This is beneficial because sampling weights reduced the sample substantially.

Future Research

Most of the research recommendations resulting from this study's findings are made in the above discussion. However, it is worthy to note here a broader research agenda for future investigators of racial health disparities. First, race differentiates life course pathways. Although most of the ways in which race affects health in old age remains an area for future research, this current study shows that employer-provided insurance, health problems, and health care treatment are three ways in which race shapes health pathways.

Health care treatment, or doctor visits and hospital and nursing home stays, negatively affects the health of Black adults, providing evidence that Black patients are not treated similarly to other patients by medical professionals, or that Blacks have inferior medical care when compared to all other racial groups. It is notable that controlling for SES and other health-related

factors, such as health insurance and health problems, did not negate this effect. Although I suspect that differential treatment by medical professionals and segregation are at the root of some these treatment inequalities and resulting health differences by race, this study could not specifically address these.

In addition, cumulative disadvantages continue to accrue in old age, affecting elder adult health. This study found cumulative disadvantages associated with health care treatment and health problems. Women, compared to men, accrue disadvantages in functional limitations over time. This study had minimal statistical power to detect potential racial and ethnic differences in health care treatment and health problems over time. Future waves of the Health and Retirement Study may provide more insight into these accruing processes and be able to distinguish differences by race and ethnicity.

Due to the nature of HLM as a statistical technique, it was not possible to examine the relationship between childhood health and childhood SES and race and ethnicity over time in this study. This study does show that these early disadvantages are persistent contributors to health, affecting health into old age. The relationship between these early disadvantages and race on health over time may be important in future explanations of racial health disparities.

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