THE EFFECT OF LIFETIME SOCIOECONOMIC STATUS ON CARDIOVASCULAR HEALTH AMONG ADULTS 50-YEARS AND OLDER: FINDINGS FROM THE 2006-2012 HEALTH AND RETIREMENT STUDY

by

JOSEPH C. ALLEGRA

(Under the Direction of Toni Miles)

ABSTRACT

The relationship between wealth and health continues to have important implications for public health policy as well as for individual behavior. As a result, economists, sociologists, and epidemiologists, among other disciplines, persist in pursuing a plausible working model linking wealth and health. Previous research indicates that childhood socioeconomic status (SES) plays a significant role in late-life health outcomes, however the mechanism by which this effect occurs remains unclear. Four competing models have been developed to explain this association: the critical-period model, the accumulation of risks model, and the pathway model, and the social-mobility model.

Using data from the Health and Retirement Study, we conducted three observational investigations in order to 1) establish the prevalence of cardiovascular diseases (CVD) during the baseline year of 2006, 2) determine if social-mobility best explains the relationship between total net worth and incident CVD during the study period 2006-2012, and 3) provide an alternative hypothesis to the social-mobility model.

Key findings from our analyses showed an inverse association between total net worth quintiles and prevalent CVD. The odds of any CVD diagnosis were 32% and 38% less among respondents in the two highest quintiles compared to the bottom quintile. Respondents in the top quintile also had lower odds of CHF (OR=0.57; 0.40-0.81, p=0.002) and angina (OR=0.58; 0.43-0.79, p<0.0001). In terms of economic mobility, respondents born into affluence who subsequently fell to the lowest tertile of net worth still had 0.69 times the risk of incident CVD compared to lifetime economically poor respondents. Maintaining middle class status from childhood to adulthood yielded an incidence rate ratio of 0.53 (0.37-0.78, p = 0.001). In addition to social mobility, we investigated the critical-period model. Results from this analysis suggested an association between respondents who identified their childhood socioeconomic status as "about average" and incident CVD (RR=0.73; 0.57-0.93, p=0.01) compared to respondents who identified their childhood SES as "poor".

Our results add to a growing body of research concerning the timing of SES circumstance and its effect on health later in life. Accurate early-life SES information will be needed in order to determine the appropriate model driving this association.

INDEX WORDS: Cardiovascular disease, Net worth, Health and retirement study, Aging, Loss, Life cycle models, Comorbid conditions, Public health

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DEDICATION

To my father, who, while on a walk with his 11-year old son, told me follow my own path and to never stop learning.

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I could not have completed this journey by myself, and I owe my gratitude to many:

To my wife, Sara. Your unconditional love and support throughout this endeavor have been extraordinary, and I know that I would not have been able to accomplish this goal without you in my life.

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CHAPTER 1

INTRODUCTION

Overview

The relationship between wealth and health continues to have important implications for public health policy as well as for individual behavior. As a result, economists, sociologists, and epidemiologists, among other disciplines, persist in pursuing a plausible working model linking wealth and health. The consensus among all studies points to a positive association between higher socioeconomic status (SES), better health and longer life (1, 2). This positive and significant relationship occurs regardless of the operational definition of SES (i.e. as education, occupation, income, wealth or level of social integration), and whether health is an objective or subjective assessment (3). However, the direction of causality appears to change over time. SES is more likely to be a determinant of health in early life and a result of health during middle-to-late life (4).

The "American Dream", the idea that anyone can succeed regardless of the economic circumstances in which they were born, is an ethos in the United States. Paradoxically, it invokes a sense of freedom, but may conversely, be obstructive. An emerging body of evidence suggests that the current state of income inequality devalues hard work and accentuates the role of family background in determining the outcomes of future generations (5). Our limited understanding regarding the effect socioeconomic mobility has on the health of the wage earner represents an emerging issue in public health, public policy, estate planning and economics.

Purpose of the Study

Income inequality is a barrier to achieving good health, and transitions in economic status from childhood to adulthood has the potential to either protect against or increase the risk of disease later in life. The author conducted three observational studies in order to further understand the relationship between SES and cardiovascular disease (CVD), and determine which life-cycle model most sufficiently explains this quantifiable association. Specifically, how does the risk of CVD differ for someone who moves from the lowest economic tier to the highest economic tier compare to someone who remains in the lowest economic tier, *and* how does their profile compare to someone already in the economic tier into which they have risen. The extended, applied goal of this study adds to the growing socio-epidemiologic research on wealth and its effect on chronic disease development in an aging population.

The first observational study is a cross-sectional design comparing the prevalence of cardiovascular diseases among five different wealth classes during the baseline year of 2006. The study achieves two goals: it confirms results from previous studies, indicating that the association between SES and CVD is true, and it lays a foundation for exploring how the risk of CVD changes under dynamic SES conditions. The second study is a secondary time-to-event analysis estimating the effect economic mobility has on incident cases of CVD over the period 2006-2012. The author compares new diagnoses of CVD within tertiles of peak net worth and among five categories of economic mobility in an effort to conclude if the socioeconomic mobility model justifies the association between exposure and outcome. The third study tests the critical-period model as an alternative to the economic mobility model. This investigation is also longitudinal by design, and uses childhood economic status as the primary exposure. By using adult total net worth, economic mobility and childhood economic status as exposures of interest we can produce evidence for a specific life cycle model and determine if SES is an independent predictor of CVD.

Literature Review

Role of SES in onset heart disease

The seminal Framingham Heart Study established several risk factors for coronary heart disease (6). However, those factors: hypertension, diabetes, elevated cholesterol level, physical inactivity, and cigarette smoking, only account for half of the outcomes reported in the study (7). With 50% of coronary heart disease not attributable to those accepted risk factors, investigators turned their attention to other physiologic factors like obesity (8) and hemostasis (9, 10). Along with those physiologic factors, investigators also began to look at socioeconomic factors for potential associations with heart disease.

Several studies have examined coronary heart disease and SES when operationally defined as education. One of the earliest studies conducted by Hinkle et al. (11) demonstrated that education had a greater influence on risk of heart disease when compared to occupation. There was a 30% decrease in incident coronary heart disease among college men compared to non-college men. Moreover, the difference seen among managers and lower-level employees was largely attributable to education level. Three epidemiologic studies of middle-aged, employed, white men in Chicago showed an inverse relation between education and long-term risk of coronary heart disease, cardiovascular disease, and all-cause mortality (12). This relationship was also exhibited in the Systolic Hypertension in the Elderly Program pilot project, which prospectively followed 551 men and women over the age of 60 years. Results indicated that low education was a predictor of myocardial infarction or sudden death (13). Subjects with at least some college had a 66% decrease in risk of sudden death (RR=0.34; 95%CI 0.12-0.97), and a 59% decrease in risk of myocardial infarction (RR=0.41; 95%CI 0.19-0.85). In a study of 1,560 employed males in Ireland, those attaining higher levels of education had consistently lower levels of known coronary heart disease risk factors (smoking, diastolic blood pressure, weight, and plasma cholesterol level) as well as a lower level of coronary morbidity (14). However, not all studies demonstrated a protective effect of education on coronary events. The Quebec Cardiovascular Disease Study followed 4,576 disease free

Quebec men between the ages of 35 and 44 years over 11 years for first incidence of coronary events, and showed that education's protected effect was nullified by systolic blood pressure, diastolic blood pressure, cholesterol level, and smoking, and were related to incidence of first event. Furthermore, the investigators observed that those risk factors accounted for two thirds of the attributable risk of first coronary event (15).

Defined as occupation, SES works in a similar manner. The Evans County Georgia Heart Study followed 3,102 residents over seven years and found incident cases of coronary heart disease among non-farming white men were lowest among professionals and highest among laborers and unemployed workers (16). Meanwhile, the Whitehall Study of 17,530 civil servants aged 40 to 64 years in London, England demonstrated the age-adjusted prevalence of angina pectoris to be 53% higher for men in the lowest employment grade than for those in the top administrative grade (17).

Investigators in the Evans County Georgia Heart Study (16) were also able to explain why excess prevalence of coronary heart disease in the high-SES group was nearly the same as lower-SES groups (84 per 1000 in the highest group compared with 81 per 1000 in men of low SES). Postulating that the excess prevalence previously found in the high-SES group was a function of prior high incidence in this class, the investigators stratified by age (35 to 54 years and 55 years and older), and established that the incidence rates were higher among men of high SES and lower in men of lower SES. However, the opposite association occurred in the younger men; that is, men of high SES had lower incidence rates than men of low SES, which suggested an age-related SES crossover effect. In the Charleston Heart Study, a cohort of 101 black men of high SES were followed for 14 years. Those men had half the rate of acute myocardial infarction and coronary heart disease rates compared to other black men in the study who were almost entirely of lower SES (18).

Models of socioeconomic status and health

An essential determinant of population-level health is social class (19). Throughout the course of history, civilizations have observed an association between SES and morbidity and mortality (19-21). More income and wealth were associated with better health (22-24). A number of studies have suggested that inadequate living conditions in childhood and adolescence increase the risk of arteriosclerotic heart disease later in life. Forsdahl (25) first proposed in 1977, that great poverty in childhood and adolescence followed by prosperity is a risk factor for arteriosclerotic heart disease. In his study of subjects between the ages of 40 and 69 years, a significant positive correlation was found in age adjusted mortality from arteriosclerotic heart disease and infant mortality in the same cohort. His results suggested that poverty in childhood followed by affluence was a risk factor for arteriosclerotic heart disease. Forsdahl argued that onset of disease was a consequence of late life prosperity and supported this argument by showing that mortality rates for arteriosclerotic heart disease remained low in underdeveloped countries. A secondary analysis of 823 men in Eastern Finland and 888 men in Western Finland by Notkola et al. (26) tested the hypothesis that bad socioeconomic conditions in childhood increase the probability of coronary heart disease in adulthood, and found increases in the relative risks of coronary death, myocardial infarction, and ischemic heart disease occurred in those individuals born without land (a measure of SES) in east Finland. A prevalence study of the 2,679 Finnish men between the ages of 42 and 60 years examined the effect of economic conditions in childhood and ischemic heart disease. Their findings suggested an association between low SES in childhood and higher prevalence of ischemia during exercise when compared to the highest and middle tertiles of childhood SES (27).

Since economic circumstances can change over time, determining at which point of the life cycle to intervene becomes crucial. Much of the research has focused on whether early-life exposure influences health outcomes later in life (28-31). The results from these studies suggest four possible mechanisms by which early-life SES effects health outcomes in adulthood. Each model has implications for public health

and policy interventions based on timing. First, the critical-period model assumes that SES exerts its greatest influence on health outcomes during windows of time, most often, early childhood when the body goes through important developmental processes. Second, the cumulative risk model, emphasizes the additive and compounding effects of SES on health. Third, the trajectory model puts forward the idea that SES in childhood affects the trajectory of exposures (positively or negatively) in adulthood. That is, childhood SES indirectly affects health by influencing both health behaviors and SES achievement in adulthood. Finally, the social mobility model suggests that childhood exposures can be modified by SES in adulthood.

In the critical-period model, early childhood SES exerts continual and irreversible effects on health later in life. Support for this model includes studies showing early childhood environments as predictors of CVD, hemorrhagic stroke, and stomach cancer (32, 33). This model proposes exposure during this time period may induce biological level structural and function changes that are difficult to reverse, and thus affect disease risk later in life (30).

Competing with the critical-period model of the life course process are three alternative models. The cumulative risk model stresses that damage occurs through the accumulation of exposures to risk factors from childhood to adulthood (34,35). The trajectory model suggests that rather than distal negative exposures experienced in childhood, proximal exposure to disadvantage in adulthood have a direct and consequential effect on health. Evidence from previous research demonstrated that current SES is an important predictor of self-rated health and CVD mortality (36, 37). The final competing model is the social mobility model. In this model, movement across SES levels from childhood to adulthood has the potential to mitigate early life exposures and offset risk of disease. In recent years, studies demonstrated downward social mobility predicted poor health outcomes (38). However, a few studies suggest upward mobility can also adversely affect health: Marin et al. (39) found low early-life SES that

increased through childhood had an association with the highest blood pressure measurements in adolescence.

Advancing Knowledge

The results of these observational studies will generalizable for several reasons. First, the data sets used in the analyses are from a nationally representative sample of men and women in the United States. We frame general hypotheses regarding wealth within a set age range. The same hypotheses are testable in countries with a similar aging population. Second, aging and economic mobility are global issues affecting both developing and developed countries. With cross-national data, similar outcomes within different settings are a viable avenue of for additional research. Third, the scope of the data sets allows for broad inclusion criteria while limiting exclusion criteria within the study. These methods are transferable and applicable to other settings.

Furthermore, these studies address important public health questions related to income, assets, biomarkers of chronic health conditions, and healthcare use. Together, they will provide a novel and synergistic view of the effect income inequality and socioeconomic status has on the development of CVD. We hope to learn if achieving and/or maintaining wealth over time affects physical health, and whether or not wealth offsets potential damage done due to negative early-life economic circumstances. These studies may also inform health policy by demonstrating when during the life cycle, the most beneficial time is to intervene.

CHAPTER 2

SOCIOECONOMIC STATUS AND CARDIOVASCULAR DISEASE AMONG ADULTS 50-YEARS AND OLDER IN THE UNITED STATES: A CROSS-SECTIONAL STUDY [1]

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[1] Allegra, J.C. To be submitted to *Social Science & Medicine*

Abstract

This study investigates the prevalence of cardiovascular disease (CVD) among men and women ages 50 years and older in the United States who participated in the 2006 wave of the Health and Retirement Study. We used quintiles of net worth as the primary exposure. In addition to net worth quintiles, we also incorporated education as an alternative indicator of socioeconomic status (SES). Specific CVD, ascertained through self-report and physical measures were used as health indicators. Prevalence data suggests an inverse association between CVD and net worth quintile. Results of multiple logistic regression analyses indicated increases to net worth reduces the odds of diagnosis of stroke with accompanying heart disease after adjusting for demographic and health covariates. The fourth and top quintiles showed a reduction in the odds of any CVD diagnosis by 32% and 38% respectively. Respondents in the top quintile also had lower odds of congestive heart failure (OR=0.57; 0.40-0.81, p=0.002) and angina (OR=0.58; 0.43-0.79, p<0.0001). A diagnosis of hypertension has the strongest association with CVD, increasing the odds of developing any CVD (OR=2.25; 1.92-2.63, p<0.0001), and stroke with (OR=2.53; 1.99-3.21, p<0.0001) or without (OR=2.07; 1.32-3.25, p=0.002) comorbid heart disease. Conversely, physical activity was protective and showed a significant decrease in the odds for the same outcomes: any CVD (OR=0.42; 0.31-0.58, p<0.0001), stroke with heart disease (OR=0.45; 0.32-0.64, p<0.0001), and stroke without heart disease (OR=0.40; 0.21-0.76, p=0.005). These findings are important because it provides an opportunity to separate the variety of components that make up the intricate association between SES and health in an aging population. These results corroborate previous results regarding known predictors of CVD. Subsequent studies should investigate the mechanism by which SES affects CVD. It may be that respondents who have moved up in economic status benefit from the advantages net worth imbues on health, but may not escape the biological damage sustained during childhood.

Introduction

Studying the relationship between wealth and health is not a new research endeavor, but it continues to have important implications for public health policy as well as for individual behavior. As a result, economists, sociologists, and epidemiologists, among other disciplines, persist in pursuing a plausible working model linking wealth and health. A general finding among all studies shows a positive association between higher socioeconomic status (SES), better health and longer life (1, 2). This positive and significant relationship occurs regardless of the operational definition of SES (i.e. as education, occupation or occupational prestige, income, wealth or level of social integration), and whether health is an objective or subjective assessment (3). However, the direction of causality appears to change over time. SES is more likely to be a determinant of health in early life and a result of health during middle-to-late life (4).

An essential determinant of population-level health is social class (19). Throughout history, civilizations have demonstrated an association between socioeconomic status (SES) and morbidity and mortality (19-21). More income and wealth were associated with better health (22-24). Not surprisingly, the opposite is also true. Lower SES has been associated with an increase in risk of unhealthy life styles (40). Differences in SES have shown that not only do lower groups have less access to health care, but receive worse quality of care (41). Measured as education, employment, or money, SES represents a gradient in health. Moreover, although these gradients persist in both industrialized and non-industrialized locations; among both children and adults; for infectious and chronic diseases alike; and for physical as well as mental health, determining at which point of the life cycle to intervene remains unclear. The inverse association between SES and health is especially evident with cardiovascular diseases (42). SES also shows an inverse association with risk factors of CVD, including hypertension (43), smoking (44, 45), cholesterol level (46), and diabetes (47, 48). What is less evident, and more difficult to determine, is whether SES acts as an independent risk factor for CVD. This study investigates the prevalence of CVD

within net worth quintiles in a large population-based survey, and seeks to confirm results from studies showing an inverse relationship between economic status and cardiovascular health.

Background

At the dawn of the 20th century, the United States went through its epidemiologic transition. Mortality due to infectious disease declined with the discovery and use of vaccines, and improvements in personal hygiene and sanitation. Along with the decrease in infectious disease mortality came an increase heart disease and other degenerative (i.e. chronic) diseases. After World War II, the United States began to invest in specific aspects of health. In 1948, the U.S. government created the National Heart Institute (a division of the National Institute of Health). Immediately, the Framingham Heart Study was initiated, and demonstrated that hypertension, diabetes, elevated cholesterol level, physical inactivity, and cigarette smoking were risk factors for heart disease (6). Although subsequent studies have been able to replicate the findings from Framingham, those factors could only account for half of the reported outcomes (7).

With 50% of coronary heart disease not attributable to those accepted risk factors, investigators turned their attention to other physiologic factors like obesity (8) and hemostasis (9, 10). Along with physiologic factors, investigators began to look at socioeconomic factors for potential associations with heart disease.

Several studies have examined coronary heart disease and SES when operationally defined as education. One of the earliest studies conducted by Hinkle et al (11) demonstrated that education had a greater influence on risk of heart disease when compared to occupation. There was a 30% decrease in incident coronary heart disease among college men compared to non-college men. Moreover, the difference seen among managers and lower-level employees was largely attributable to education level. Three epidemiologic studies of middle-aged, employed, white men in Chicago showed an inverse relation

between education and long-term risk of coronary heart disease, cardiovascular disease, and all-cause mortality (12). This relationship was also exhibited in the Systolic Hypertension in the Elderly Program pilot project, which prospectively followed 551 men and women over the age of 60 years. Results indicated that low education was a predictor of myocardial infarction or sudden death (13). Subjects with at least some college had a 66% decrease in risk of sudden death (RR=0.34; 95%CI 0.12-0.97), and a 59% decrease in risk of myocardial infarction (RR=0.41; 95%CI 0.19-0.85). In a study of 1,560 employed males in Ireland, those attaining higher levels of education had consistently lower levels of known coronary heart disease risk factors (smoking, diastolic blood pressure, weight, and plasma cholesterol level) as well as a lower level of coronary morbidity (14). However, not all studies demonstrated a protective effect of education on coronary events. The Quebec Cardiovascular Disease Study followed 4,576 disease free Quebec men between the ages of 35 and 44 years over 11 years for first incidence of coronary events, and showed that not education, but rather systolic blood pressure, diastolic blood pressure, cholesterol level, and smoking, were related to incidence of first event. Furthermore, the investigators observed that those risk factors accounted for two thirds of the attributable risk of first coronary event (15).

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investigators stratified by age (35 to 54 years and 55 years and older), and established that the incidence rates were higher among men of high SES and lower in men of lower SES. However, the opposite association occurred in the younger men; that is, men of high SES had lower incidence rates than men of low SES, which suggested an age-related SES crossover effect. In the Charleston Heart Study, a cohort of 101 black men of high SES were followed for 14 years. Those men had half the rate of acute myocardial infarction and coronary heart disease rates compared to other black men in the study who were almost entirely of lower SES (18).

The breadth of data collected through the Health and Retirement Study has yielded over 1800 journal publications (49). However, few papers have examined the effect of net worth on cardiovascular disease. Most investigations focused specifically on stroke as the outcome and either education (50) or social support (51) as the primary exposure. One study investigated the effect of childhood social conditions on heart disease, diabetes, and stroke using marginal structural models (52). Our investigation adds to the understudied aspect of net worth (i.e. income plus assets) as an indicator of SES and its effect on CVD within a nationally representative sample of men and women in the United States over the age of 50 years.

Methods

Data source

This study used data from the 2006 wave of HRS. Since its inception in 1992, HRS has captured data on changes in the labor force as well as on the health transitions that individuals undergo toward the end of their working lives and into retirement (53). Every two years, the HRS surveys over 20,000 individuals with diverse economic conditions, racial and ethnic backgrounds, health, marital histories and family compositions, as well as other aspects of life (54). The overall response rate for each of the follow-up waves is higher than 80%. The HRS weighted sample is representative of all non-institutionalized individuals in the U.S. population in the age-eligible range. Sampling weights provided on all HRS data sets

compensate for the unequal probabilities of selection between core and oversample domains. Specifically, HRS oversamples Blacks, Hispanics, and residents of Florida. In this analysis, our sample (N=17,907) included non-institutionalized men and women over the age of 50 years in the United States, in order to summarize and analyze characteristics of mid-to-late-life participants of the 2006 HRS survey.

Outcome variables

Cardiovascular disease (CVD)

Heart disease was the leading cause of death among all men and women in the United States in 2006 (55, 56). During the same year, stroke was the third leading cause of death among all women (56), and ranked fifth among all men in the United States (55). Table 2.1 shows the breakdown of cardiovascular conditions within the study population. We measured CVD as both a general and specific diagnosis. A respondent who answered 'yes' to at least one of the HRS questions regarding a diagnosis of angina, congestive heart failure (CHF), heart condition, myocardial infarction (MI) or stroke, fell into the 'Any CVD' category. The outcome variable 'Any CVD' does not double count respondents who reported multiple cardiovascular diagnoses, rather it is the sum of all respondents who reported a CVD diagnosis. In HRS, the variable 'heart condition' refers to any diagnosis of "heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems". We also differentiated between a diagnosis of stroke exclusively and stroke with comorbid heart disease in order to capture respondents who gave yes answers to stroke and heart condition questions, but did not provide information for specific heart diseases.

Exposure variables

Net worth

Net worth represented the primary socioeconomic indicator in this analysis. We combined the respondents' economic information from several variables within HRS and then grouped them into quintiles of wealth. HRS regularly collects data regarding respondent income, savings, pension, as well as

a variety asset information. Specifically, HRS obtains data on net financial wealth, net housing wealth, pension wealth, and present value of social security benefits. Net financial wealth includes savings, investments, business assets, and non-residential real estate less outstanding debt not related to housing. The household wealth value is the sum of the main home value, net value of other real estate, net value of vehicles, net value of any farms or businesses, net value of stocks and other financial instruments, cash accounts, and the net value of other assets less outstanding mortgage principle and other debts. Total net worth was then defined as the combination of the respondents' net wealth, net household wealth, pension, and social security, less all reported debt. The resulting continuous variable was then divided into wealth quintiles of the purposes of analysis. The bottom quintile represents the study population whose total net worth was under $8,530.00, and included respondents reporting debt (i.e. negative net worth). The ceiling for the second quintile was $33,553.00, $94,172.00 for the third quintile, and $236,544.00 for the fourth quintile. The top quintile included those respondents whose net worth exceeded $236,544.00.

We chose total net worth as the surrogate measure for socioeconomic status over education or occupation for several reasons. HRS collects extensive and thorough information with regard to respondent income, housing, and asset classes. The number of questions asked (and answered) allowed for an accurate depiction of adult net worth and realistic quintile boundaries. Although education is often used as a measure of SES, it can be prone to birth cohort differences such that the perceived value of education may be inconsistent across age groups. Occupation as a measure of SES is difficult to use as a primary exposure in observational studies because of the large number of categories needed to define the occupation. Furthermore, while occupation can be seen as a characteristic of status, ranking occupation in terms of prestige is inherently subjective and not an appropriate measurement of exposure.

Covariates

Demographics characteristics

We defined age categorically: 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, and 85+ years. We also included gender and race (white, non-white) as demographic covariates. We measured education as the respondent's total number of years of completed education, and separated the variable into four categories (less than high school, high school degree, some/completed college, graduate degree). Despite the possibility of cohort effects, education is a useful as an SES exposure in social epidemiology and was kept as a covariate in the analysis. Many exposure variables within this field are prone to reverse causality, that is, the potential for the outcome (in this case, CVD) to affect the exposure (net worth). Education is unique in that it is less susceptible to reverse causality (compared to net worth or occupation) because it is fixed after young adulthood. Most people have completed their education before onset of chronic disease. Additionally, questions regarding education tend to have low non-response rates. Although it is possible to lose your job or wealth, you cannot lose your education.

Biomarkers

In 2006, HRS began collecting biological data in an effort to match biological factors with health and social data. In addition to the core interview process, a random sample of 50% of the respondents were selected for the Enhanced Face-to-Face Interview (EFTF) which included the collection of saliva and blood samples (biomarkers), anthropometric measurements, physical performance tests and a leave-behind questionnaire detailing psychosocial topics (57). Biomarkers refer to the general range of physiological, metabolic, biochemical, endocrine and genetic measures obtained from living organisms. For many of these measures, there is a normal range, and values outside of this range can serve as an indicator of disease or as an early sign of potential disease (57). HRS collected dried blood spots (DBS) for five biomarkers: total cholesterol (TC), high density lipoprotein (HDL); an indicator of lipid levels, glycosylated hemoglobin (HbA1c); an indicator of glycemic control over the previous 2-3 months, C-

reactive protein (CRP); a marker of inflammation, and Cystatin C; an indicator of kidney function. We used cut-off points for each biomarker based on the National Library of Medicine and the National Institute of Health (Appendix A). HRS also provides physical measure data on blood pressure, via three successful readings of diastolic and systolic pressures and body mass index (BMI) via weight and height measurements. Blood pressure cut points and BMI levels also came from the National Institute of Health.

Health/lifestyle covariates

We assessed hypertension through a combination of self-report and/or three successive blood pressure readings. We determined diabetic status through self-report and a HbA1c biomarker reading of ≥ 6.5%. We also included additional variables known to influence health: physical activity (any vs. none) and cigarette smoking status (never vs. quit vs. current). Health insurance status (insured vs. not insured) was also included as a covariate to and serves a proxy for access to care.

Statistical analysis

We analyzed quintiles of total net worth in relation to prevalent cases of CVD among men and women 50 years of age and older in the United States. Tables 2.1 shows the distribution of CVD and covariate frequencies across quintiles of net worth. Using the bottom quintile as the reference group, we implemented bivariate analyses to assess crude associations between each outcome of interest net worth quintile and potential confounders. Specifically, we looked at each covariate in the absence of the exposure and then in the absence of the outcome to determine whether it was a confounder, effect modifier, both, or neither. If the difference between the Mantel-Haenszel odds ratio and crude odds ratios were ≥ 10%, then the covariate was further considered for confounder candidacy. The Breslow-Day test for homogeneity was used to determine if a covariate was an effect modifier. We used Stata/SE 14 (College Station, TX) to produce prevalence data and multiple logistic regression models for each cardiovascular condition, adjusted for confounders, and estimated odds ratios with 95% confidence intervals and associated p-values. The Pearson chi square test was used over the Fisher's exact test and

likelihood ratio test for three reasons: 1) Fisher's exact test is best used for small sample sizes. The sample size in these cross sectional analyses is sufficiently large. 2) Pearson chi square test is appropriate for categorical data. 3) As sample size increases the test statistics for both Pearson and likelihood ratio converge (example from Table 2.1: Any CVD and bottom quintile Pearson chi2(1) = 44.9665, p= 0.000: likelihood-ratio chi2(1) = 43.5686, p=0.000).

All regression models in the analyses used the HRS household weights. The household weight allows for analyses of economic measures like income, assets, debts and housing use. Through the household weight, we can make inferences at the U.S. population level for households containing a not-initially-institutionalized adult born in the relevant birth cohort for that wave. Respondents received a non-zero weight if they were living, non-institutionalized, and born in an appropriate year. This methodology yield weight sums which correspond to the number of individuals in the U.S. population.

Results

Table 2.1 shows the characteristics of the 2006 HRS respondents over the age of 50 years. In this sample of 17,907 adults, 58.4% are women, and 73.3% of the sample is non-Hispanic white. Seventy-five percent of the sample has at least a high school education, and 54% occupy the two highest quintiles of net worth. Two-thirds of respondents were designated as overweight or obese, however 91.1% were reported that they are physically active. Nearly 30% of the sample reported being diagnosed with at least one cardiovascular disease diagnosis, and the most reported condition was angina (21.6%). The second and top quintiles accounted for over half of all CVD. It is important to note that angina, CHF and MI are not mutually exclusive, and it is possible for a respondent to have comorbid conditions related to CVD. Although not included in the analysis, 614 respondents had a sole diagnosis of angina, 305 respondents reported only a diagnosis of CHF, and 111 respondents reported MI as their only cardiovascular event.

The collection of biomarker data (Table 2.2) by HRS in 2006 occurred in a subpopulation of the biennial wave. Overall, respondents in this inaugural wave displayed favorable biomarker levels. A

majority of respondents had desirable total cholesterol level (51.5%) as well as normal levels HDL, or "good", cholesterol (47.0%). Hypertension was prevalent in 52.5% of the sample population, but diabetes afflicted only 20.5% of respondents. Hemoglobin A1c, a measure used to indicate management of diabetes, showed respondents had normal (57.4%) or controlled (30%) glycated hemoglobin levels. Respondents with measured C-reactive protein, a biomarker used to indicate inflammation, was elevated in only one-fifth of the population.

In order to demonstrate changes in CVD over a period of time in a sample population, it was important to survey the landscape and establish a foundation upon which to build. Nearly 30% of adults over the age of 50 years in the 2006 HRS wave reported a diagnosis of CVD. Table 2.3 illustrates the prevalence of general CVD as well as specific cardiovascular conditions by net worth quintiles. The prevalence data for CVD suggests an inverse association between CVD diagnoses and net worth. That is, the prevalence of disease decreases as net worth increases across quintiles. Of note, the second quintile of net worth saw a slight increase (+6 and +2 respectively per 1000 persons) in prevalence compared to the bottom quintile for any CVD and MI. Compared to the bottom quintile, the prevalence of stroke with an accompanying heart condition diagnosis decreases by 50.3% in the top quintile, and deceases by 54.8% for stroke without a diagnosis of a heart condition. All cardiovascular conditions decrease in prevalence by at least 24% at the top quintile. The Pearson chi-square p-values indicate that, which exception of MI, the differences observed between disease prevalence and net worth quintile are not due to chance.

The logistic regression analysis in Table 2.4 indicated the second quintile of net worth had a non-significant effect of the odds of all CVD diagnoses across all models. Similarly, total net worth did not have an effect on the odds of MI diagnosis in any model. Model I shows crude odds ratios and 95% confidence intervals. The third, fourth and top net worth quintiles showed a reduction in the odds for any CVD, stroke with and without a comorbid heart condition, and angina compared to the bottom quintile. The pattern of the association took the form of a dose-response. As total net worth increased, the odds those

diagnoses decreased. Of note, the top quintile (net worth >$236,555.00) reduced the odds of stroke without heart disease by 57% (OR=0.43; 0.34-0.55, p<0.0001). Model II adjusted for demographic characteristics as well as education. The third, fourth and top net worth quintiles again showed statistically significant odds ratios below 1 for any CVD, stroke with heart disease, and angina. After adjusting for age, sex, race, and education, the top quintile reduced the odds of stroke with heart disease by 60% (OR=0.40; 0.33-0.49, p<0.0001). Model III further adjusted for known risk factors of heart disease: hypertension, diabetes, BMI, total cholesterol and smoking status. Additionally, this model adjusted for physical activity and health insurance status. In this model, stroke with a comorbid heart condition kept the same statistically significant pattern seen in models I and II. The fourth and top quintiles continue to show a significant reduction in odds of any CVD diagnosis, but those odds ratios moved closer to 1 compared to model II. The odds of CHF diagnosis in the top quintile was 64% lower compared to the bottom quintile (OR=0.36; 0.18-0.74, p=0.006). Model IV represents the final models, and removed insignificant covariates by the process of backward step-wise elimination. After removing insignificant covariates, the third (OR=0.62; 0.42-0.92, p=0.02) fourth (OR=0.50; 0.34-0.75, p=0.001) and top quintiles (OR=0.38; 0.27-0.55, p<0.0001) of net worth displayed clear and significant reductions in the odds of a diagnosis of stroke with a comorbid heart condition.

Table 2.5 shows the odds ratios for selected covariates in relation to CVD outcomes. Respondents with a diagnosis of hypertension had at least twice the odds of having any CVD (OR=2.25; 1.92-2.63, p<0.0001), stroke with heart disease (OR=2.53; 1.99-3.21, p<0.0001), and stroke without heart disease (OR=2.07; 1.32-3.25, p=0.002). A diagnosis of diabetes also increases the odds of any CVD diagnosis (OR= 1.71; 1.43-2.03, p<0.0001), CHF (OR=1.79; 1.17-2.73, p=0.007), stroke with a heart disease diagnosis (OR=2.03; 1.62-2.55, p<0.0001), and MI (OR=1.70; 1.03-2.83, p=0.04). Respondents who identified as former smokers had a 25% and 55% increase in the odds of any CVD diagnosis and stroke with heart disease. Current smokers showed similar increases for the same diagnoses, but had over the twice the

odds of stroke without heart disease (OR= 2.36; 1.32-4.20, 0.004). Physical activity reduces the odds any CVD (OR=0.42; 0.31-0.58, p<0.0001), stroke with heart disease (OR=0.45; 0.32-0.64, p<0.0001), and stroke without heart disease (OR=0.40; 0.21-0.76, p=0.005). Compared to the normal range of total cholesterol (<200 mg/dL), borderline and high total cholesterol levels had a statistically significant decrease in the odds of any CVD diagnosis, stroke with heart disease, and MI.

Discussion

We designed this cross-sectional study to examine the prevalence of cardiovascular disease within quintiles of net worth among adults over the age of 50 years who participated in the 2006 Health and Retirement Study. Like previous studies, we found an inverse association between prevalent CVD and total net worth quintiles. Respondents in the top quintile of net worth (≥ $236,555.00) saw the largest decreases in prevalence of stroke both with and without an accompanying heart condition when compared to the bottom quintile (≤ $8,305.00). Likewise, we found an inverse association of the odds ratios and quintiles of net worth for any CVD diagnosis, stroke with an accompanying heart condition, and angina after adjusting for demographic characteristics. The same association held for any CVD and stroke with heart disease after adjusting for health indicators. However, we did not find an association between net worth and diagnosis of stroke without a comorbid heart condition or myocardial infarction, and statistically significant reduction in the odds ratios for CHF and angina occurred only in the top quintile of net worth. Our findings are consistent with other reports investigating SES and heart disease (17). Additionally, our results corroborate studies of known risk factors for heart disease (6). Respondents with hypertension and diabetes had increased odds of any CVD and stroke with a comorbid heart condition. Conversely, physical activity reduced the odds of any CVD and stroke diagnoses. In the absence of CVD, an inverse association was seen for diagnoses of hypertension and diabetes, and the odds ratios for physical activity increased as net worth increased (supplemental Table 1). These are consistent with studies investigating SES and known risk factors of heart disease (43, 47, 59). Perhaps the most interesting

finding is the decrease in the odds ratios for respondents with borderline to high total cholesterol. The calculation for total cholesterol is the sum of LDL, HDL, and 20% of the triglyceride level. It may be that disproportionately high HDL levels are masking the true effect of total blood cholesterol on CVD.

Certain limitations of this study need to be taken into account. Foremost, this was a cross-sectional study. As such, no causal inferences can be made regarding the association between net worth and CVD. The cross-sectional design also negates the effect of age versus cohort effects. A more expansive roster of co-variates could have been included in this study, however a post-estimation analysis for specification error indicated a non-significant squared linear predicted value for the final models. This suggests that relevant covariates were not omitted from the model. Preliminary analysis indicated interaction on several levels. However, because the primary exposure was a multi-level category, collinearity became an issue and made the incorporation of multiple interaction terms in the final model impossible.

Despite the limitations of this study design, the large number of respondents (N=17,907) allowed for precise estimations with narrow confidence intervals. We mitigated information bias through use of biomarker data as well as repeated physical measures. Likewise, the HRS designers' implementation of random-entry bracketing (i.e. a ranges of values rather than an absolute number) for questions regarding income and assets decreased the likelihood of selection bias and misclassification by eliciting responses from participants who might otherwise not have provided such information. In addition to proper model specification, we also tested how well our model fit using Hosmer and Lemeshow's goodness-of-fit test (computed as the Pearson chi-square from the contingency table of observed frequencies and expected frequencies). For example, the final model for Any CVD diagnosis yielded a Hosmer-Lemeshow p-value of 0.88, indicating a good-fit. Our results confirm associations found in previous studies, establishes a baseline for longitudinal analysis of data provided by HRS, and offered the possibility that SES defined as net worth may be an independent risk factor for certain cardiovascular diseases.

These results suggest conducting a longitudinal study in order to determine whether or not economic movement (from childhood to adulthood) is a predictor of incident CVD. Such an association would provide evidence for a particular life cycle model of wealth and health. In an aging society, the movement between economic divisions may be an important indicator of cardiovascular disease over time. Coupled with an expansive array of covariates, studies investigating SES life-cycle models and health will reveal the true association between SES and health and provide more evidence for SES as an independent risk factor of CVD.

Table 2.1 Characteristics of adults 50 years and older by quintile of net worth: 2006 Health and Retirement Study

Wealth Quintile*	**Bottom**	**2nd**	**3rd**	**4th**	**Top**
N = 17,907**	n (%)***	n (%)	n (%)	n (%)	n (%)
	2,031 (11.3)	3,211 (17.9)	2,995 (16.7)	3,076 (17.2)	6,594 (32.8)
Any CVD$^{\alpha}$ ****					
Yes	738 (13.8)	1,185 (22.1)	896 (16.7)	836 (15.6)	1,703 (31.8)
No	1,293 (10.3)	2,026 (16.1)	2,099 (16.7)	2,240 (17.8)	4,891 (39.0)
Specific CVD diagnosis$^{\alpha}$					
Angina	189 (16.4)	303 (26.2)	211 (18.3)	160 (13.8)	292 (25.6)
CHF	119 (16.8)	183 (25.9)	131 (18.5)	107 (15.1)	167 (23.6)
MI	55 (14.6)	93 (24.7)	56 (14.9)	67 (17.8)	105 (27.9)
Stroke w/ heart condition	339 (16.2)	532 (25.5)	357 (17.1)	309 (14.8)	549 (26.3)
Stroke w/o heart condition	126 (18.2)	180 (26.0)	105 (15.1)	100 (14.4)	182 (26.3)
BMI$^{\alpha}$					
Low	133 (29.0)	118 (25.7)	59 (12.8)	55 (12.0)	94 (20.5)
Normal	565 (10.4)	919 (17.0)	761 (14.0)	901 (16.6)	2,272 (41.9)
Overweight	612 (9.2)	1,086 (16.3)	1,186 (17.8)	1,132 (17.0)	2,659 (39.8)
Obese	653 (12.8)	1,038 (20.4)	944 (18.5)	949 (18.6)	1,505 (29.6)
Missing	68 (25.6)	50 (18.8)	45 (16.9)	39 (14.7)	64 (24.1)
Cigarette smoking$^{\alpha}$					
Current	882 (11.5)	1,362 (17.7)	1,201 (15.6)	1,254 (16.3)	2,995 (38.9)
Ever	776 (10.1)	1,271 (16.5)	1,271 (16.5)	1,344 (17.5)	3,026 (39.4)
Never	349 (14.8)	547 (23.2)	496 (21.0)	440 (18.7)	525 (22.3)
Missing	24 (14.3)	31 (18.4)	27 (16.1)	38 (22.6)	48 (28.6)
Physical activity$^{\alpha}$					
Any	1,618 (9.9)	2,757 (16.9)	2,772 (17.0)	2,885 (17.7)	6,277 (38.5)
None	411 (25.8)	451 (28.3)	222 (13.5)	191 (12.0)	316 (19.9)
Missing	2 (28.6)	3 (42.9)	1 (14.3)	0 (0)	1 (14.3)
Health insurance$^{\alpha}$					
Any	1,802 (10.8)	2,916 (17.5)	2,714 (16.3)	2,915 (17.5)	6,304 (37.9)
None	229 (18.2)	295 (23.5)	281 (22.4)	161 (12.8)	290 (23.1)
Education level$^{\alpha}$					
< High school	1,083 (24.6)	1,447 (32.9)	799 (18.2)	495 (11.3)	570 (13.0)
High school	544 (9.0)	1,075 (17.9)	1,205 (20.0)	1,194 (19.8)	1,996 (33.2)
Some/completed college	322 (5.8)	580 (10.5)	829 (15.0)	1,081 (19.5)	2,731 (49.3)
Graduate school	82 (4.2)	109 (5.6)	162 (8.3)	306 (15.6)	1,297 (66.3)
Job prestige$^{\alpha}$					
High (6-10)	333 (6.3)	583 (11.1)	797 (15.0)	941 (17.8)	2,618 (49.7)
Low (1-5)	280 (16.8)	446 (26.8)	368 (22.1)	290 (17.4)	281 (16.9)
Missing	1,418 (12.9)	2,182 (19.9)	1,830 (16.7)	1,845 (16.8)	3,695 (33.7)

Sex[α]					
Male	595 (8.0)	1,141 (15.3)	1,261 (16.9)	1,357 (18.2)	3,105 (41.6)
Female	1,436 (13.7)	2,070 (19.8)	1,734 (16.6)	1,719 (16.4)	3,489 (33.4)
Race[α†]					
White	819 (6.3)	1,799 (13.7)	2,095 (16.0)	2,466 (18.8)	5,914 (45.2)
Non-white	1,206 (25.3)	1,401 (29.4)	892 (18.7)	605 (12.7)	667 (14.0)
Missing	6 (13.9)	11 (25.6)	8 (18.6)	5 (11.6)	13 (30.2)
Age (years) [α]					
50-54	163 (9.9)	215 (13.1)	332 (20.2)	354 (21.5)	583 (35.4)
55-59	246 (9.7)	329 (13.0)	446 (18.4)	532 (21.0)	961 (37.9)
60-64	205 (8.6)	316 (13.3)	431 (18.1)	423 (17.8)	1,000 (42.1)
65-69	350 (10.2)	628 (18.3)	582 (16.9)	588 (17.1)	1,286 (37.4)
70-74	333 (11.7)	568 (20.0)	464 (16.3)	422 (14.8)	1,059 (37.2)
75-79	207 (10.3)	438 (21.8)	311 (15.5)	296 (14.7)	760 (37.8)
80-84	216 (13.9)	333 (21.5)	205 (13.2)	244 (15.7)	553 (35.6)
85+	311 (20.6)	384 (25.5)	204 (13.5)	217 (14.4)	392 (6.0)

* Quintile cutoffs: Bottom ≤ $8,305.00, 2nd ≤ $33,553.00, 3rd ≤ $94,172.00, 4th ≤ $236,554.00, Top ≥ $236,555.00.

**Based on responses to diagnoses of cardiovascular disease and income/assets.

*** Percentages based on row totals

****Any cardiovascular disease= a yes response to a diagnosis of angina, CHF, MI, stroke or heart condition. Specific cardiovascular diagnoses calculated by yes response to the respective condition. Stroke without heart condition is a yes response to stroke diagnosis and a non-yes response to all other heart conditions. Stroke with heart condition is a yes response to stroke diagnosis and a yes response to any other heart related diagnosis.

α = Pearson's chi square p-value < 0.0001; † non-white aggregates African-American, Hispanic, Native American, and pacific islander Abbreviations: BMI= body mass index calculated from self-reported height and weight; Low: <18.5 kg/m^2, Normal: 18.5 kg/m^2 – 24.9 kg/m^2, Overweight: 25 kg/m^2- 29 kg/m^2, Obese: ≥30 kg/m^2. CHF= congestive heart failure; MI= myocardial infarction; Physical activity = any response other than "hardly or never" to questions: How often vigorous activity? How often moderate activity? How often mild activity? Response of "hardly or never" to all 3 questions=none; Occupational prestige=self- reported 1-10 scale where 10 is most important/prestigious.

Table 2.2 Biomarker Characteristics* of adults 50 years and older in the 2006 Health and Retirement Study

Wealth Quintile**	**Bottom**	**2nd**	**3rd**	**4th**	**Top**
	n (%)***	n (%)	n (%)	n (%)	n (%)
	2,031 (11.3)	3,211 (17.9)	2,995 (16.7)	3,076 (17.2)	6,594 (32.8)
Total Cholesterol (n=5,993) α					
Desirable (<200 mg/dL)	285 (9.2)	492 (15.9)	504 (16.3)	553 (17.9)	1,250 (40.5)
Borderline (200-239 mg/dL)	150 (8.4)	261 (14.6)	295 (16.5)	330 (18.4)	755 (42.2)
High Risk (>240 mg/dL)	96 (8.6)	163 (14.6)	202 (18.1)	195 (17.4)	462 (41.3)
Missing	1,500 (12.6)	2,295 (19.3)	1,994 (16.7)	1,998 (16.8)	4,127 (34.6)
HDL Level (n=4,873) α					
Protective (≥60 mg/dL)	143 (8.8)	212 (13.0)	250 (15.3)	294 (18.0)	733 (44.9)
Normal (40-59 mg/dL)	203 (8.9)	364 (15.9)	390 (17.0)	403 (17.6)	930 (40.6)
Risk Factor (<40 mg/dL)	88 (9.2)	154 (16.2)	172 (18.1)	169 (17.8)	368 (38.7)
Missing	1,597 (12.2)	2,481 (19.0)	2,183 (16.7)	2,210 (17.0)	4,563 (35.0)
Hypertension α					
Yes	1,251 (13.3)	1,886 (20.1)	1,608 (17.1)	1,582 (16.8)	3,072 (32.7)
No	776 (9.1)	1,319 (15.5)	1,385 (16.3)	1,494 (17.6)	3,516 (41.4)
Missing	4 (22.2)	6 (33.3)	2 (11.1)	0 (0)	6 (33.3)
Blood pressure (mmHg) α					
Normal (<120/<80)	172 (8.8)	262 (13.4)	319 (16.3)	356 (18.2)	848 (43.3)
Pre-hypertension (≤139/≤89)	79 (7.9)	128 (12.9)	168 (16.9)	191 (19.2)	428 (43.1)
Hypertension (≥140/≥90)	90 (12.6)	128 (17.9)	127 (17.8)	117 (16.4)	252 (35.3)
Missing	1,690 (11.9)	2,693 (18.9)	2,381 (16.7)	2,412 (16.9)	5,066 (35.6)
Diabetes α					
Yes	597 (16.2)	855 (23.4)	683 (18.6)	602 (16.4)	939 (25.5)
No	1,433 (10.1)	2,353 (16.5)	2,310 (16.2)	2,471 (17.4)	5,652 (39.7)
Missing	1 (8.3)	3 (25.0)	2 (16.7)	3 (25.0)	3 (25.0)
HbA1c (%) (n=6,303) α					
Normal (4.5-6.0)	254 (7.0)	451 (12.5)	571 (15.8)	645 (17.8)	1,699 (46.9)
Controlled (6.1-7.9)	200 (10.6)	339 (18.0)	336 (17.8)	327 (17.4)	682 (36.2)
Diabetic (≥ 8)	121 (15.1)	182 (22.8)	137 (17.1)	154 (19.3)	205 (25.7)
Missing	1,456 (12.5)	2,239 (19.3)	1,951 (16.8)	1,950 (16.8)	4,008 (34.5)
C reactive protein (n=5,665) α					
Low (<1 mg/dL)	162 (6.3)	346 (13.5)	391 (15.2)	446 (17.4)	1,220 (47.6)
Moderate (1-3 mg/dL)	191 (9.8)	307 (15.8)	332 (17.1)	349 (18.0)	764 (39.3)
High (>3 mg/dL)	152 (13.1)	225 (19.4)	214 (18.5)	213 (18.4)	353 (30.5)
Missing	1,562 (12.5)	2,333 (19.1)	2,058 (16.8)	2,068 (16.9)	4,257 (34.8)

*50% random sample of the 2006 HRS wave.

** Quintile cutoffs: Bottom ≤ $8,305.00, 2nd ≤ $33,553.00, 3rd ≤ $94,172.00, 4th ≤ $236,554.00, Top ≥ $236,555.00.

*** Percentages based on row totals ; α = Pearson's chi square p-value < 0.0001

HDL: High density lipoprotein; Hypertension assessed through self-report and three successive blood pressure readings. Blood pressure cut points based on values set forth by the American Heart Association. Diabetes assessed

through self-report and HbA1c biomarker reading of ≥ 6.5% HA1c: hemoglobin A1c. Note: All biomarker values are adjusted to meet standards set by the National Health and Nutrition and Examination Survey (NHANES). Biomarker cut offs provided by the Nation Library of Medicine and the National Institute of Health

Table 2.3 Prevalence of cardiovascular disease per 1000 persons in the 2006 HRS wave by net worth quintile

Net worth quintile (N=17,907)	Bottom (N=2,031)	2nd (N=3,211)	3rd (N=2,995)	4th (N=3,076)	Top (N=6,594)	p-value
Any CVD	363	369	279	271	258	<0.0001
Stroke with HC	167	166	119	100	83	<0.0001
Stroke without HC	62	56	35	32	28	<0.0001
CHF	218	203	181	165	121	<0.0001
MI	100	102	78	103	76	0.07
Angina	345	335	291	246	212	<0.0001

Quintile cutoffs: Bottom ≤ $8,305.00, 2nd ≤ $33,553.00, 3rd ≤ $94,172.00, 4th ≤ $236,554.00, Top ≥ $236,555.00. All prevalence statistics use corresponding quintile value as the denominator. Abbreviations: CHF= congestive heart failure; MI=myocardial infarction; CVD=cardiovascular disease; HC=heart condition. Prevalence rounded to the nearest whole number. P-value based on the Pearson chi-square.

Table 2.4 Household weighted odds ratios and (95% confidence intervals) of cardiovascular diseases by quintiles of net worth among adults 50 years and older in the 2006 HRS cohort

	Any CVD	Stroke w/ HD	Stroke w/o HD	CHF	Angina	MI
Model I*						
Bottom	1.00	1.00	1.00	1.00	1.00	1.00
Second	1.02 (0.91, 1.15)	0.99 (0.85, 1.15)	0.90 (0.71, 1.14)	0.91 (0.70, 1.19)	0.96 (0.76, 1.20)	1.03 (0.72, 1.49)
Third	**0.75 (0.66, 0.84)**	**0.67 (0.57, 0.80)**	**0.55 (0.42, 0.72)**	0.79 (0.59, 1.05)	**0.78 (0.61, 0.99)**	0.76 (0.50, 1.14)
Fourth	**0.65 (0.58, 0.74)**	**0.56 (0.47, 0.66)**	**0.51 (0.38, 0.67)**	**0.70 (0.52, 0.95)**	**0.62 (0.48, 0.80)**	1.04 (0.70, 1.54)
Top	**0.61 (0.55, 0.68)**	**0.45 (0.39, 0.52)**	**0.43 (0.34, 0.55)**	**0.49 (0.38, 0.65)**	**0.51 (0.41, 0.64)**	0.74 (0.52, 1.07)
Model II**						
Bottom	1.00	1.00	1.00	1.00	1.00	1.00
Second	0.95 (0.81, 1.11)	0.90 (0.74, 1.10)	1.04 (0.76, 1.43)	0.91 (0.64, 1.29)	0.87 (0.65, 1.15)	1.14 (0.74, 1.75)
Third	**0.72 (0.62, 0.85)**	**0.64 (0.52, 0.79)**	**0.63 (0.44, 0.90)**	0.76 (0.52, 1.12)	**0.71 (0.52, 0.98)**	0.87 (0.53, 1.41)
Fourth	**0.63 (0.53, 0.74)**	**0.50 (0.40, 0.62)**	0.77 (0.53, 1.12)	**0.63 (0.42, 0.93)**	**0.55 (0.39, 0.77)**	1.17 (0.73, 1.87)
Top	**0.56 (0.48, 0.65)**	**0.40 (0.33, 0.49)**	**0.62 (0.44, 0.87)**	**0.44 (0.30, 0.65)**	**0.53 (0.39, 0.72)**	0.94 (0.59, 1.48)
Model III***						
Bottom	1.00	1.00	1.00	1.00	1.00	1.00
Second	0.90 (0.67, 1.22)	0.82 (0.56, 1.20)	1.24 (0.63, 2.42)	0.62 (0.31, 1.21)	0.74 (0.44, 1.24)	1.24 (0.59, 2.60)
Third	0.85 (0.62, 1.17)	**0.64 (0.43, 0.96)**	0.69 (0.33, 1.44)	**0.48 (0.24, 0.99)**	0.63 (0.36, 1.09)	0.76 (0.34, 1.69)
Fourth	**0.70 (0.51, 0.96)**	**0.51 (0.33, 0.78)**	1.28 (0.60, 2.71)	0.50 (0.23, 1.08)	0.57 (0.32, 1.04)	0.70 (0.30, 1.62)
Top	**0.63 (0.47, 0.85)**	**0.39 (0.26, 0.57)**	0.91 (0.44, 1.86)	**0.36 (0.18, 0.74)**	**0.55 (0.32, 0.96)**	0.61 (0.26, 1.41)
Model IV****						
Bottom	1.00	1.00	1.00	1.00	1.00	1.00
Second	0.88 (0.65, 1.19)	0.80 (0.80, 1.16)	1.08 (0.79, 1.48)	1.04 (0.73, 1.47)	0.91 (0.68, 1.20)	1.22 (0.59, 2.54)
Third	0.82 (0.60, 1.12)	**0.62 (0.42, 0.92)**	**0.69 (0.49, 0.97)**	0.92 (0.63, 1.33)	0.75 (0.55, 1.02)	0.80 (0.37, 1.73)
Fourth	**0.68 (0.50, 0.93)**	**0.50 (0.34, 0.75)**	0.84 (0.59, 1.18)	0.75 (0.51, 1.10)	**0.59 (0.43, 0.82)**	0.80 (0.36, 1.74)
Top	**0.62 (0.47, 0.83)**	**0.38 (0.27, 0.55)**	**0.68 (0.50, 0.92)**	**0.57 (0.40, 0.81)**	**0.58 (0.43, 0.79)**	0.60 (0.28, 1.30)

* Crude measure of association. ** Model adjusted for age (<64 years vs. ≥ 65 years), sex, race (white vs. non-white), and education; *** Model adjusted for hypertension, diabetes, smoking status, BMI, total cholesterol, physical activity, and insurance status; ****Final model, using step-wise backward elimination. Quintile cutoffs: Bottom ≤ \$8,305.00, 2nd ≤ \$33,553.00, 3rd ≤ \$94,172.00, 4th ≤ \$236,554.00, Top ≥ \$236,555.00. Bold values indicate significant (p<0.05) confidence intervals.

Table 2.5 Household weighted odds ratios and (95% confidence intervals) of other covariates in relation to CVD outcomes among adults 50 years and older in the 2006 HRS cohort

	Any CVD	Stroke w/ HD	Stroke w/o HD	CHF	Angina	MI
Age (<64 years vs. ≥65 years)	**1.87 (1.58, 2.21)**	1.64 (1.27, 2.11)	1.12 (0.74, 1.71)	1.44 (0.90, 2.32)	**0.55 (0.38, 0.79)**	0.74 (0.43, 1.30)
Sex (female vs. male)	**1.24 (1.06, 1.45)**	1.20 (0.95, 1.51)	1.21 (0.79, 1.85)	1.03 (0.69, 1.54)	0.76 (0.55, 1.05)	1.24 (0.76, 2.01)
Race (white vs. non-white)	**0.69 (0.56, 0.85)**	0.62 (0.47, 0.81)	1.14 (0.72, 1.82)	0.99 (0.58, 1.68)	0.74 (0.49, 1.11)	0.65 (0.37, 1.16)
Education						
High school	0.85 (0.69, 1.05)	0.77 (0.58, 1.01)	0.73 (0.40, 1.32)	1.51 (0.92, 2.48)	0.75 (0.51, 1.12)	0.86 (0.51, 1.46)
College	0.96 (0.77, 1.21)	0.85 (0.62, 1.16)	0.89 (0.48, 1.66)	1.37 (0.79, 2.36)	0.74 (0.48, 1.13)	**0.41 (0.21, 0.81)**
Graduate school	0.77 (0.57, 1.03)	0.86 (0.55, 1.35)	**0.27 (0.10, 0.72)**	2.10 (0.95, 4.61)	0.71 (0.37, 1.34)	0.70 (0.29, 1.67)
Hypertension	**2.25 (1.92, 2.63)**	**2.53 (1.99, 3.21)**	**2.07 (1.32, 3.25)**	1.28 (0.84, 1.96)	1.27 (0.89, 1.81)	1.07 (0.64, 1.80)
Diabetes	**1.71 (1.43, 2.03)**	**2.03 (1.62, 2.55)**	1.38 (0.87, 2.19)	**1.79 (1.17, 2.73)**	1.14 (0.81, 1.59)	**1.70 (1.02, 2.83)**
Total cholesterol						
Borderline	**0.68 (0.58, 0.81)**	**0.57 (0.44, 0.74)**	1.04 (0.66, 1.63)	0.79 (0.49, 1.27)	0.79 (0.54, 1.15)	**0.45 (0.24, 0.83)**
Risk factor	**0.58 (0.46, 0.71)**	**0.59 (0.42, 0.82)**	0.95 (0.55, 1.65)	1.04 (0.59, 1.87)	1.04 (0.66, 1.63)	**0.41 (0.17, 0.96)**
BMI						
Normal	1.30 (0.69, 2.47)	1.38 (0.71, 2.69)	0.38 (0.11, 1.34)	**0.23 (0.08, 0.61)**	0.59 (0.22, 1.59)	0.69 (0.20, 2.34)
Overweight	1.16 (0.62, 2.19)	1.02 (0.53, 1.98)	0.59 (0.17, 2.10)	**0.15 (0.06, 0.41)**	0.58 (0.21, 1.55)	0.44 (0.13 1.52)
Obese	1.00 (0.53, 1.90)	1.11 (0.57, 2.24)	0.34 (0.10, 1.24)	**0.24 (0.09, 0.64)**	0.75 (0.27, 2.04)	0.43 (0.13, 1.51)
Smoking						
Ever	**1.25 (1.06, 1.46)**	**1.55 (1.22, 1.97)**	1.31 (0.83, 2.06)	1.48 (0.97, 2.25)	1.17 (0.84, 1.65)	1.12 (0.66, 1.88)
Current	**1.41 (1.10, 1.80)**	**1.42 (1.01, 1.99)**	**2.36 (1.32, 4.20)**	1.62 (0.85, 3.10)	1.38 (0.83, 2.30)	1.42 (0.71, 2.88)
Physical activity	**0.42 (0.31, 0.58)**	**0.45 (0.32, 0.64)**	**0.40 (0.21, 0.76)**	0.72 (0.40, 1.31)	0.64 (0.39, 1.04)	0.66 (0.35, 1.26)
Health insurance	1.11 (0.80, 1.56)	1.21 (0.69, 2.11)	0.72 (0.36, 1.43)	0.91 (0.30, 2.79)	1.07 (0.48, 2.43)	1.93 (0.49, 7.69)

Physical activity: none vs any; health insurance: none vs any. Estimates were derived from logistic regression using Any cardiovascular disease (CVD), angina, congestive heart failure (CHF), myocardial infarction (MI), stroke with a diagnosis of heart disease (w/HD) and stroke without a diagnosis of heart disease (w/o HD) as dependent variables. Bold values indicate significant ($p<0.05$) confidence intervals.

CHAPTER 3

SOCIOECONOMIC MOBILITY AND ITS EFFECT ON INCIDENT CARDIOVASCULAR DISEASE: A LONGITUDINAL ANALYSIS OF THE HEALTH AND RETIREMENT STUDY 2006-2012 [1]

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[1] Allegra, J.C. To be submitted to *Social Science & Medicine*

Abstract

This longitudinal study investigates the time to event for incident cardiovascular disease within peak net worth tertiles as well as economic mobility among men and women ages 50 years and older in the United States who participated in the 2006-2012 waves of the Health and Retirement Study (HRS). Peak net worth remained significant through each model iteration. Compared to the bottom tertile, the middle and top tertiles of peak net worth affords the same amount of protection after controlling for demographic and health characteristics. Both tertiles had 0.72 times the rate of incident CVD compared to the bottom tertile (top tertile IRR = 0.72; 0.65-0.81, p<0.0001, middle tertile IRR = 0.72; 0.64-0.81, p<0.0001). Being older (IRR=1.31; 1.17-1.45, p<0.0001), being male (IRR=1.17; 1.07- 1.28, p=0.001), and being hypertensive increased the risk of CVD diagnosis. Although greater incidence rates occurred among respondents with uncontrolled hypertension (IRR=3.05; 2.38-3.91, p<0.0001), respondents with controlled hypertension still had a 1.68 times the rate of incident CVD diagnoses compared to normotensives. Cardiovascular disease incident rate ratios within the middle-middle (IRR = 0.53; 0.37-0.78, p=0.001) and high-low (IRR = 0.69; 0.49-0.98, p=0.04) economic mobility groups were statistically significant in the final model. Current smokers were 1.75 times more likely to be diagnosed with CVD, and respondents with a difference in weight of more than 5% had 1.70 times rate of CVD incidence. These findings are in direct contrast to the expected results under the social mobility model. This may indicate that the critical period model is better equipped to explain the effect of SES on CVD. Subsequent studies should investigate the relationship between childhood SES independent from current adult SES.

Introduction

The link between socioeconomic conditions and cardiovascular disease has been well documented (42), and investigators have consistently shown that persons of low socioeconomic status (SES) incur higher rates of morbidity and mortality compared those of higher SES (22, 23, 60). Unlike many risk factors of cardiovascular disease (CVD), economic status can be determinant of health in early life and a result of health during middle-to-late life (4). Because of this dichotomy, there has been a growing body of work surrounding a life-course perspective of SES. Much of the research has focused on the influence of early-life exposures on health outcomes later in life (28, 29). The results from these studies suggest four possible mechanisms by which early-life SES effects health outcomes in adulthood. First, the critical-period model, which suggests that SES exerts its greatest influence on health outcomes during windows of time, most often, early childhood when the body goes through important developmental processes. Second, the cumulative risk model, which emphasizes the additive and compounding effects of SES on health. Third, the trajectory model stipulates that childhood SES indirectly affects health (either positively or negatively) by influencing both health behaviors and SES achievement in adulthood. Finally, the social mobility model suggests that childhood exposures can be modified by SES in adulthood.

In this study we explore how both current and childhood socioeconomic status affects incident cardiovascular disease in mid-to-late life adults using the Health and Retirement Study (HRS), a nationally representative longitudinal data set. In this investigation, we seek to demonstrate social mobility as a preeminent model, and appropriately explains how early life conditions shape disease susceptibility later in life.

Background

An essential determinant of population-level health is social class (19). A number of studies have suggested that inadequate living conditions in childhood and adolescence increase the risk of arteriosclerotic heart disease later in life. Forsdahl (25) first postulated in 1977 that great poverty in

childhood and adolescence followed by prosperity is a risk factor for arteriosclerotic heart disease. In his study of subjects between the ages of 40 and 69 years, a significant positive correlation was found in age adjusted mortality from arteriosclerotic heart disease and infant mortality in the same cohort. His results suggested that poverty in childhood followed by affluence was a risk factor for arteriosclerotic heart disease. Forsdahl argued that onset of disease was consequence of late life prosperity and that mortality rates for arteriosclerotic heart disease remained low in underdeveloped countries. A secondary analysis of 823 men in Eastern Finland and 888 men in Western Finland by Notkola et al (26) tested the hypothesis that low socioeconomic conditions in childhood increase the probability of coronary heart disease in adulthood, and found increases in the relative risks of coronary death, myocardial infarction, and ischemic heart disease were for those individuals born without land (a measure of SES) in east Finland. A prevalence study of the 2,679 Finnish men between the ages of 42 and 60 years examined the effect of economic conditions in childhood and ischemic heart disease. Their findings suggested an association between low SES in childhood and higher prevalence of ischemia during exercise when compared to the highest and middle tertiles of childhood SES (27).

The literature indicates that the impact of childhood economic conditions on adult health is an increasingly investigated topic (30, 31), however the mechanism(s) explaining the associations over a lifetime are unclear. In order to explain the possible causal effect of childhood SES on risk of CVD later in life, we consider several conceptual models.

The critical-period model suggests that early childhood SES exerts continual and irreversible effects on health later in life. Support for this model includes studies showing early childhood environments as predictors of CVD, hemorrhagic stroke, and stomach cancer (32, 33). This model proposes exposure during this time period may induce biological level structural and function changes that are difficult to reverse, and thus affect disease risk later in life (30). The viability of the critical-period

model depends on whether the association between childhood SES and increased risk of CVD later in life is independent of adulthood SES and other risk factors of CVD.

Competing with the critical-period model of the life course process are three alternative models. The cumulative risk model stresses that damage occurs through the accumulation of exposures to risk factors from childhood to adulthood (61, 62). The trajectory model suggests that rather than distal negative exposures experienced in childhood, proximal exposures to disadvantage in adulthood have a direct and consequential effect on health. Evidence from previous research suggests current SES is an important predictor of self-rated health and CVD mortality (36, 37). The final competing model is the social mobility model. In this model, movement across SES levels from childhood to adulthood has the potential to mitigate early life exposures and offset risk of disease. In recent years, studies demonstrated downward social mobility predicted poor health outcomes (38). However, a few studies suggest upward mobility can also adversely affect health: Marin (39) et al. found low early-life SES that increased through childhood had an association with the highest blood pressure measurements in adolescence. The social mobility model emphasizes that change between advantage and disadvantage is of greater importance than timing or continuity of economic status. This would indicate that upward mobility would negate the deleterious impact of low SES in childhood. Conversely, downward mobility would cause an increase in disease incidence.

This analysis builds on contemporary research and uses longitudinal data from the Health and Retirement Study to test social mobility model of SES and cardiovascular disease. Using longitudinal data allows us to examine dynamic patterns of economic conditions as well as biological functions. This study also uses objectively measured biomarkers of health which allows us to assess associations of SES with fundamental determinants of age related diseases.

Methods

Data source

We use data from four waves of HRS surveys over the years 2006-2012. In 1992, HRS began capturing data on changes in the labor force as well as on the health transitions that individuals undergo toward the end of their working lives and into retirement (53). Twenty-thousand individuals with diverse economic conditions, racial and ethnic backgrounds, health, marital histories and family compositions, as well as other aspects of life are surveyed every two years (54). The overall response rate for each of the follow-up waves is higher than 80%. Figure 3.1 illustrates the method of respondent inclusion for this longitudinal analysis over the timeframe. Briefly, in 2006 12,549 disease free men and women over the age of 50-years were eligible for inclusion into this analysis. In 2008, an additional 821 disease free individuals entered the study. In 2010, the final year of inclusion, 5,762 provided data for the longitudinal analysis. The final sample size for this analysis was 19,132 and consisted of non-institutionalized men and women 50 years and older in the United States. Figure 3.2 shows the breakdown of follow-up time contributed by the sample population. Men and women contributed an average of 3.9 and 4.1 person-years of follow-up time respectively. Overall, the 19,132 respondents contributed 77,358.50 person-years of follow-up time to the analysis.

Outcome variables

Cardiovascular disease (CVD)

Heart disease was the leading cause of death among all men and women in the United States during the years 2006-2012 (55, 56). Over the same time period stroke was the third leading cause of death among all women (except 2012 when it was 4th) (56), and ranked fifth among all men in the United States (55). We measured incident CVD diagnosis as a 'yes' to HRS questions regarding a diagnosis of angina, congestive heart failure (CHF), heart condition, myocardial infarction (MI) or stroke. In HRS, the

variable 'heart condition' refers to any diagnosis of "heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems".

Exposure variables

Peak net worth

Peak net worth represented the primary socioeconomic indicator in this analysis. We combined the respondents' economic information from several variables within HRS and then grouped them into tertiles of wealth. HRS collects data on respondent income, savings, pension, and asset classes. Specifically, HRS obtains data on net financial wealth, net housing wealth, pension wealth, and present value of social security benefits. Net financial wealth includes savings, investments, business assets, and non-residential real estate less outstanding debt not related to housing. The household wealth value is the sum of the main home value, net value of other real estate, net value of vehicles, net value of any farms or businesses, net value of stocks and other financial instruments, cash accounts, and the net value of other assets less outstanding mortgage principle and other debts. Total net worth was then defined as the combination of the respondents' net wealth, net household wealth, pension, and social security, less all reported debt. We defined peak net worth as the maximum value of total net worth for a respondent over the six-year period of analysis. The resulting continuous variable was then divided into wealth tertiles of the purposes of analysis. The bottom tertile represents the study population whose peak net worth was under $59,991.00, and included respondents reporting debt (i.e. negative net worth). The ceiling for the middle tertile was $346,800.00, and the top tertile included those respondents whose net worth exceeded $346,800.00. These numbers are similar to net worth statistics issued by the US Census Bureau (63).

In addition to peak net worth, we also looked at respondent economic movement from childhood to adulthood in order to ascertain the viability of the socioeconomic mobility model. Respondents provided information on their family financial situation when they were children in one of three ways:

well off, about average, or poor. Socioeconomic mobility was then categorized based on responses to childhood SES and peak net worth tertiles as an adult. In terms of economic movement, respondents could be in one of the following groups: low-low, middle-middle, high-high, low-high, and high-low.

Covariates

Demographics characteristics

We defined age categorically: 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, and 85+ years. For the purposes of the regression models, we further dichotomized the age variable into "less than 65 years" and "65 years and older". We also included gender and race (white vs. non-white) as demographic covariates. We measured education as the respondent's total number of years of completed education, and separated the variable into four categories (less than high school, high school degree, some/completed college, graduate degree).

Biomarkers

In 2006, HRS began collecting biological data in an effort to match biological factors with health and social data (57). Biomarkers refer to the general range of physiological, metabolic, biochemical, endocrine and genetic measures obtained from living organisms. For many of these measures, there is a normal range, and values outside of this range can serve as an indicator of disease or as an early sign of potential disease (57). HRS collected dried blood spots (DBS) for five biomarkers: total cholesterol (TC), high density lipoprotein (HDL); an indicator of lipid levels, glycosylated hemoglobin (HbA1c); an indicator of glycemic control over the previous 2-3 months, C-reactive protein (CRP); a marker of inflammation, and Cystatin C; an indicator of kidney function. We used cut-off points for each biomarker based on the National Library of Medicine and the National Institute of Health (Appendix A). HRS also provides physical measure data on blood pressure, via three successful readings of diastolic and systolic pressures and percent weight difference via weight measurements. We based blood pressure cut points on values set forth by the American Heart Association.

Health/lifestyle covariates

We assessed hypertension through self-report and three successive blood pressure readings. We determined diabetic status through self-report and an HbA1c biomarker reading of ≥ 6.5%. We also included additional variables known to influence health: physical activity (any vs. none) and cigarette smoking status (never vs. quit vs. current). Health insurance status (insured vs. not insured) was also included as a covariate to and serves a proxy for access to care. The decision was also made to replace BMI in the regression analysis with a different surrogate, percent weight difference, in an effort to clarify the effect weight or mass has on CVD morbidity (64).

Statistical analyses

We analyzed tertiles of peak net worth as well as socioeconomic mobility in relation to incident cases of CVD among men and women 50-years of age and older in the United States over a six-year period. Tables 3.1 shows the baseline characteristics of the disease free population as they entered the study. Using the bottom tertile as the reference group for peak net worth and the low-low group as the referent group for economic movement, we implemented bivariate analyses to assess crude associations of incidence rate ratios (IRR) between the exposures of interest and new cases of CVD (Table 3.3). Finally, we produced multiple logistic regression models of CVD, adjusted for confounders, and estimated IRR with 95% confidence intervals for each exposure of interest (peak net worth and economic movement). Since this cohort of 19,132 respondents was dynamic in nature, the investigators decided not to incorporate the HRS weights for the final analysis. Note that with a fixed cohort, it would have been possible to use either the base-year weight or the terminal-year weight depending on the direction of study. The dynamic nature of the cohort complicated our ability to incorporate repeated measure analysis of variance (ANOVA). This method would have been preferable had the primary exposure been changes to levels of biomarker or anthropometric readings, however our main exposure (social mobility) is

ultimately categorical based on counts. We used Stata14/SE (College Station, TX) for all statistical analyses.

Results

Table 3.1 displays absolute peak net worth baseline characteristics of the study population made up of disease-free adults over the age of 50 years, living in the United States. All cells were populated with data from the respondents' initial wave responses. Coming into the study period, over half the population were normotensive. Of those with a diagnosis of hypertension, 97% (7691/7,973) indicated their hypertension was controlled through medication. Only 16% of the study population began the study period with a diagnosis of diabetes, however 43% of diabetics had a peak net worth profile in the bottom tertile. Two-thirds of the study population was overweight or obese at the beginning of the study period. Most respondents had health insurance, and nearly everyone engaged in some form a physical activity. Two-thirds of the study population was white, but over half of all non-white respondents (54%) were part of the bottom tertile. Thirty-nine percent of respondents were under the age of 60 years.

Table 3.2 show the same characteristics broken down by childhood-to-adulthood economic mobility. Fewer respondents provided data on childhood and adult economic circumstances. Consequently, the overall number reduced to 4,597 respondents. While sufficiently large enough to conduct our analysis, it did necessitate aggregation of data when cell sizes did not meet the minimum requirement (n=5). The high-high (3.9%) and low-high (6.8%) were underrepresented within the total population compared to the other mobility groups. Of note, a majority of respondents were categorized as overweight or obese in each economic mobility group. Forty percent of respondents in the low-low and low-high groups had a diagnosis of hypertension at baseline, but over 70% of all respondents across groups did not present with diabetes. A majority of respondents in the low-low group did not have health

insurance (51.8%). Respondents in the high-high group received at least college degree (82.3%) and were more likely to be white (81.5%).

The sample of 19,132 men and women who provided data on adult peak net worth and CVD diagnosis contributed 77,358.50 person-years of follow-up time. Table 3.1 also shows the number of incident CVD cases at the end of the six-year follow-up period. At that time, 2,332 respondents had developed CVD (12.2%). New cases were not disproportionate within peak net worth tertiles. Thirty-eight percent of respondents in the top tertile developed CVD over the course of follow-up, compared to 33% in the bottom tertile and 29% in the middle tertile. Fewer respondents provided information regarding their childhood economic conditions. Of those 4,597 respondents, 240 (5.2%) developed CVD by the end of the follow-up period. The low-high mobility group had the largest proportion of within group incident CVD with 12.2% of respondents reporting CVD diagnosis. The low-low group represented 30% of all new CVD cases in the study.

Table 3.3 shows the number incident CVD cases and the total number of person-years contributed to the study, followed by crude and adjusted incidence rate ratio models, as well as attributable risk of disease due to exposure for both tertiles of peak net worth and economic mobility. In terms of peak net worth, both the top and middle tertiles protect against incident CVD compared to the bottom tertile. After adjusting for demographic information and indicators of health (model III), both tertiles had 0.72 times the rate of incident CVD compared to the bottom tertile (top tertile IRR = 0.72; 0.65-0.81, $p<0.0001$, middle tertile IRR = 0.72; 0.64-0.81, $p<0.0001$). Using the preventative fraction in the exposed, we estimated 20% of potential CVD cases could be prevented by "exposing" a population to the top tertile of wealth compared to the bottom tertile. An estimated 12% of all cases (N=1,651) were prevented by having a peak net worth in the top tertile. Similarly, we estimated that 25% of potential CVD cases could be prevented by having a net worth identified in middle tertile, and an estimated 14% of all cases (N=1,443) were prevented by having a peak net worth in the middle tertile.

The CVD incidence rate ratios were less stable across categories of economic mobility. The high-low and middle-middle groups maintained significant protection against CVD in each regression model. Respondents in the high-low group had 0.69 times the rate of incident CVD compared to the low-low group (IRR = 0.69; 0.49-0.98, p=0.04) after adjusting for demographics and health indicators (model III). Under the same conditions, the middle-middle group had 0.53 times the rate of incident CVD compared to respondents in the low-low group (IRR = 0.53; 0.37-0.78, p=0.001). The preventative fraction in the exposed estimated 32% of potential CVD cases could be prevented if downward economic mobility occurred. An estimated 18% of all cases (N=135) were prevented by growing up in affluence despite losing wealth as an adult. Furthermore, an estimated 48% of the potential CVD cases could be prevented by exposure to middle class stability from childhood to adulthood. An estimated 28% of all cases (N=125) were prevented by growing up and maintaining middle class wealth status.

Table 3.4 displays the incidence rate ratios for selected covariates of interest. Among the 19,132 respondents within the three tertiles of peak net worth, those 65 years and older (IRR = 1.31; 1.17-1.45, p <0.0001) and male (IRR = 1.17; 1.07-1.28, p=0.001) demonstrated increased incidence rates compared to respondents under 65 years and female, respectively. Respondents with either controlled (IRR = 1.68; 1.51-1.86, p<0.0001) or uncontrolled (IRR = 3.05;2.38-3.91, p<0.0001) hypertension also incurred increased rates of CVD. Conversely, respondents who were physically active and were educated beyond high school saw decreased rates of CVD. Physically active respondents had 0.56 times the rate of incident CVD compared to physically inactive respondents, while college graduates and respondents with advanced degrees had 0.88 times and 0.79 times the rate of incident over the study period.

With regard to economic mobility, older respondents were still at risk (IRR = 1.37; 1.02-1.85, p=0.04). Current smokers were 1.75 times more likely to be diagnosed with CVD, and respondents with a difference in weight of more than 5% had 1.70 times rate of CVD incidence. As in Table 3.2, education, hypertension, and diabetes had to be collapsed due to small cell numbers. Education did not have a

significant association with incident CVD among economically mobile respondents, however increased rates were seen among respondents with diagnoses of either hypertension (IRR = 1.94; 1.42-2.64, p<0.0001) or diabetes (IRR = 1.58; 1.19-2.09, p<0.0001).

Discussion

This study looked at the association of socioeconomic status, defined as both peak net worth and economic movement, and incident cardiovascular disease in a nationally representative population of men and women over the age of 50 years. Our findings contribute new knowledge to the complex role of SES and CVD across the life span.

The results of the crude measures of association and the regression analysis lend support to the idea that there is a critical period where economic circumstance can affect health outcomes. The social mobility model predicts that upward mobility would mitigate the negative impact of low SES in childhood, and downward mobility would cause an increase in disease incidence. Our results appear to support the opposite effect. Although not included in the final analysis, supplemental tables found in Appendix C show the crude relative risks for incident CVD by peak net worth tertile and economic mobility. Ending up in the lowest economic tertile is not as damaging to health later in life compared to achieving higher SES (low-high) if your early childhood is one of affluence (High-Low). Being middle class offers the most consistent protection in terms of both absolute net worth and economic mobility. This was not the only unexpected result seen in this study. Being non-white protected against incident CVD. However, a study of white and black men of equal economic status found white men of either low or high economic status had higher rates of CVD mortality compared to black men in the same economic bracket (65).

While our results are noteworthy, several limitations surfaced in our investigation into how childhood SES affects CVD in adulthood. Although we had data on both childhood and adult SES, the information provided by respondents regarding economic status in their childhood is subject to recall bias. Furthermore, the number of respondents who provided such information was smaller than the overall

sample population (N=4,597). Despite have SES information at two points in time, the temporality of these associations cannot be certain because we do not have SES information for the intermediate years. Additionally, we were unable to determine the length of time the respondent experienced the exposure in early in life. The number of respondents in the high-high (n=178) and low-high (n=311) were small relative to the other mobility categories. This may have underpowered the sample and diluted the true effect of these groups.

In order to counteract the likelihood of a Type I error that is possible given multiple comparisons, we used the Bonferroni correction for comparison of new CVD cases at the end of follow up by peak net worth tertiles and social mobility. Comparing the bottom tertile to the top tertile was significant at $p=0.002$, and the comparison between the middle tertile and the top tertile was significant at $p<0.0001$. Comparison of CVD cases between the bottom and middle tertiles was not statistically significant. Comparisons of low-low vs middle-middle, low-high, and high-low were statistically significant at the 0.05 level or better. Middle-middle vs low-high and low-high vs. high-low were also statistically significant at $p<0.0001$.

Unlike many studies investigating the effect of childhood SES on adult health outcomes, our study did contain multiple indicators of SES. The integration of biomarker data allows for an examination of the biological mechanisms that maybe triggering the association between SES over the life course and CVD morbidity later in life. The social mobility model and critical period model may be two sides of the same coin. Our findings suggest that social mobility may not be as important as where you start in early childhood. Future studies based on these results should examine how childhood SES affects late life CVD independent of concurrent SES.

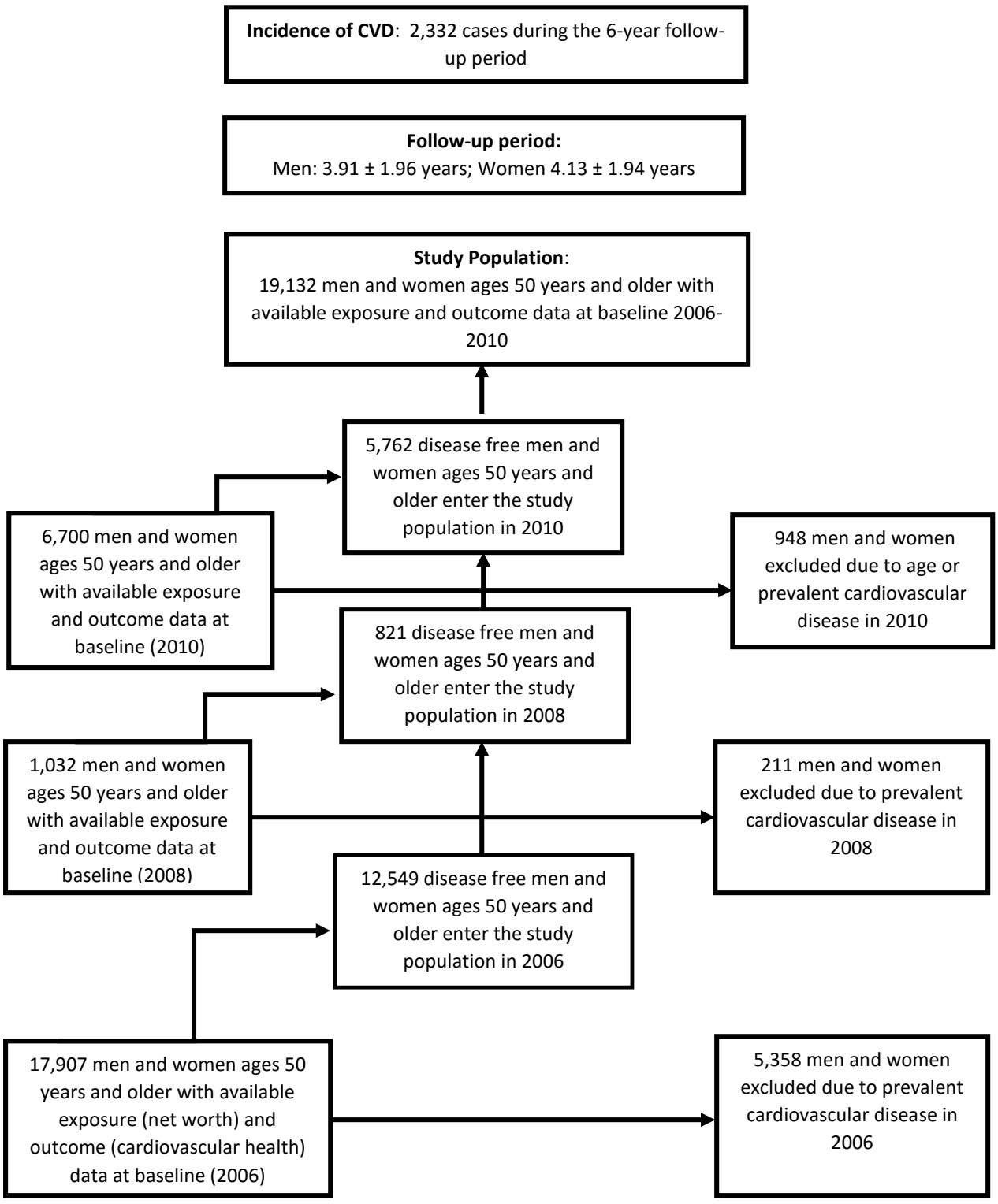

Figure 3.1 Flow chart of study population: Health and Retirement Study 2006-2012

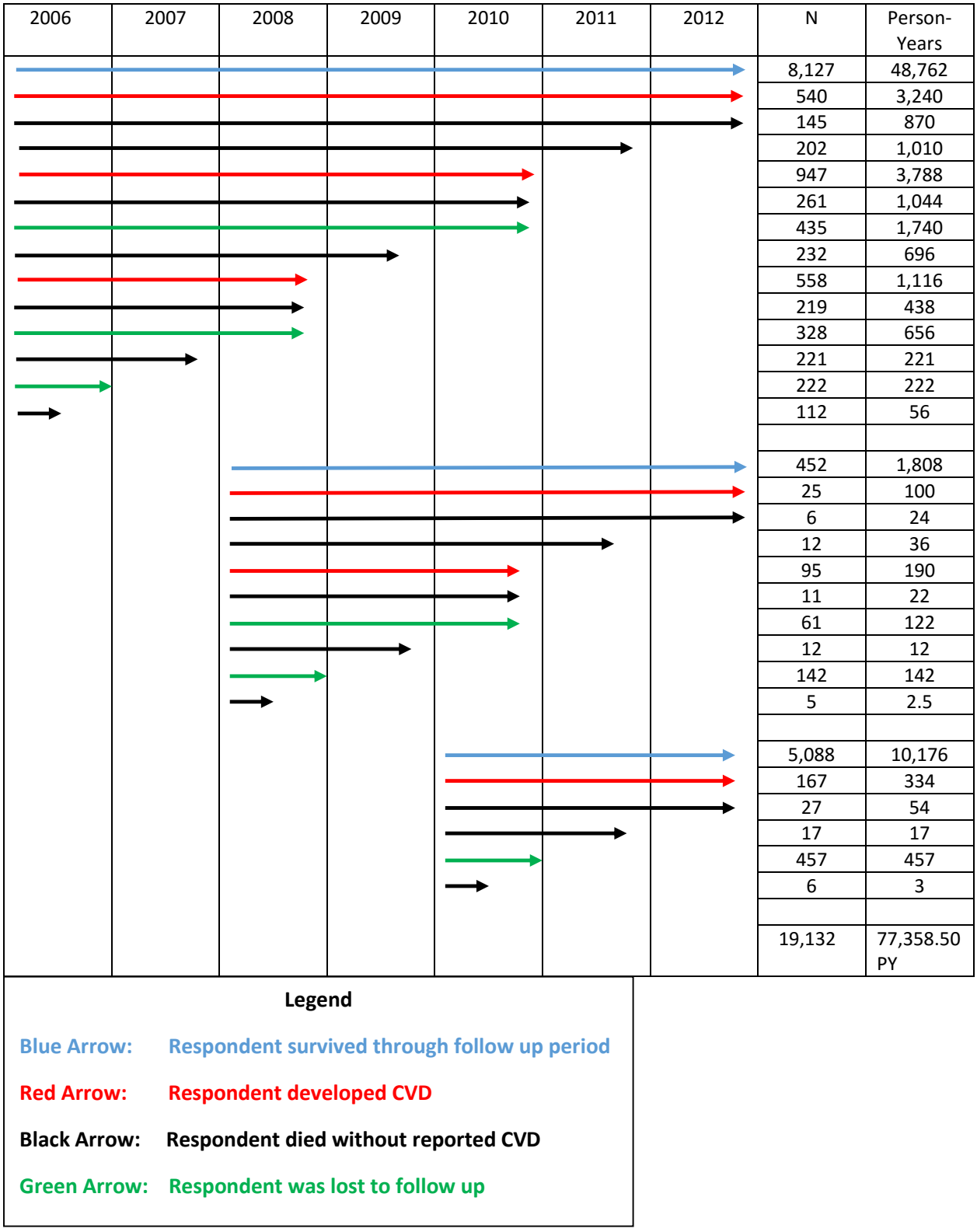

Figure 3.2. Follow up breakdown for incident cardiovascular disease among men and women ages 50 and older in the 2006-2010 Health and Retirement Study

Table 3.1. Characteristics of adults 50 years and older by peak net worth tertile in the 2006-2012 Health and Retirement Study

Peak net worth tertile[†]	**Bottom**	**Middle**	**Top**	**p-value[α]**
(N=19,132) *	n (%)[γ]	n (%)[γ]	n (%)[γ]	
	6,378 (33.3)	6,378 (33.3)	6,376 (33.3)	
Baseline				
BMI				<0.0001
Low	295 (62.2)	87 (18.3)	92 (19.4)	
Normal	1,445 (28.2)	1,549 (30.2)	2,137 (41.6)	
Overweight	1,960 (28.9)	2,346 (34.6)	2,471 (36.5)	
Obese	2,058 (36.5)	2,051 (36.3)	1,534 (27.2)	
Missing	620 (56.0)	345 (31.2)	142 (12.8)	
Cigarette smoking				<0.0001
Current	1,414 (46.2)	1,036 (33.9)	609 (19.9)	
Ever	1,371 (24.9)	1,726 (31.3)	2,417 (43.8)	
Never	1,663 (26.6)	1,857 (29.8)	2,720 (43.6)	
Missing	1,930 (44.7)	1,759 (40.7)	630 (14.6)	
Hypertension**				<0.0001
Normotensive	3,080 (30.0)	3,552 (34.5)	3,652 (35.5)	
Controlled	2,638 (34.2)	2,473 (32.1)	2,600 (33.7)	
Uncontrolled	163 (57.4)	68 (23.9)	53 (18.7)	
Missing	497 (58.3)	285 (33.4)	71 (8.3)	
Diabetes***				<0.0001
Non-diabetic	4,606 (30.1)	5,173 (33.9)	5,499 (36.0)	
Controlled	1,143 (41.9)	834 (30.6)	749 (27.5)	
Uncontrolled	187 (50.0)	116 (31.0)	71 (19.0)	
Missing	442 (58.6)	255 (33.8)	57 (7.6)	
Physical activity				<0.0001
Any	5,415 (31.0)	5,937 (34.0)	6,108 (35.0)	
None	530 (56.1)	200 (21.2)	214 (22.7)	
Missing	433 (59.5)	241 (33.1)	54 (7.4)	
Health insurance				<0.0001
Any	2,781 (24.1)	3,625 (31.4)	5,128 (44.5)	
None	3,597 (47.3)	2,753 (36.2)	1,248 (16.4)	
Education level				<0.0001
< High school	2,455 (61.2)	901 (22.5)	645 (16.3)	
High school	1,850 (31.5)	2,174 (37.1)	1,842 (31.4)	
Some/completed college	1,406 (21.8)	2,437 (37.7)	2,613 (40.5)	
Graduate school	239 (11.5)	626 (30.1)	1,213 (58.4)	
Missing	428 (59.3)	240 (33.2)	54 (7.5)	
Sex				<0.0001
Male	2,341 (30.1)	2,780 (35.8)	2,649 (34.1)	

Female	4,037 (35.5)	3,598 (31.7)	3,727 (32.8)	
Race				<0.0001
White	2,726 (21.9)	4,380 (35.3)	5,309 (42.8)	
Non-white	3,286 (54.4)	1,749 (29.0)	1,006 (16.6)	
Missing	366 (54.1)	249 (36.8)	61 (9.0)	
Age (years)				<0.0001
50-54	1,683 (37.3)	1,883 (41.7)	945 (21.0)	
55-59	1,258 (33.3)	1,473 (39.0)	1,042 (27.6)	
60-64	661 (27.7)	755 (31.6)	973 (40.7)	
65-69	767 (28.2)	733 (28.4)	1,182 (43.4)	
70-74	609 (30.0)	520 (25.6)	903 (44.4)	
75-79	375 (28.8)	314 (24.1)	614 (47.1)	
80-84	303 (32.8)	232 (25.1)	389 (42.1)	
85+	369 (44.4)	188 (22.6)	274 (33.0)	
Missing	353 (54.6)	240 (37.1)	54 (8.3)	
Follow-up				
New CVD				<0.0001
Yes	762 (32.7)	681 (29.2)	889 (38.1)	
No	5,616 (33.4)	5,697 (33.9)	5,487 (32.7)	

Note: Data provided in this table represents responses from the study population during the first interview year of the Health & Retirement Study.

γ: percentages correspond to row totals; †: Peak net worth is the maximum value assigned for net worth between 2006-2012; Bottom < $59,991.00; Middle $59,991.00-$346,800.00; Top ≥ $346,801.00

α: p-value based on differences in proportion (Chi-square test statistic)

*Based on responses to cardiovascular health and income/assets.

** Hypertension was assessed through self-report and three successive blood pressure readings (blood pressure ≥ 140/90 mmHg). Controlled hypertension indicates the respondent actively takes medication for their condition at baseline. Those respondents not taking medication to treat hypertension at baseline were assigned to the uncontrolled group.

*** Diabetes assessed through self-report and HbA1c biomarker reading of ≥ 6.1%. Controlled diabetes indicates the respondent actively takes medication for their condition at baseline. Respondents not taking medication to treat diabetes at baseline were assigned to the uncontrolled group.

**** non-white collapses African-American, Hispanic, native American, and pacific islander

Abbreviations: BMI= body mass index- calculated from self-reported height and weight; ; Low: <18.5 kg/m^2, Normal: 18.5 kg/m^2 – 24.9 kg/m^2, Overweight: 25 kg/m^2- 29 kg/m^2, Obese: ≥30 kg/m^2Physical activity = any response other than “hardly or never” to questions: How often vigorous activity? How often moderate activity? How often mild activity? Response of “hardly or never” to all 3 questions=none.

Respondents were categorized with health insurance if they had Medicare, Medicaid, ChampUs, or private health insurance.

Table 3.2. Characteristics of adults 50 years and older by economic mobility in the 2006-2012 Health and Retirement Study

Economic Mobility	Low-Low	High-High	Middle-Middle	Low-High	High-Low	p-value[α]
(N= 4,597) *	n (%)[γ]	n (%)[γ]	n (%)[γ]	n (%)[γ]	n (%)[γ]	
	1,071 (23.3)	178 (3.9)	1,532 (33.3)	311 (6.8)	1,505 (32.7)	
Baseline						
BMI						<0.0001
Underweight/Normal	248 (23.1)	68 (6.3)	332 (30.9)	92 (8.6)	334 (31.1)	
Overweight/Obese	710 (23.2)	102 (3.3)	1,058 (34.5)	208 (6.8)	998 (32.2)	
Missing	113 (24.7)	8 (1.7)	142 (31.1)	11 (2.4)	183 (40.0)	
Cigarette smoking						<0.0001
Current	260 (27.0)	18 (1.9)	245 (25.4)	32 (3.3)	409 (42.4)	
Ever	55 (22.5)	33 (13.5)	52 (21.2)	70 (28.6)	35 (14.3)	
Never	68 (19.1)	30 (8.5)	96 (27.0)	101 (28.5)	60 (16.9)	
Missing	688 (22.7)	97 (3.2)	1,139 (37.6)	108 (3.6)	1,001 (33.0)	
Hypertension**						<0.0001
Normotensive	519 (21.0)	123 (5.0)	894 (36.2)	176 (7.1)	755 (30.7)	
Hypertensive	432 (26.1)	46 (2.8)	491 (29.7)	126 (7.6)	560 (33.8)	
Missing	120 (25.3)	9 (1.9)	147 (30.9)	9 (1.9)	190 (40.0)	
Diabetes***						<0.0001
Non-diabetic	750 (21.7)	156 (4.5)	1,228 (35.6)	259 (7.5)	1,058 (30.7)	
Diabetic	222 (30.3)	15 (2.1)	173 (23.6)	45 (6.1)	278 (37.9)	
Missing	99 (24.0)	7 (1.7)	131 (31.7)	7 (1.7)	169 (40.9)	
Physical activity						<0.0001[β]
Any	922 (22.7)	169 (4.2)	1,389 (34.2)	296 (7.3)	1,279 (31.5)	
None	53 (36.5)	2 (1.4)	18 (12.4)	8 (5.5)	64 (44.1)	
Missing	96 (24.2)	7 (1.8)	125 (31.5)	7 (1.8)	162 (40.8)	
Health insurance						<0.0001
Any	523 (19.0)	132 (4.8)	1,091 (39.6)	250 (9.1)	760 (27.1)	
None	548 (29.8)	61 (2.5)	441 (24.0)	61 (3.3)	745 (40.5)	

Education level						<0.0001
≤ High school	726 (32.3)	24 (1.1)	533 (23.7)	139 (6.2)	825 (36.7)	
≥ College	249 (12.7)	147 (7.5)	874 (44.7)	165 (8.4)	520 (26.6)	
Missing	96 (24.2)	7 (1.8)	125 (31.7)	7 (1.8)	160 (40.5)	
Sex						<0.0001
Female	653 (25.0)	87 (3.3)	819 (31.3)	181 (6.9)	874 (33.4)	
Male	418 (21.1)	91 (4.6)	713 (36.0)	130 (6.6)	631 (31.8)	
Race****						<0.0001
White	358 (15.9)	145 (6.4)	980 (43.4)	211 (9.3)	563 (24.9)	
Non-white	616 (31.7)	26 (1.3)	425 (21.9)	93 (4.8)	780 (40.2)	
Missing	97 (24.2)	7 (1.8)	127 (31.7)	7 (1.8)	162 (40.5)	
Age (years)						<0.0001
≤ 64 years	865 (23.2)	134 (3.6)	1,304 (35.0)	176 (4.7)	1,246 (33.4)	
≥ 65 years	111 (23.2)	37(7.7)	103 (21.5)	128 (26.8)	99 (20.7)	
Missing	95 (24.1)	7 (1.8)	125 (31.7)	7 (1.8)	160 (40.6)	
Follow up						
New CVD						<0.0001
Yes	72 (30.0)	14 (5.8)	53 (22.2)	38 (15.8)	63 (26.2)	
No	999 (22.9)	164 (3.8)	1,479 (33.9)	273 (6.3)	1,442 (33.1)	

Note: Data provided in this table represents responses from the study population during the first interview year of the Health & Retirement Study.

α: p-value based on differences in proportion (Chi-square test statistic); β: p-value based on Fisher's exact test due to small cell size; γ- percentages based on row values

*Based on responses to cardiovascular health, economic status during childhood, and adult net worth.

** Hypertension was assessed through self-report and three successive blood pressure readings (blood pressure ≥ 140/90 mmHg). Variable collapsed due to <5 in cells

*** Diabetes assessed through self-report and HbA1c biomarker reading of ≥ 6.1%. Variable collapsed due to <5 in cells

**** non-white collapses African-American, Hispanic, native American, and pacific islander

Abbreviations: BMI= body mass index- calculated from self-reported height and weight; Variable collapsed due to <5 in cell; Low: <18.5 kg/m^2, Normal: 18.5 kg/m^2 – 24.9 kg/m^2, Overweight: 25 kg/m^2- 29 kg/m^2, Obese: ≥30 kg/m^2 ; Physical activity = any response other than "hardly or never" to questions: How often vigorous activity? How often moderate activity? How often mild activity? Response of "hardly or never" to all 3 questions=none. Respondents were categorized with health insurance if they had Medicare, Medicaid, ChampUs, or private health insurance.

Table 3.3: Regression models † for incident CVD by tertiles of peak net worth and economic mobility among adults ages 50 years and older in the Health and Retirement Study 2006-2012.

	# Events / Person-years	Unadjusted Association IRR (95% CI)	Adjusted Association (I)* IRR (95% CI)	Adjusted Association (II)** IRR (95% CI)	Adjusted Association (III)*** IRR (95% CI)	Attributable Risk	Pop Attr Fraction
Absolute net worth (in tertiles) N=19,132							
Top	889/30,349	0.80 (0.73, 0.88) α	0.72 (0.64, 0.80) α	0.72 (0.64, 0.81) α	0.72 (0.65, 0.81) α	0.20 (0.11, 0.27) α	0.12
Middle	681/25,300	0.75 (0.68, 0.83) α	0.73 (0.66, 0.82) α	0.72 (0.64, 0.80) α	0.72 (0.64, 0.81) α	0.25 (0.17, 0.32) α	0.14
Low (reference)	762/21,209.5	1.00	1.00	1.00	1.00		
Wealth Mobility N=4.597							
High – High	14/601	0.81 (0.46, 1.44)	0.68 (0.37, 1.26)	0.66 (0.36, 1.22)	0.68 (0.37, 1.23)	0.19 (0.45, 0.58)	0.04
Middle – Middle	53/3,541.5	0.52 (0.36, 0.74) α	0.52 (0.36, 0.76) β	0.52 (0.36, 0.77) β	0.53 (0.37, 0.78) β	0.48 (0.25, 0.64) β	0.28
Low – High	38/1,237	1.07 (0.72, 1.58)	0.83 (0.54, 1.27)	0.75 (0.48, 1.16)	0.76 (0.49, 1.17)	0.07 (-0.42, 0.38)	0.02
High – Low	63/3,207	0.68 (0.49, 0.96) β	0.74 (0.52, 1.04)	0.69 (0.48, 0.97) β	0.69 (0.49, 0.98) β	0.32 (0.03, 0.52) β	0.18
Low – Low (reference)	72/2,508	1.00	1.00	1.00	1.00		

†: Unweighted Models; IRR = incidence rate ratio; 95% CI = confidence intervals

*model adjusted for: age, gender, race, and education

** model adjusted for: hypertension, diabetes, physical activity, health insurance, smoking, and weight difference

*** final model: removing insignificant covariates via backward stepwise elimination

α: p-value <0.0001; β: p-value ≤ 0.05

Peak net worth is the maximum value assigned for net worth between 2006-2012; Bottom < $59,991.00; Middle $59,991.00-$346,800.00; Top ≥ $346,801.00

Economic movement based on childhood and adult SES

Table 3.4: Regression models† for selected covariates among adults ages 50 years and older in the Health and Retirement Study 2006-2012.

	Absolute wealth IRR (95% CI; p-value) N=19,132	**Economic mobility IRR (95% CI; p-value)** N=4,597
Age: ≥ 65 years	1.31 (1.17, 1.45; < 0.0001)	1.37 (1.02-1.85; 0.04)
Sex: Male	1.17 (1.07, 1.28; 0.001)	1.14 (0.87-1.48; 0.33)
Race: non-white	0.75 (0.67, 0.83; <0.0001)	0.75 (0.57-1.00; 0.05)
Education		1.03 (0.78-1.37; 0.83)
High school	0.99 (0.88, 1.11; 0.83)	
College	0.88 (0.77, 0.99; 0.04)	
Grad School	0.79 (0.66, 0.94; 0.008)	
Hypertension		1.94 (1.42-2.64; <0.0001)
Controlled	1.68 (1.51, 1.86; <0.0001)	
Uncontrolled	3.05 (2.38, 3.91; <0.0001)	
Diabetes		1.58 (1.19-2.09; <0.0001)
Controlled	1.14 (1.03, 1.26; 0.01)	
Uncontrolled	1.15 (0.93, 1.41; 0.2)	
Physical activity	0.56 (0.50, 0.63; <0.0001)	0.56 (0.38-0.85; 0.006)
Weight difference: > 5.0%	1.08 (0.99, 1.18; 0.07)	1.70 (1.30-2.51; <0.0001)
Smoking status		
Quit	1.16 (1.06, 1.28; 0.001)	1.34 (0.99-1.81; 0.058)
Current	1.11 (0.96, 1.28; 0.17)	1.75 (1.22-2.51; 0.002)
Health insurance status	3.39 (2.85, 4.04; <0.0001)	1.62 (1.14-2.32; <0.0001)

†: Unweighted Models; IRR = incidence rate ratio; 95% CI = confidence intervals

Peak net worth is the maximum value assigned for net worth between 2006-2012; Bottom < $59,991.00; Middle $59,991.00-$346,800.00; Top ≥ $346,801.00

Economic movement based on childhood and adult SES

Hypertension was assessed through self-report and three successive blood pressure readings (blood pressure ≥ 140/90 mmHg). Controlled hypertension indicates the respondent actively takes medication for their condition at baseline. Those respondents not taking medication to treat hypertension at baseline were assigned to the uncontrolled group; Diabetes assessed through self-report and HbA1c biomarker reading of ≥ 6.5% HA1c; Physical activity = any response other than "hardly or never" to questions: How often vigorous activity? How often moderate activity? How often mild activity? Response of "hardly or never" to all 3 questions=none. Respondents were categorized with health insurance if they had Medicare, Medicaid, ChampUs, or private health insurance.

CHAPTER 4

CHILDHOOD SOCIOECONOMIC STATUS, PEAK NET WORTH, AND INCIDENT CARDIOVASCULAR DISEASE: RESULTS FROM THE HEALTH AND RETIREMENT STUDY 2006-2012 [1]

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[1] Allegra, J.C. To be submitted to *Social Science & Medicine*

Abstract

This longitudinal study investigates the critical period life cycle model as it relates to incident cardiovascular disease by using self-reported childhood socioeconomic status, among men and women ages 50 years and older in the United States who participated in the 2006-2012 waves of the Health and Retirement Study (HRS). Results from multiple regression models indicated an association between respondents who identified their childhood socioeconomic status as "about average" and incident CVD (RR=0.73; 0.57-0.93, p=0.01) when compared to respondents who identified their childhood SES as "poor". This association occurred at each in each model iteration, and was independent of peak net worth in adulthood. The middle tertile of peak net worth in adulthood also reduced the risk of incident CVD by 37% after adjusting for demographics, health indicators, and childhood SES (RR= 0.63; 0.47-0.83, p= 0.001). Adults over the age of 65 (RR= 3.38; 2.63-4.34, p<0.0001), respondents with a diagnosis of hypertension, (RR=2.12; 1.64-2.75, p<0.0001), and current smokers (RR= 1.72; 1.25-2.36, p=0.001), had the strongest associations with incident CVD. Additionally, those respondents with a weight difference over 5% had a 59% increase in CVD incidence (RR=1.59; 1.27-2.00, p<0.0001). The association between childhood SES independent of adult SES supports the critical-period model of SES and health. Although noteworthy, a longer follow-up period with better data regarding childhood SES would help to confirm these findings and clarify which life-cycle model drives the effect of SES on CVD in late-life.

Introduction

Socioeconomic status (SES) is an instrumental determinant of cardiovascular morbidity and mortality (12, 18, 21, 22, 27,42, 60). Whether defined by education, occupation, income or index of status, the association is found on a gradient. Low SES is associated with poor health outcomes compared to high SES. The health of the population in the United States has improved, and at the same time, gaps relating SES and health has widened (34, 66). This deviation has stimulated discussion among investigators in the United States who have focused attention on the pathway by which SES affects health. Research has suggested that this pathway may begin in early life, and that childhood SES, as well as adult SES, are determinants of health in late life (32, 33). Several life-course models were developed to explain how early-life economic circumstances affect late-life health. First, the critical-period model, which suggests that SES exerts its greatest influence on health outcomes during windows of time, most often, early childhood when the body goes through important developmental processes (30). Second, the cumulative risk model, which emphasizes the additive and compounding effects of SES on health (29). Third, the trajectory model stipulates that SES in childhood affects the trajectory of exposures (positively or negatively) in adulthood (33). That is, childhood SES indirectly affects health by influencing both health behaviors and SES achievement in adulthood. Finally, the social mobility model suggests that childhood exposures can be modified by SES in adulthood (28).

The current study contributes in a number of ways to the continuing dialogue regarding childhood and adult SES and its association with health, specifically CVD, later in life. First, we examine the effect of child SES on late life health independent of adult SES. This allows the investigators to better understand the role that the critical-period life cycle model has in relation to SES and CVD. Second, the analysis uses data from a nationally representative sample which allows for comparison of change to SES and health across the life span. Furthermore, we can study the process by which early life characteristics impact CVD in the sample population of adults over the age of 50 years. Finally, the use of a longitudinal dataset like

HRS permits the investigators to control for a substantial number of variables that may mask the true association between SES and CVD, and help to ascertain whether SES is an independent risk factor of health.

Methods

Data source

This study used data from four waves of HRS surveys over the years 2006-2012. In 1992, HRS began capturing data on changes in the labor force as well as on the health transitions that individuals undergo toward the end of their working lives and into retirement (53). Twenty-thousand individuals with diverse economic conditions, racial and ethnic backgrounds, health, marital histories and family compositions, as well as other aspects of life are surveyed every two years (54). The overall response rate for each of the follow-up waves is higher than 80%. Inclusion criteria has been referred to elsewhere. Briefly, in 2006 12,549 disease free men and women over the age of 50-years were eligible for inclusion into this analysis. In 2008, an additional 821 disease free individuals entered the study. In 2010, the final year of inclusion, 5,762 provided data for the longitudinal analysis. The final sample size for this analysis was 6,512 and consisted of non-institutionalized men and women 50 years and older in the United States who provided data on the primary outcome (CVD) as well as information for both childhood and adult SES. Men and women contributed an average of 3.9 and 4.1 person-years of follow-up time respectively.

Outcome variables

Cardiovascular disease (CVD)

Heart disease was the leading cause of death among all men and women in the United States during the years 2006-2012 (55, 56). Over the same time period stroke was the third leading cause of death among all women (except 2012 when it was 4th) (56), and ranked fifth among all men in the United States (55). We measured incident CVD diagnosis as a 'yes' to HRS questions regarding a diagnosis of angina, congestive heart failure (CHF), heart condition, myocardial infarction (MI) or stroke. In HRS, the

variable 'heart condition' refers to any diagnosis of "heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems".

Exposure variables

Childhood SES

In order to study the critical-period life cycle model, the investigators used peak childhood SES as the primary exposure variable. Respondents provided information on their family financial situation when they were children. Respondents could answer in one of three ways: well off (corresponding to the top tertile of net worth, about average (corresponding to the middle tertile of net worth), or poor (corresponding to the lowest tertile of net worth).

The investigators also incorporated peak net worth as a secondary exposure of socioeconomic indicator in this analysis. The use of peak net worth served two purposes: First, it allowed the investigators to continue the analysis from the previous study by looking the association between the exposure and incident CVD in terms of relative risk. Second, by controlling for an indicator of adult SES, we could study the independent effects of childhood SES, and thereby determine legitimacy of the critical period model. In order to create tertiles of peak net worth, we combined the respondents' economic information from several variables within HRS and then grouped them into tertiles of wealth. HRS collects data on respondent income, savings, pension, and asset classes. Specifically, HRS obtains data on net financial wealth, net housing wealth, pension wealth, and present value of social security benefits. Net financial wealth includes savings, investments, business assets, and non-residential real estate less outstanding debt not related to housing. The household wealth value is the sum of the main home value, net value of other real estate, net value of vehicles, net value of any farms or businesses, net value of stocks and other financial instruments, cash accounts, and the net value of other assets less outstanding mortgage principle and other debts. Total net worth was then defined as the combination of the respondents' net wealth, net household wealth, pension, and social security, less all reported debt. We defined peak net worth as

the maximum value of total net worth for a respondent over the six-year period of analysis. The resulting continuous variable was then divided into wealth tertiles of the purposes of analysis. The bottom tertile represents the study population whose peak net worth was under $59,991.00, and included respondents reporting debt (i.e. negative net worth). The ceiling for the middle tertile was $346,800.00, and the top tertile included those respondents whose net worth exceeded $346,800.00. These numbers are similar to net worth statistics issued by the US Census Bureau (59).

Covariates

Demographics characteristics

We defined age categorically: 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, and 85+ years for the descriptive purposes. We also included gender and race (white vs. non-white) as demographic covariates. We measured education as the respondent's total number of years of completed education, and separated the variable into four categories (less than high school, high school degree, some/completed college, graduate degree). For the purposes of the regression models, we further dichotomized the education variable into high school or less, and college and graduate school, and age to less than 65 years and 65 years and older.

Biomarkers

In 2006, HRS began collecting biological data in an effort to match biological factors with health and social data (57). Biomarkers refer to the general range of physiological, metabolic, biochemical, endocrine and genetic measures obtained from living organisms. For many of these measures, there is a normal range, and values outside of this range can serve as an indicator of disease or as an early sign of potential disease (57). HRS collected dried blood spots (DBS) for five biomarkers: total cholesterol (TC), high density lipoprotein (HDL); an indicator of lipid levels, glycosylated hemoglobin (HbA1c); an indicator of glycemic control over the previous 2-3 months, C-reactive protein (CRP); a marker of inflammation, and Cystatin C; an indicator of kidney function. We used cut-off points for each biomarker based on the

National Library of Medicine and the National Institute of Health. HRS also provides physical measure data on blood pressure, via three successful readings of diastolic and systolic pressures and percent weight difference via weight measurements. We based blood pressure cut points on values set forth by the American Heart Association.

Health/lifestyle covariates

We assessed hypertension through self-report and three successive blood pressure readings. We determined diabetic status through self-report and an HbA1c biomarker reading of ≥ 6.5%. We also included additional variables known to influence health: percent weight difference (≤5% and >5%), physical activity (any vs. none) and cigarette smoking status (never vs. quit vs. current). We used health insurance status (any vs. none) as a proxy for access to care.

Loss

We included total number of losses and age at first loss, indicators of family transitions, in the models. Early age of parental death can affect available social and economic resources while growing up and affect SES attainment. Moreover, it can also serve as a risk factor for one's own health through a series of potential genetic and social influences (67). We categorized age at first loss as 30-years and older (reference), 19-29 years-old, 13-18 years-old and 12-years and younger. The maximum number of losses for a respondent was four (mother, father, child, and/or spouse). We then transformed total number of losses into a three level categorical variable: no losses (reference), 1-2 losses, and 3-4 losses.

Statistical analysis

We analyzed childhood SES as well as peak net worth (in adulthood) in relation to incident cases of CVD among men and women 50-years of age and older in the United States over a six-year period. Tables 1.3 shows the baseline characteristics of the disease free population as they entered the study by childhood SES. while Table 2.3 shows those same characteristics in relation to adult peak net worth.

Finally, we produced multivariate logistic regression models of CVD, adjusted for confounders, and estimated relative risks with 95% confidence intervals for each exposure of interest (peak net worth and childhood SES independent of adult net worth). Since this cohort was dynamic in nature, the investigators decided not to incorporate the HRS weights for the final analysis. Note that with a fixed cohort, it would have been possible to use either the base-year weight or the terminal-year weight depending on the direction of study. We used Stata 14/SE (College Station, TX) for all statistical analyses.

Results

Table 1.3 displays baseline characteristics of the study population made up of disease-free adults over the age of 50 years, living in the United States. All cells were populated with data from the respondents' initial wave responses. Respondents who reported their childhood economic status of "about average" comprised 58% of the study population (n= 3,769). Coming into the study period, 46% of the study population had a diagnosis of hypertension. Only 19% of the study population began the study period with a diagnosis of diabetes. Two-thirds of the study population was overweight or obese at the beginning of the study period. Most respondents have health insurance, and nearly everyone engages in some form a physical activity. We used the chi-square statistic to test differences in proportions. In this study population, no statistical difference was found for health insurance status (Pearson chi square =3.99, *d.f.*=2, p-value =0.136) or gender (Pearson chi square =2.74, *d.f.*=2, p-value =0.254).

At the end of the follow-up period, 366 incident cases of CVD (5.6%) were reported among respondents with the primary exposure of interest. Although respondents who identified their childhood SES as "poor" made up just over 31% of the study population, that group accounted for 41% of the new CVD cases at the end of follow-up. Disease-free respondents are evenly distributed across peak net worth tertiles, as are incident cases in 2012. However, in 2008 39% of incident cases occur in the bottom tertile, while in 2010, 44% of incident CVD occurs in the top tertile.

We previously mentioned that body mass index was found not to be predictor of CVD in either our cross-sectional study or the longitudinal study despite studies indicating otherwise (67, 68). As such, the investigators decided use a different surrogate, percent weight difference, as a substitute of BMI in an effort to clarify the effect weight or mass has on CVD morbidity (64).

Table 4.2 shows five logistic regression models. Model I shows the unadjusted relative risk of incident CVD for both childhood and adult SES as comparators. Respondents who identified their childhood economic status to be 'about average' were 41% less likely to have a CVD diagnosis at the end of the follow-up period in 2012. The middle tertile of peak net worth also showed a 12% risk reduction for incident CVD. Respondents in the top tertile of peak net worth were 19% more likely to develop incident CVD compared to the bottom tertile (RR= 1.19 (1.08-1.32, p=0.001). Model II adjusted for adult peak net worth along with demographic covariates in order to determine if childhood SES acts independently from adult SES, and lend support to the critical-period model. Results from this model suggested that respondents who reported their childhood SES circumstance to be "about average" were strongly protective against incident CVD (RR= 0.67 (0.53-0.85, p=0.001). The third model controlled indicators of health, and average childhood SES maintained its protective association (0.74 (0.58-0.95, p= 0.02). Model IV adjusted for variables related to loss: age at first loss and number of losses. No significant associations occurred with regard to age at first loss and CVD, however respondents who experienced three or four losses had nearly had 61% increase in risk of incident CVD (RR=1.61; 1.15-2.26, p= 0.006). The loss variables negated the association between childhood SES and incident CVD, however after removing all insignificant covariates in the final model (Model V, Table 4.3), average childhood SES regained its significant protective effect (RR = 0.73; 0.57-0.93, p=0.01). In the final model, the middle tertile of adult peak net worth also suggested a significant protective effect (RR = 0.63; 0.47-0.83, p= 0.001). Model V follows similar patterns of SES, CVD and its known risk factors. Hypertension, (RR=2.12; 1.64-2.75, p<0.0001), diabetes (RR=1.46; 1.13-1.88, p=0.004), and percent weight difference (RR=1.59; 1.27-2.00,

p<0.0001). Additionally, respondents who either currently smoke cigarettes (RR=1.72; 1.25-2.36, p=0.001) or who reported being a former smoker (RR=1.47; 1.14-1.89, p=0.003) had a significant increase in risk of CVD compared to non-smokers.

Discussion

We designed this study to compare the critical period model to the social mobility model, and lend legitimacy to the hypothesis that SES is an independent indicator of CVD. Our findings indicate that childhood middle class economic status confers a protective effect against CVD independent of adult economic status. Measured as childhood SES, adult net worth, or economic movement, these results consistently show that middle class SES consistently and significantly offers protection from incident CVD.

This study adds to the current body of literature on early-life socioeconomic status and late-life health. Using a nationally representative longitudinal data set from the Health and Retirement Study, we were able to establish an association between childhood SES and late-life CVD. We were also able to clarify the role childhood SES has on the causal pathway to CVD in relation its other risk factors. After controlling for childhood SES, the top tertile of peak net worth showed an (insignificant) increase in CVD risk. This trend may be evidence of the concurrent life cycle model which hypotheses that current economic conditions dictate current health, and runs counter to the early life models. It is also the first indication of SES as an independent risk factor of CVD. Using information from several areas of interest (demography, health, financial, family, labor force), we analyzed and controlled for appropriate confounding variables, which permitted the investigators to make more accurate conclusions. This study also confirmed the formative findings of investigations into risk factors of coronary heart disease.

Despite these advantages, this study had several limitations. First, compared to the overall sample population of 19,132, only 6,512 were included in the final multivariate model. This occurred because of the reduced number of respondents who provided information on childhood SES and the covariates of

interest. Second, compared to the multitude of questions concerning adult SES, information regarding childhood SES was based on a single question, and potentially be subject to recall bias. Third, even with the number of questions designed to assess net worth, there is still the possibility of measurement error. Moreover, if changes to other risk factors of CVD have an association with SES, then misclassification of the exposure may be present, weaken the association between a risk factor and CVD and in turn, weaken the association between SES and CVD.

Future investigations into the life cycle models of SES and CVD should focus on better collection of early life economic circumstances and include mid-life health economic and health information so addition models can be scrutinized. Additionally, inclusion of social aspects of life, specifically as it relates to family in both early and mid-to-late life, may eliminate the inconsistencies seen in the dose-response within economic groups.

Table 4.1. Characteristics of adults 50 years and older by childhood socioeconomic status in the 2006-2012 Health and Retirement Study

Childhood SES	**Poor**	**About Average**	**Well-Off**	**p-value[α]**
(N= 6,512) *	n (%)[γ]	n (%)[γ]	n (%)[γ]	
	2,061 (31.6)	3,769 (57.9)	682 (10.5)	
Baseline Characteristics				
BMI				<0.0001
Underweight	77 (47.8)	64 (39.8)	20 (12.4)	
Normal	401 (28.2)	834 (58.7)	185 (13.0)	
Overweight	683 (31.1)	1,293 (58.8)	221 (10.1)	
Obese	727 (34.1)	1,219 (57.1)	187 (8.8)	
Missing	173 (28.8)	359 (59.7)	69 (11.5)	
Cigarette smoking				<0.0001
Current	425 (32.4)	735 (56.1)	150 (11.5)	
Ever	195 (43.7)	186 (41.7)	65 (14.6)	
Never	225 (38.9)	285 (49.3)	68 (11.8)	
Missing	1,216 (29.1)	2,563 (61.4)	399 (9.6)	
Hypertension**				<0.0001
Normotensive	867 (29.4)	1,761 (59.7)	321 (10.9)	
Hypertensive	1,042 (34.4)	1,686 (55.7)	298 (9.9)	
Missing	152 (28.3)	322 (60.0)	63 (11.7)	
Diabetes***				<0.0001
Non-diabetic	1,443 (30.3)	2,826 (59.3)	496 (10.4)	
Diabetic	471 (38.5)	627 (51.2)	126 (10.3)	
Missing	147 (28.1)	316 (60.4)	60 (11.7)	
Physical activity				0.034
Any	1,845 (31.7)	3,364 (57.8)	610 (10.5)	
None	70 (40.5)	91 (52.6)	12 (6.9)	
Missing	146 (28.1)	314 (60.4)	60 (11.5)	
Health insurance				0.136
Any	1,271 (31.0)	2,410 (58.8)	417 (10.2)	
None	790 (32.7)	1,359 (56.3)	265 (11.0)	
Education level				<0.0001
≤ High school	1,202 (40.5)	1,556 (52.4)	213 (7.2)	
≥ College	713 (23.6)	1,901 (62.9)	409 (13.5)	
Missing	146 (28.2)	312 (60.2)	60 (11.6)	
Sex				0.254
Male	886 (30.7)	1,682 (58.3)	316 (11.0)	
Female	1,175 (32.4)	2,087 (57.5)	366 (10.1)	

Race				<0.0001
White	908 (26.5)	2,134 (62.2)	389 (11.3)	
Non-white	1,005 (39.3)	1,317 (51.5)	234 (9.2)	
Missing	148 (28.2)	318 (60.6)	59 (11.2)	
Age (years)				<0.0001
≤ 64 years	1,581 (30.4)	3,094 (59.4)	534 (10.2)	
≥ 65 years	335 (42.6)	363 (46.1)	89 (11.3)	
Missing	145 (28.1)	312 (60.5)	59 (11.4)	
Number of Losses				
None	69 (20.1)	231 (67.4)	43 (12.5)	
1-2	1,107 (30.4)	2,191 (61.9)	350 (9.4)	
3-4	739 (37.0)	1,032 (51.6)	229 (11.4)	
Missing	146 (28.0)	315 (60.5)	60 (11.5)	
Age at 1st Loss				p=0.004
≤ 12 years-old	96 (37.3)	137 (53.3)	24 (9.3)	
13-18 years-old	77 (37.6)	107 (52.2)	21 (10.2)	
19-29 years-old	227 (35.4)	362 (56.5)	52 (8.1)	
≥ 30 years-old	845 (29.3)	1,730 (60.0)	309 (10.7)	
Missing	816 (32.3)	1.433 (56.8)	276 (10.9)	
Follow up				
New CVD				<0.0001
Yes	152 (41.5)	170 (46.5)	44 (12.2)	
No	1,909 (31.1)	3,599 (58.5)	638 (10.4)	

Note: Data provided in this table represents responses from the study population during the first interview year of the Health & Retirement Study.

* α: p-value based on differences in proportion (Chi-square test statistic);

*Based on responses to cardiovascular health, economic status during childhood.

** Hypertension was assessed through self-report and three successive blood pressure readings (blood pressure ≥ 140/90 mmHg). Variable collapsed due to <5 in cells

*** Diabetes assessed through self-report and HbA1c biomarker reading of ≥ 6.1%. Variable collapsed due to <5 in cells

**** non-white collapses African-American, Hispanic, native American, and pacific islander

Abbreviations: BMI= body mass index- calculated from self-reported height and weight;

Variable collapsed due to <5 in cell; Low: <18.5 kg/m^2, Normal: 18.5 kg/m^2 – 24.9 kg/m^2, Overweight: 25 kg/m^2- 29 kg/m^2, Obese: ≥30 kg/m^2 ; Physical activity = any response other than"hardly or never" to questions: How often vigorous activity? How often moderate activity? How often mild activity? Response of "hardly or never" to all 3 questions=none.

Respondents were categorized with health insurance if they had Medicare, Medicaid, ChampUs, or private health insurance.

Age at first loss on the reported year for first parent death relative to the year the respondent was born.

Table 4.2 Full multivariate regression models of incident CVD childhood SES, and adult SES : HRS 2006-2012 (N=6,512)

	Unadjusted Association (I) Relative Risk (95% CI, p value)	**Adjusted Association (II)* Relative Risk (95% CI, p value)**	**Adjusted Association (III)** Relative Risk (95% CI, p value)**	**Adjusted Association (IV)*** Relative Risk (95% CI, p value)**
Childhood SES				
Well Off	0.87 (0.61-1.22, p= 0.4)	0.92 (0.64-0.1.32, p=0.6)	1.01 (0.69-1.47, p= 0.9)	1.27 (0.77- 2.12, p= 0.3)
About Average	0.59 (0.47-0.74, p<0.0001)	0.67 (0.53-0.85, p=0.001)	0.74 (0.58-0.95, p= 0.02)	0.77 (0.54-1.08, p= 0.1)
Poor (reference)	1.00	1.00	1.00	1.00
Absolute net worth (in tertiles)				
Top	1.19 (1.08-1.32, p=0.001)	1.29 (0.97-1.73, p=0.08)	0.95 (0.69-1.32, p=0.8)	0.89 (0.54-1.44, p= 0.6)
Middle	0.88 (0.79-0.98, p=0.02)	0.80 (0.62-1.05, p=0.1)	0.65 (0.49-0.87, p=0.003)	0.53 (0.36-0.79, p=0.002)
Low	1.00	1.00	1.00	1.00

* Adjusted for age, gender, race, education, and adult peak net worth

** Adjusted for hypertension, diabetes, weight difference, physical activity, smoking status, health insurance status

*** Adjusted for age at first loss and number of losses

Table 4.3 Final regression model of incident CVD, childhood SES, and significant covariates: HRS 2006-2012 (N=6,512)

	Adjusted Association (V)* Relative Risk	95% Confidence Intervals	p-value
Childhood SES			
Top	0.98	0.68-1.42	0.9
Middle	0.73	0.57-0.93	0.011
Low (reference)	1.00		
Adult peak pet worth			
Top	0.88	0.64-1.21	0.4
Middle	0.63	0.47-0.83	0.001
Bottom (reference)			
Age (≥65 years)	3.38	2.63-4.34	<0.0001
Race (Non-white)	0.69	0.54-0.89	0.005
Hypertension	2.12	1.64-2.75	<0.0001
Diabetes	1.46	1.13-1.88	0.004
Weight difference (>5%)	1.59	1.27-2.00	<0.0001
Smoking Status			
Quit	1.47	1.14-1.89	0.003
Current	1.72	1.25-2.36	0.001
Health insurance status (Any)	2.12	1.54-2.94	<0.0001

*Final model created using backward stepwise elimination.

CHAPTER 5
SUMMARY

Summary of Results

We conducted three observational studies which yielded several noteworthy results. The cross-sectional study set to confirm results from other studies investigating risk factors of cardiovascular disease, and establish a baseline from which a longitudinal analysis could begin. Prevalence data suggests an inverse association between cardiovascular disease (CVD) and net worth quintile. Results of multiple logistic regression analyses indicate increases to net worth reduces the odds of diagnosis of stroke with accompanying heart disease after adjusting for demographic and health covariates. The fourth and top quintiles showed a reduction in the odds of any CVD diagnosis by 32% and 38% respectively. Respondents in the top quintile also had lower odds of CHF (OR=0.57; 0.40-0.81, p=0.002) and angina (OR=0.58; 0.43-0.79, p<0.0001). A diagnosis of hypertension has the strongest association with CVD, increasing the odds of developing any CVD (OR=2.25; 1.92-2.63, p<0.0001), and stroke with (OR=2.53; 1.99-3.21, p<0.0001) or without (OR=2.07; 1.32-3.25, p=0.002) comorbid heart disease. Conversely, physical activity was protective and showed a significant decrease in the odds for the same outcomes: any CVD (OR=0.42; 0.31-0.58, p<0.0001), stroke with heart disease (OR=0.45; 0.32-0.64, p<0.0001), and stroke without heart disease (OR=0.40; 0.21-0.76, p=0.005).

The longitudinal analysis switched the focus from absolute net worth to economic movement in an effort to better understand the mechanisms the drive the association between SES and CVD represented by the social mobility life-cycle model. Results of the regression models show that respondents who grew up middle class and maintained middle class economic status as an adult (middle-middle) displayed a consistent protective effect on CVD risk. Moreover, respondents with an affluent childhood who experienced downward economic mobility (high-low) also had a significant protective effect, while the low-high group demonstrated an increase in risk of CVD in terms of cumulative incidence,

but not incidence rate. These associations maintained statistical significance after adjusting for demographic and health indicators like hypertension and diabetes were introduced into the model. The effect of social mobility on CVD suggests that while economic movement may play a role in CVD outcomes, it may be that this effect may be a result of specific timing rather than economic fluctuation, and the critical-period model may be a more appropriate model. This conclusion may be biased by an underpowered high-high and low-high economic mobility groups. Future studies should ensure each group has sufficient power in order to obtain the most accurate results. Furthermore, this study focused on extreme economic mobility (low-high & high-low). It is possible that the addition of incremental movement (example: low-middle) could provide more evidence of a particular life-cycle model.

A second longitudinal study turned focused on an alternative early life cycle model of SES and health. This investigation looked into the critical period life cycle model which purports that there is a critical timeframe (thought to be early in life) through which SES exerts its effect on cardiovascular health. An association was seen among respondents who identified their childhood socioeconomic status as "about average" and incident CVD (RR=0.73; 0.57-0.93, p=0.01) when compared to respondents who identified their childhood SES as "poor". This association occurred at each in each model iteration, and was independent of peak net worth in adulthood. The middle tertile of peak net worth in adulthood also reduced the risk of incident CVD by 37% after adjusting for demographics, health indicators, and childhood SES (RR= 0.63; 0.47-0.83, p= 0.001). Adults over the age of 65 (RR= 3.38; 2.63-4.34, p<0.0001), respondents with a diagnosis of hypertension, (RR=2.12; 1.64-2.75, p<0.0001), and current smokers (RR= 1.72; 1.25-2.36, p=0.001), had the strongest associations with incident CVD. Additionally, those respondents with a weight difference over 5% had a 59% increase in risk of CVD (RR=1.59; 1.27-2.00, p<0.0001). While significant, these results do not point to an absolute pathway by which SES exercises its effect on health, and necessitates further investigation.

Future Directions

In order to properly understand how SES affects CVD later in life, it will be important to collect information all along the life course. Although HRS captures large amounts of data from a large sample, it is hindered by its focus on near-retired and retired persons. What data is collected for childhood SES relies solely on respondents' recall of the past. Furthermore, those questions are not asked of every individual, so the ability to make comparisons at both points in time are reduced. The design of HRS eliminates two of the four life cycle models. To test the accumulation of risk model, investigators would need information on SES and health during the middle years of life as well. To properly test the trajectory pathway model, investigators would also need mid-life data in order to see if late-life risk of disease in mediated or transmitted through SES at each life stage.

Pioneering studies from Framingham and Whitehall established clear risk factors of heart disease, but the picture risk is far from complete. Determining whether SES acts as an independent risk factor of cardiovascular health warrants continued investigation. Our findings indicate that childhood middle class economic status confers a protective effect against CVD independent of adult economic status, as does middle class stability in terms of social mobility. Measured as childhood SES, adult net worth, or economic movement, our results show that middle class SES consistently and significantly offers protection from incident CVD. While promising, it only represents a step toward confirming that SES is an independent risk factor of CVD. If SES is an antecedent of a known risk factor for CVD, that is, if SES is a component in the development of other risk factors, then it could still be classified as an independent risk factor in the presence of confounding variables.

Using HRS for secondary data analyses can be more fruitful with each successive wave. Future studies can use data from further back in time while waiting for future waves' data. The downside to this is the loss of biomarker data. Instead of exclusively using data from HRS, future studies could incorporate

additional data sets like the National Longitudinal Study of Adolescent to Adult Health (Add Health), or National Social Life, Health and Aging Project (NSHAP), in order to cast a wider net as it pertains to family, health, and economics over the course of the life span.

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Appendix A: Biomarker indication levels*

Diabetes Diagnosis	Hemoglobin A1c level
Normal	below 5.7 percent
Prediabetes	5.7 to 6.4 percent
Diabetes	6.5 percent or above
cystatin C category	Cystatin C normal range
Males 50-59 years	0.72-1.32 mg/L
Males 60-69 years	0.77-1.42 mg/L
Males 70-79 years	0.82-1.52 mg/L
Females 50-59 years	0.64-1.17 mg/L
Females 60-69 years	0.66-1.26 mg/L
Females 70-80 years	0.68-1.36 mg/L
Females 81-86 years	0.70-1.45 mg/L
Hypertension Diagnosis	Blood pressure reading
Normal	<120 / < 80 mmHg
Prehypertension	80-89 / 120-139 mmHg
Hypertension	>90 / >140 mmHg
Total Cholesterol category	Total cholesterol level
Desirable	Less than 200 mg/Dl
Borderline high	200–239 mg/Dl
High	240 mg/dL and higher
HDL Cholesterol category	HDL cholesterol level
Risk factor for heart disease	Less than 40 mg/dL
Good	40–59 mg/Dl
Protective against heart disease	60 mg/dL and higher
C reactive protein category	C reactive protein level
Low risk	Less than 1.0 mg/L
Average risk	1.0-3.0 mg/L
High risk	Greater than 3.0 mg/L
Body Mass Index category†	BMI range
Low	Less than 18.5 kg/m^2
Normal	18.5 kg/m^2-25 kg/m^2
Overweight	25 kg/m^2-29 kg/m^2
Obese	Greater than 30 kg/m^2

*Reference ranges from the National Library of Medicine and the National Institutes of Health

† Reference ranges from the National Heart, Lung and Blood Institute

Appendix B- Supplemental tables

Crude odds ratio (95% confidence intervals) for selected covariates by wealth quintile w/o CVD*

	Bottom Quintile	2nd Quintile	3rd Quintile	4th Quintile	Top Quintile
Age >64 years	1.00	1.14 (0.98, 1.32)	0.60 (0.52, 0.69)	0.57 (0.49, 0.65)	0.66 (0.58, 0.75)
p-value		0.08	<0.00001	<0.00001	<0.00001
Gender	1.00	1.22 (1.04, 1.42)	1.57 (1.35, 1.82)	1.71 (1.47, 1.98)	1.84 (1.60, 2.10)
p-value		0.01	<0.00001	<0.00001	<0.00001
Race: Black	1.00	0.54 (0.45, 0.64)	0.27 (0.22, 0.32)	0.17 (0.14, 0.20)	0.46 (0.38, 0.58)
p-value		<0.00001	<0.00001	<0.00001	<0.00001
Race: Other**	1.00	0.59 (0.49, 0.70)	0.32 (0.27, 0.39)	0.18 (0.14, 0.21)	0.11 (0.09, 0.13)
p-value		<0.00001	<0.00001	<0.00001	<0.00001
Job prestige	1.00	1.04 (0.81, 1.33)	1.71 (1.33, 2.19)	2.65 (2.06, 3.42)	7.65 (5.97, 9.78)
p-value		0.77	<0.00001	<0.00001	<0.00001
Education	1.00	1.04 (0.88, 1.24)	1.82 (1.55, 2.14)	3.14 (2.68, 3.68)	5.87 (5.07, 6.70)
p-value		0.62	<0.00001	<0.00001	<0.00001
Hypertension	1.00	0.86 (0.75, 0.99)	0.74 (0.64, 0.85)	0.70 (0.61, 0.81)	0.59 (0.52, 0.66)
p-value		0.04	<0.00001	<0.00001	<0.00001
Diabetes	1.00	0.88 (0.74, 1.04)	0.75 (0.63, 0.89)	0.61 (0.51, 0.72)	0.43 (0.37, 0.50)
p-value		0.12	0.0006	<0.00001	<0.00001
Physical Activity	1.00	1.55 (1.24, 1.93)	3.20 (2.46, 4.17)	4.21 (3.19, 5.58)	5.19 (4.11, 6.56)
p-value		0.0001	<0.00001	<0.00001	<0.00001
Self-rated health	1.00	1.17 (1.00, 1.37)	2.04 (1.74, 2.38)	2.86 (2.45, 3.33)	4.60 (4.00, 5.30)
p-value		0.05	<0.00001	<0.00001	<0.00001

BMI	1.00	0.98 (0.84, 1.15)	1.00 (0.85, 1.16)	0.96 (0.82, 1.12)	0.63 (0.55, 0.72)
p-value		0.82	0.97	0.58	<0.00001
Smoking	1.00	1.00 (0.87, 1.15)	1.13 (0.98, 1.30)	1.11 (0.97, 1.28)	0.89 (0.79, 1.01)
p-value		0.99	0.09	0.12	0.07

Outcome variable AnyCVD=0; Age: 50-64 years old=0; Gender: Female=0; w/o hypertension=0; w/o diabetes=0; no physical activity=0; good-excellent self-rated heath=0; BMI normal/overweight=0; low job prestige=0; high school or less education=0; race: white=0; never smoking=0. ** Other race includes Hispanic,

Asian, Native American and pacific islanders.

Crude odds ratio (95% confidence intervals) for selected covariates by CVD status in respondents' w/o wealth*

	Any CVD	p-value
Age >64 years	1.97 (1.59, 2.44)	<0.00001
Gender	1.03 (0.84, 1.26)	0.78
Race: Black	0.93 (0.75, 1.14)	0.51
Race: Other	0.56 (0.43, 0.71)	<0.00001
Job prestige	0.79 (0.56, 1.14)	0.20
Education	0.70 (0.54, 0.88)	0.002
Hypertension	2.41 (1.97, 2.96)	<0.00001
Diabetes	1.94 (1.59, 2.37)	<0.00001
Physical Activity	0.35 (0.28, 0.45)	<0.00001
Self-rated health	0.31 (0.23, 0.43)	<0.00001
BMI	1.11 (0.98, 1.36)	0.28
Smoking	1.20 (1.00, 1.44)	0.05

Exposure variable HRSWealthQuintiles= 4(Bottom); Age: 50-64 years old=0; Gender: Female=0; w/o hypertension=0; w/o diabetes=0; no physical activity=0; good-excellent self-rated heath=0; normal/overweight=0; low job prestige=0; high school or less education=0; race: white=0; never smoking=0.

Crude vs. adjusted odds ratios (95% CI) with magnitude of for selected covariates

	2nd Quintile	3rd Quintile	4th Quintile	Top Quintile
Age				
Crude	1.02 (0.91, 1.15)	0.75 (0.66, 0.84)	0.65 (0.58, 0.74)	0.61 (0.55, 0.68)
Adjusted	1.00 (0.89, 1.12)	0.81 (0.72, 0.91)	0.72 (0.63, 0.81)	0.65 (0.59, 0.73)
M-H X^2 p-value	0.97	<0.00001	<0.00001	<0.00001
Magnitude*	2%	-7.4%	-9.7%	-6.1%
Gender				
Crude	1.02 (0.91, 1.15)	0.75 (0.66, 0.84)	0.65 (0.58, 0.74)	0.61 (0.55, 0.68)
Adjusted	1.01 (0.90, 1.14)	0.72 (0.64, 0.81)	0.62 (0.55, 0.71)	0.55 (0.50. 0.62)
M-H X^2 p-value	0.82	<0.00001	<0.00001	<0.00001
Magnitude	1%	4.2%	4.8%	3.3%
Race: Black				
Crude	0.99 (0.87, 1.13)	0.70 (0.61, 0.80)	0.60 (0.52, 0.68)	0.55 (0.49, 0.62)
Adjusted	0.95 (0.84, 1.09)	0.67 (0.58, .077)	0.54 (0.47, 0.63)	0.53 (0.46, 0.61)
M-H X^2 p-value	0.5	<0.00001	<0.00001	<0.00001
Magnitude	4.2%	4.5%	11.1%	3.8%
Race: Other**				
Crude	1.13 (0.98, 1.30)	0.81 (0.70, 0.94)	0.72 (0.63, 0.83)	0.64 (0.57, 0.73)
Adjusted	1.06 (0.92, 1.22)	0.72 (0.63, 0.84)	0.62 (0.53, 0.72)	0.54 (0.47, 0.62)
M-H X^2 p-value	0.44	<0.00001	<0.00001	<0.00001
Magnitude	6.6%	12.5%	16.1%	18.5%
Education				
Crude	1.02 (0.91, 1.15)	0.75 (0.66, 0.84)	0.65 (0.58, 0.74)	0.61 (0.55, 0.68)
Adjusted	1.03 (0.92, 1.15)	0.78 (0.68, 0.86)	0.70 (0.62, 0.80)	0.67 (0.60, 0.75)
M-H X^2 p-value	0.63	<0.00001	<0.00001	<0.00001
Magnitude	-1%	-3.8%	-7.1%	-8.9%

Job prestige				
Crude	1.17 (0.94, 1.46)	0.97 (0.78, 1.21)	0.80 (0.65, 1.00)	0.77 (0.63, 0.94)
Adjusted	1.17 (0.95, 1.46)	0.99 (0.79, 1.22)	0.84 (0.67, 1.05)	0.83 (0.67, 1.02)
M-H X^2 p-value	0.14	0.91	0.12	0.08
Magnitude	0%	-2%	-4.8%	-7.2%
Hypertension				
Crude	1.02 (0.91, 1.15)	0.75 (0.66, 0.84)	0.65 (0.58, 0.74)	0.61 (0.55, 0.68)
Adjusted	1.05 (0.94, 1.18)	0.79 (0.70, 0.90)	0.70 (0.62, 0.80)	0.68 (0.61, 0.76)
M-H X^2 p-value	0.39	0.0002	<0.00001	<0.00001
Magnitude	-2.8%	-5%	-7.1%	-10.3%
Diabetes				
Crude	1.02 (0.91, 1.15)	0.75 (0.66, 0.84)	0.65 (0.58, 0.74)	0.61 (0.55, 0.68)
Adjusted	1.04 (0.93, 1.17)	0.78 (0.69, 0.88)	0.70 (0.62, 0.79)	0.67 (0.60, 0.75)
M-H X^2 p-value	0.48	<0.00001	<0.00001	<0.00001
Magnitude	-1.9%	-3.84%	-7.14%	-10.3%
Physical Activity				
Crude	1.02 (0.91, 1.15)	0.74 (0.66, 0.84)	0.65 (0.58, 0.74)	0.61 (0.55, 0.68)
Adjusted	1.09 (0.97, 1.23)	0.86 (0.76, 0.97)	0.77 (0.68, 0.87)	0.73 (0.65, 0.82)
M-H X^2 p-value	0.13	0.017	<0.00001	<0.00001
Magnitude	-6.4%	-13.9%	-15.6%	-16.4%
Self-rated health				
Crude	1.02 (0.91, 1.15)	0.74 (0.66, 0.84)	0.65 (0.58, 0.74)	0.61 (0.55, 0.68)
Adjusted	1.05 (0.93, 1.18)	0.86 (0.76, 0.97)	0.81 (0.72, 0.92)	0.88 (0.79, 0.99)
M-H X^2 p-value	0.39	0.014	0.001	0.03
Magnitude	-2.8%	-13.9%	-19.7%	-30.7%

BMI				
Crude	1.02 (0.90, 1.15)	0.75 (0.66, 0.84)	0.65 (0.57, 0.73)	0.60 (0.54, 0.67)
Adjusted	1.02 (0.91, 1.14)	0.75 (0.66, 0.84)	0.65 (0.57, 0.73)	0.60 (0.54, 0.67)
M-H X^2 p-value	0.76	<0.00001	<0.00001	<0.00001
Magnitude	0%	0%	0%	0%
Smoking				
Crude	1.02 (0.91, 1.15)	0.74 (0.66, 0.84)	0.65 (0.57, 0.73)	0.61 (0.54, 0.67)
Adjusted	1.02 (0.91, 1.14)	0.74 (0.65, 0.83)	0.64 (0.57, 0.73)	0.61 (0.55, 0.68)
M-H X^2 p-value	0.75	<0.00001	<0.00001	<0.00001
Magnitude	0%	0%	0%	0%

In this table, we have compared the crude odds ratio to the adjusted odds ratio along with the Mantel-Haenszel chi-square test. The magnitude refers to the difference between the crude and adjusted odds ratios. A magnitude of 10% or more identify the covariate as a potential confounder.

Age, gender, race, and education all show significant odds ratios ($p<0.00001$) in the third, fourth, and top quintiles, however race (white vs. black & white vs. other) meet the 10% crude/adjusted cut-point identifying the covariate as a potential confounder. Although only demonstrated in the top quintile, hypertension and diabetes also meet the criteria as potential confounders. Self-rated health and physical activity were also identified as potential confounding variables.

Stratum specific odds ratios (95% confidence intervals) for the effect of wealth on CVD

	2nd Quintile	3rd Quintile	4th Quintile	Top Quintile
Age				
50-64-years	0.93 (0.73, 1.19)	0.67 (0.53, 0.85)	0.56 (0.44, 0.71)	0.44 (0.36, 0.55)
65+ years	1.02 (0.89, 1.18)	0.87 (0.75, 1.00)	0.79 (0.68, 0.91)	0.73 (0.65, 0.83)
BD Homogeneity	0.47	0.66	0.014	0.0001
Gender				
Female	0.94 (0.81, 1.08)	0.63 (0.54, 0.74)	0.54 (0.46, 0.63)	0.44 (0.38, 0.51)
Male	1.18 (0.96, 1.46)	0.92 (0.75, 1.13)	0.81 (0.66, 0.99)	0.82 (0.68, 0.99)
BD Homogeneity	0.07	0.003	0.002	<0.00001
Race				
White	1.06 (0.89, 1.26)	0.72 (0.60, 0.85)	0.61 (0.52, 0.72)	0.54 (0.46, 0.63)
Black	0.80 (0.64, 1.00)	0.56 (0.42, 0.73)	0.37 (0.26, 0.51)	0.50 (0.35, 0.71)
Other	1.05 (0.80, 1.37)	0.75 (0.55, 1.02)	0.65 (0.45, 0.94)	0.55 (0.39, 0.76)
BD Homogeneity	0.12	0.22	0.01	0.93
Job prestige				
Low	1.06 (0.76, 1.47)	0.87 (0.61, 1.23)	0.81 (0.55, 1.17)	0.80 (0.55, 1.16)
High	1.29 (0.95 (1.75)	1.08 (0.81, 1.21)	0.86 (0.65, 1.15)	0.84 (0.65, 1.10)
BD Homogeneity	0.37	0.33	0.76	0.8
Education				
High School or less	1.00 (0.87, 1.13)	0.72 (0.63, 0.83)	0.69 (0.59, 0.79)	0.64 (0.56, 0.73)
College/Graduate	1.18 (0.90, 1.55)	0.93 (0.72, 1.21)	0.76 (0.59, 0.98)	0.76 (0.60, 0.96)
BD Homogeneity	0.26	0.09	0.5	0.18
Hypertension				
No	1.01 (0.82, 1.25)	0.77 (0.62, 0.95)	0.71 (0.57, 0.88)	0.77 (0.58, 0.84)
Yes	1.07 (0.93, 1.24)	0.81 (0.69, 0.94)	0.70 (0.60, 0.82)	0.67 (0.59, 0.77)
BD Homogeneity	0.64	0.67	0.92	0.78
Diabetes				
No	1.05 (0.91, 1.21)	0.79 (0.68, 0.91)	0.69 (0.59, 0.79)	0.68 (0.60, 0.78)

Yes	1.02 (0.82, 1.27)	0.76 (0.60, 0.95)	0.72 (0.57, 0.91)	0.64 (0.52, 0.80)
BD Homogeneity	0.82	0.77	0.73	0.65
Physical Activity				
None	1.05 (0.79, 1.39)	0.93 (0.66, 1.31)	1.01 (0.71, 1.46)	0.88 (0.65, 1.20)
Any	1.10 (0.97, 1.26)	0.85 (0.74, 0.97)	0.74 (0.64, 0.85)	0.71 (0.63, 0.80)
BD Homogeneity	0.74	0.60	0.09	0.17
Self-rated health				
Good-Excellent	1.03 (0.91, 1.18)	0.84 (0.74, 0.97)	0.81 (0.70, 0.94)	0.90 (0.79, 1.01)
Fair-Poor	1.16 (0.84, 1.61)	0.92 (0.67, 1.26)	0.83 (0.61, 1.13)	0.81 (0.62, 1.09)
BD Homogeneity	0.51	0.62	0.9	0.53

In order to assess effect measure modification, we used a cut off of 0.2 for the Breslow-Day test for homogeneity across covariate stratum specific odds ratios. We found qualitative effect modification (stratum specific odds ratios are on both sides of 1) for gender and race in the second quintile, as well as physical activity in the 4th quintile. We found potential age effect modification in the 4th and top quintile, effect modification by gender in the 3rd, 4th, and top quintiles, race in the 4th quintile, and education in the 3rd and top quintiles. Physical activity is a potential effect modifier in the 4th and top quintile. Ever smoking is also an effect modifier in the top quintile.

Appendix C: Sample regression equation

Model III (Table 2.4) regression equation*

$$\ln\left[\frac{P(CVD)}{1-P(CVD)}\right] = \text{-1.007216 – 0.1025677(2}^{\text{nd}}\text{ Quintile) - 0.1575207(3}^{\text{rd}}\text{ Quintile) - 0.3628763 (4}^{\text{th}}\text{ Quintile)}$$

-0.46236(Top Quintile) + 0.6265182(Age ≥ 65 years) + 0.2133493(Male) - 0.3677588(White) - 0.1569801(High school degree) - 0.0354064(College degree) - 0.2605635(Graduate degree) + 0.8126261(hypertensive) + 0.5358438(diabetic) + 0.2691588(BMI Normal) + 0.1505462(BMI Overweight) + 0.0060147(BMI Obese) - 0.8663934(physically active) + 0.1096384 (Health insured) + 0.2203356(Ever smoker) + 0.3413179(Current smoker) - 0.3788303(Normal total cholesterol level) - 0.5516751(High total cholesterol level)

*The other dependent variables, stroke with CVD, stroke without CVD, congestive heart failure, angina and myocardial infarction can be substituted for 'Y' in the above model to obtain the odds ratios seen in Table 2

Sample Size Determination

For the prevalence study, we determined that a sample size of at least 384 respondents were necessary to reject the null hypothesis with a Type I error probability of 0.05 and an absolute precision, defined as the half-length of the confidence interval, of 5 percentage points. This sample size will afford a 95% confidence interval of width 0.10. In order to obtain the appropriate sample size, we used Kish's formula (71):

$$n = (Z_{1-\alpha})^2 \left(\frac{P(1-P)}{D^2}\right)$$

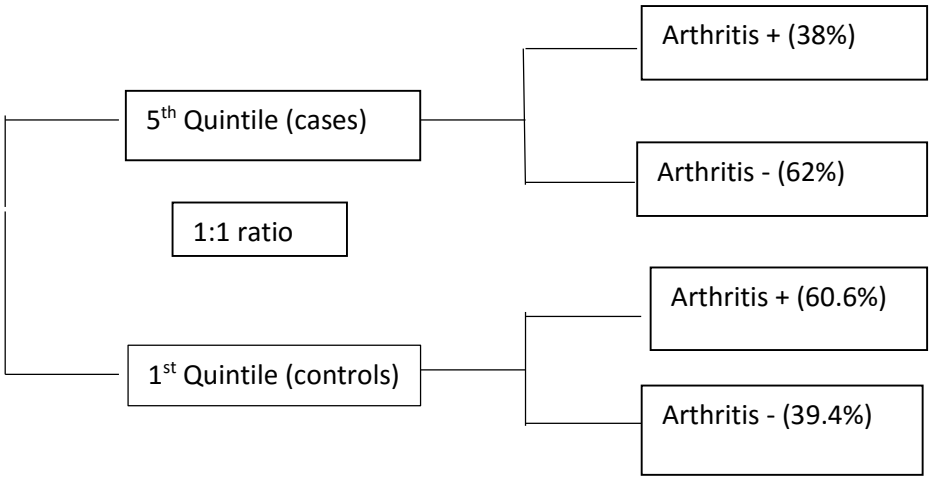
Based on the CDC's report on chronic disease in the United States (10), the prevalence for adults with at least one chronic disease in the United States is 49.8% (defined as 'P' in the equation). Using an absolute precision of 5 percentage points (defined as 'D' in the equation), the true value of prevalence is between

44.8% - 54.8%.

$$384 = 1.96^2 \, x \, (\frac{0.498(0.502)}{0.0025})$$

Since there is a paucity of literature focusing on how economic mobility affects the risk of developing chronic disease, we determined the sample size for this study using published data from the 2006 HRS survey of 55-64 year-olds (72). The upper most quintile of economic wealth served as cases and the lowest quintile of economic wealth were controls. Arthritis was a proxy for chronic disease because it is the most common in the United States.

Sample Size Justification for a Case-Control Study



The minimum sample size for this study is 170 respondents using 95% confidence intervals with an associated power of 80%. The equation for sample size determination of a case-control study comes from biostatistician JL Fleiss (59):

$$P = \frac{0.606 + (1 * \ 0.38)}{1 + 1} = 0.493$$

$$Q = 1 - 0.493 = 0.507$$

$$m` = \frac{1.96\sqrt{(1+1) * 0.493 * 0.507} - (-0.842)\sqrt{(1 * 0.606 * 0.394 + (0.38 * 0.62)}}{1 * (0.38 - 0.606)^2} =$$

$$m` = \frac{3.064}{0.051076} = 75.6522$$

$$m = \frac{75.6522}{4} * (1 + \sqrt{1 + \frac{2 * (1+1)}{75.6522 * 1 * .226}})^2$$

$$m = 18.91305 * 1 + \sqrt{1 + \frac{4}{17.0974}} = 84.27$$

$$m = n_1 = 85$$

$$n_2 = r * m = 1 * 85;\ n_1 + n_2 = 170$$

Appendix D: Stata codes for Cross sectional, and regression analyses

2006 Stata Coding

Age Variables

KA019 R CURRENT AGE CALCULATION

```
rename (KA019)(R2006AGE)
gen ragecat=.
replace ragecat=0 if R2006AGE <50
replace ragecat =1 if R2006AGE >=50 & R2006AGE <=54
replace ragecat =2 if R2006AGE >=55 & R2006AGE <=59
replace ragecat =3 if R2006AGE >=60 & R2006AGE <=64
replace ragecat =4 if R2006AGE >=65 & R2006AGE <=69
replace ragecat =5 if R2006AGE >=70 & R2006AGE <=74
replace ragecat =6 if R2006AGE >=75 & R2006AGE <=79
replace ragecat =7 if R2006AGE >=80 & R2006AGE <=84
replace ragecat =8 if R2006AGE >=85 & R2006AGE <.
label variable ragecat “categorical age of Respondent”
label define RAGECAT 0 “Under 50 years”, modify
label define RAGECAT 1 “50-54 years”, modify
label define RAGECAT 2 “55-59 years”, modify
label define RAGECAT 3 “60-64 years”, modify
label define RAGECAT 4 “65-69 years”, modify
label define RAGECAT 5 “70-74 years”, modify
label define RAGECAT 6 “75-79 years”, modify
label define RAGECAT 7 “80-84 years”, modify
label define RAGECAT 8 “85+ years”, modify
label values ragecat RAGECAT
```

KAGE AGE AT 2006 INTERVIEW

```
replace ragecat=0 if KAGE <50
replace ragecat =1 if KAGE >=50 & KAGE <=54
replace ragecat =2 if KAGE >=55 & KAGE <=59
replace ragecat =3 if KAGE >=60 & KAGE <=64
replace ragecat =4 if KAGE >=65 & KAGE <=69
replace ragecat =5 if KAGE >=70 & KAGE <=74
replace ragecat =6 if KAGE >=75 & KAGE <=79
replace ragecat =7 if KAGE >=80 & KAGE <=84
replace ragecat =8 if KAGE >=85 & KAGE <.
```

UA019 R CURRENT AGE CALCULATION

replace ragecat=0 if UA019 <50
replace ragecat =1 if UA019 >=50 & UA019 <=54
replace ragecat =2 if UA019 >=55 & UA019 <=59
replace ragecat =3 if UA019 >=60 & UA019 <=64
replace ragecat =4 if UA019 >=65 & UA019 <=69
replace ragecat =5 if UA019 >=70 & UA019 <=74
replace ragecat =6 if UA019 >=75 & UA019 <=79
replace ragecat =7 if UA019 >=80 & UA019 <=84
replace ragecat =8 if UA019 >=85 & UA019 <.

Race/Ethnicity Variables

KB028 R HISPANIC/LATINO
gen rhispaniclatino=.
replace rhispaniclatino=0 if KB028==5
replace rhispaniclatino=1 if KB028==1
label var rhispaniclatino “Respondent is Hispanic/Latino”
label define RHL 0 “No”, modify
label define RHL 1 “Yes”, modify
label values rhispaniclatino RHL

UB028 R HISPANIC/LATINO
replace rhispaniclatino=0 if UB028==5
replace rhispaniclatino=1 if UB028==1

KB089M1M R RACE - MULTIPLE RESPONSE -1 MASKED
gen resprace=.
replace resprace=0 if KB089M1M==1
replace resprace=0 if KB089M2M==1
replace resprace=0 if KB089M3M==1
replace resprace=1 if KB089M1M==2
replace resprace=1 if KB089M2M==2
replace resprace=1 if KB089M3M==2
replace resprace=2 if rhispaniclatino==1
replace resprace=3 if KB089M1M==97
replace resprace=3 if KB089M2M==97
replace resprace=3 if KB089M3M==97
label var resprace “Race of the Respondent”
label define RESPRACE 0 “White/Caucasian”, modify
label define RESPRACE 1 “Black/African American”, modify
label define RESPRACE 2 “Hispanic/Latino, modify
label define RESPRACE 3 “American Indian/Alaskan Native/Pacific Islander”, modify
label values resprace RESPRACE

UB089M1M R RACE -1- MASKED
UB089M2M R RACE -2- MASKED
UB089M3M R RACE -3- MASKED

replace resprace=0 if UB089M1M==1
replace resprace=0 if UB089M2M==1
replace resprace=0 if UB089M3M==1
replace resprace=1 if UB089M1M==2
replace resprace=1 if UB089M2M==2
replace resprace=1 if UB089M3M==2
replace resprace=3 if UB089M1M==97
replace resprace=3 if UB089M2M==97
replace resprace=3 if UB089M3M==97
HISPANIC Hispanicity Type
replace resprace=3 if HISPANIC==1| HISPANIC==2| HISPANIC==3

RACE Race/Ethnicity
replace resprace=0 if RACE==1
replace resprace=1 if RACE==2

gen WhiteElse=.
replace WhiteElse=1 if resprace==0
replace WhiteElse=0 if resprace ==1| resprace ==2| resprace ==3
label var WhiteElse "White vs all other"
label define white 1 "White", modify
label define white 0 "All other races", modify
label values WhiteElse white

gen BlackElse=.
replace BlackElse =1 if resprace ==1
replace BlackElse =0 if resprace ==0| resprace ==2| resprace ==3
label var BlackElse "Black vs all other"
label define black 1 "Black", modify
label define black 0 "All other races", modify
label values BlackElse black

gen HispanicElse=.
replace HispanicElse =1 if resprace ==2
replace HispanicElse =0 if resprace ==0| resprace ==1| resprace ==3
label var HispanicElse "Hispanic vs all other"
label define hispanic 1 "Hispanic", modify
label define hispanic 0 "All other races", modify
label values HispanicElse hispanic

```
gen AmericanIndianElse=.
replace AmericanIndianElse =1 if resprace ==3
replace AmericanIndianElse =0 if resprace ==0| resprace ==1| resprace ==2
label var AmericanIndianElse "American Indians vs all other"
label define americanidians 1 "American Indians", modify
label define americanidians 0 "All other races", modify
label values AmericanIndianElse americanidians

gen raceWE=.
replace  raceWE=0 if resprace==0
replace  raceWE=1 if resprace>0 & resprace<.
label var raceWE "White vs. Non-white"
label define racewe 0 "White"
label define racewe 1 "Non-white", add
label values raceWE racewe
```

Gender Variables

KX060_R SEX OF INDIVIDUAL-UPDATED – R

```
gen Gender=.
replace Gender=0 if KX060_R==2
replace Gender=1 if KX060_R==1
label var Gender “Gender of R”
label define gender 0 “Female”, modify
labl define gender 1 “Male”, modify
label values Gender gender
```

GENDER Gender

```
replace Gender=0 if GENDER==2
replace Gender=1 if GENDER==1
```

UX060_R SEX OF INDIVIDUAL - RESPONDENT-UPDATED

```
replace Gender=0 if UX060_R==2
replace Gender=1 if UX060_R==1
```

R. Current Physical Health Variables

KC001 RATE HEALTH
gen ratehealth=.
replace ratehealth=0 if KC001==5
replace ratehealth=1 if KC001==4
replace ratehealth=2 if KC001==3
replace ratehealth=3 if KC001==2
replace ratehealth=4 if KC001==1
label var ratehealth “Respondent Self-Rated Health”
label define SRH 0 “Poor”, modify
label define SRH 1 “Fair”, modify
label define SRH 2 “Good”, modify
label define SRH 3 “Very Good”, modify
label define SRH 4 “Excellent”, modify
label values ratehealth SRH

gen SRH2=.
replace SHR2=0 if ratehealth<3
replace SRH2=1 if ratehealth>2 & ratehealth<.
label var SRH2 "Dichotomous SRH"
label define srh2 0 "Good to Excellent"
label define srh2 1 "Fair to Poor", add
label values SHR2 srh2

KC005 HIGH BLOOD PRESSURE
replace KC005=. if KC005>=8 & KC005<10
gen hypertension=.
replace hypertension=1 if KC005<=3
replace hypertension=0 if KC005>=4 & MC005<.
label var hypertension "current hypertension status of respondent"
label define hyper 1 “Hypertensive”, modify
label define hyper 0 “Non-Hypertensive”, modify
label values hypertension hyper

KZ101 PREV WAVE R HAS HIGH BLOODPRESSURE

replace hypertension=1 if KZ101==1 & hypertension !=0
replace hypertension=0 if KZ101==0 & hypertension !=1

UZ101 PREV WAVE R HAS HIGH BLOOD PRESSURE
replace hypertension=1 if UZ101==1 & hypertension !=0
replace hypertension=0 if UZ101==0 & hypertension !=1

KC006 BLOOD PRESSURE MEDICATION
replace KC006=. if KC006>=8 & KC006<10
gen hypermeds=.
replace hypermeds=1 if KC006<=3
replace hypermeds=0 if KC006>=4 & KC006<.
label var hypermeds "Respondent taking HTN Medication"
label define HYPERMED 1 “Yes”, modify
label define HYPERMED 0 “No”, modify
label values hypermeds HYPERMED

KC008 BLOOD PRESSURE UNDER CONTROL
replace KC008=. if KC008>=8 & KC008<10
gen hypercontrol=.
replace hypercontrol=1 if KC008==1
replace hypercontrol =0 if KC008==5
label var hypercontrol "Respondent HTN Under Control"
label define HYPERCONT 1 “Yes”, modify
label define HYPERCONT 0 “No”, modify
label values hypercontrol HYPERCONT

KHDLBIOS 2006 HDL Biosafe
rename(KHDLBIOS)(HDLBIOS2006)
replace HDLBIOS2006=0 if HDLBIOS2006>60 & HDLBIOS2006<.
replace HDLBIOS2006=1 if HDLBIOS2006>=50 & HDLBIOS2006<60| HDLBIOS2006>=40 &
HDLBIOS2006<50 & Gender==1
replace HDLBIOS2006=2 if HDLBIOS2006<50 & Gender==0| HDLBIOS2006<40 & Gender==1
label var HDLBIOS2006 “R HDL level 2006”
label define hdlbio06 0 “Protective”, modify
label define hdlbio06 1 “Normal”, modify
label define hdlbio06 2 “Risk Factor”, modify
label values HDLBIOS2006 hdlbio06

KHDL_ADJ 2006 NHANES equivalent HDL
rename(KHDl_ADJ)(HDLADJ2006)
replace HDLADJ2006=0 if HDLADJ2006>=60 & HDLADJ2006<.
replace HDLADJ2006=1 if HDLADJ2006>=40 & HDLADJ2006<60
replace HDLADJ2006=2 if HDLADJ2006<40
label var HDLADJ2006 “R Adjusted HDL level 2006”
label define hdladj06 0 “Protective”, modify
label define hdladj06 1 “Normal”, modify
label define hdladj06 2 “Risk Factor”, modify
label values HDLADJ2006 hdladj06

```
gen CatHDL=.
replace CatHDL=0 if KHDl_ADJ>=60 & KHDl_ADJ<.
replace CatHDL=1 if KHDl_ADJ>=40 & KHDl_ADJ<60
replace CatHDL=2 if KHDl_ADJ<40
label var CatHDL “Categorical R HDL level”
label define cathdl 0 “Protective”, modify
label define cathdl 1 “Normal”, modify
label define cathdl 2 “Risk factor”, modify
label values CatHDL cathdl
```

KTCBIOS 2006 TOTCHOL Biosafe

```
rename(KHDLBIOS)(TCBIOS2006)
replace TCBIOS2006=0 if TCBIOS2006<200
replace TCBIOS2006=1 if TCBIOS2006>=200 & TCBIOS2006<240
replace TCBIOS2006=2 if TCBIOS2006>=239 & TCBIOS2006<.
label var TCBIOS2006 “R Total cholesterol level 2006”
label define tcbio06 0 “Diserable”, modify
label define tcbio06 1 “Boderline”, modify
label define tcbio06 “High Risk”, modify
label values HDLBIOS2006 tcbio06
```

KTC_ADJ 2006 NHANES equivalent total cholesterol

```
rename(KTC_ADJ)(TCADJ2006)
replace TCADJ2006=0 if TCBIOS2006<200
replace TCADJ2006=1 if TCADJ2006>=200 & TCADJ2006<240
replace TCADJ2006=2 if TCADJ2006>=239 & TCADJ2006<.
label var TCADJ2006 “R Adjusted total cholesterol level 2006”
label define tcadj06 0 “Diserable”, modify
label define tcadj06 1 “Boderline”, modify
label define tcadj06 2 “High Risk”, modify
label values HDLADJ2006 tcadj06
```

```
gen CatTC=.
replace CatTC =0 if KTC_ADJ <200
replace CatTC =1 if KTC_ADJ >199 & KTC_ADJ <240
replace CatTC =2 if KTC_ADJ >239 & KTC_ADJ <.
label var CatTC “Categorical R TC level”
label define cattc 0 “Diserable”, modify
label define cattc 1 “Borderline”, modify
label define cattc 2 “High Risk”, modify
label values CatTC cattc
```

KC010 DIABETES
replace KC010=. if KC010>=8 & KC010<10
gen diabetes=.
replace diabetes=1 if KC010<=3
replace diabetes=0 if KC010>=4 & KC010<.
label var diabetes "current diabetes status of respondent"
label define DM 1 “Diabetic”, modify
label define DM 0 “Non-Diabetic”, modify
label values diabetes DM

KA1CBIOS 2006 A1C Biosafe
rename(KA1CBIOS)(A1CBIOS2006)
replace A1CBIOS2006=0 if A1CBIOS2006<5.7
replace A1CBIOS2006=1 if A1CBIOS2006>=5.7 & A1CBIOS2006<6.6
replace A1CBIOS2006=2 if A1CBIOS2006>6.5 & A1CBIOS2006<.
label var A1CBIOS2006 “R A1C level 2006”
label define ghbio06 0 “Normal”, modify
label define ghbio06 1 “Pre-diabetic”, modify
label define ghbio06 2 “Diabetic”, modify
label values A1CBIOS2006 ghbio06

KA1C_ADJ 2006 NHANES equivalent a1c
rename(KA1C_ADJ)(A1CADJ2006)
replace A1CADJ2006=0 if A1CADJ2006<5.7
replace A1CADJ2006=1 if A1CADJ2006>=5.7 & A1CADJ2006<6.6
replace A1CADJ2006=2 if A1CADJ2006>6.5 & A1CADJ2006<.
label var A1CADJ2006 “R Adjusted A1C level 2006”
label define ghadj06 0 “Normal”, modify
label define ghadj06 1 “Pre-diabetic”, modify
label define ghadj06 2 “Diabetic”, modify
label values A1CADJ2006 ghadj06

KCYSC_IMP 2006 CYSTATIN C (mg/L) - Measured and imputed values
rename(KCYSC_IMP)(CYSCIMP2006)
replace CYSCIMP2006=0 if CYSCIMP2006>0.56 & CYSCIMP2006<1.13
replace CYSCIMP2006=1 if CYSCIMP2006>0.54 & CYSCIMP2006<.
label var CYSCIMP2006 “R C Cystatin level 2006”
label define cysimp06 0 “Normal”, modify
label define cysimp06 1 “Abnormal”, modify
label values CYSCIMP2006 cysimp06

KCYSC_ADJ 2006 NHANES equivalent CystatinC
rename(KCYSC_ADJ)(CYSCADJ2006)
replace CYSCADJ2006=0 if CYSCADJ2006>0.56 & CYSCADJ2006<1.13
replace CYSCADJ2006=1 if CYSCADJ2006>0.54 & CYSCADJ2006<.
label var CYSCADJ2006 “R Adjusted C Cystatin level 2006”
label define cysadj06 0 “Normal”, modify
label define cysadj06 1 “Abnormal”, modify
label values CYSCADJ2006 cysadj06

gen CystatC=.
replace CystatC=0 if KCYSC_ADJ>0.54 & KCYSC_ADJ<1.19
replace CystatC=1 if KCYSC_ADJ>=1.19 & KCYSC_ADJ<.
replace CystatC=0 if KCYSC_ADJ<=0.55
label var CystatC “R Adjusted C Cystatin level 2006”
label define cystatc 0 “Normal”, modify
label define cystatc 1 “Abnormal”, modify
label values CystatC cystatc

KZ102 PREV WAVE R HAS DIABETES
replace diabetes=1 if KZ102==1 & diabetes!=0
replace diabetes =0 if KZ102==0 & diabetes!=1

UZ102 PREV WAVE R HAS DIABETES
replace diabetes=1 if UZ102==1 & diabetes!=0
replace diabetes =0 if UZ102==0 & diabetes!=1

KC011 SWALLOWED MEDICATION FOR DIABETES
KC012 TAKING INSULIN – DIABETES
replace KC011=. if KC011>=8 & KC011<10
replace KC012=. if KC012>=8 & KC012<10
gen DMmeds=.
replace DMmeds=1 if KC011==1|KC012==1
replace DMmeds=0 if KC011==5 & KC012==5
label var DMmeds “Respondent is being treated for DM”
label define DMM 1 “Yes”, modify
label define DMM 0 “No”, modify
label values DMmeds DMM

KC015 DIABETES UNDER CONTROL
replace KC015=. if KC015>=8 & KC015<10
gen DMcontrol=.
replace DMcontrol =1 if KC015==1
replace DMcontrol =0 if KC015==5
label var DMcontrol "Respondent DM Under Control"
label define dmcontrol 1 “Yes”, modify
label define dmcontrol 0 “No”, modify
label values DMcontrol dmcontrol

UN307 USED KIDNEY DIALYSIS SERVICES
gen DialysisUse=.
replace DialysisUse=0 if DialysisUse==5
replace DialysisUse=1 if DialysisUse==1
label var DialysisUse “R used kidney dialysis”
label define dialysis 0 “No”, modify
label define dialysis 1 “Yes”, modify
label values DialysisUse dialysis

KC036 HEART CONDITION
replace KC036=. if KC036>=8 & KC036<10
gen heartcon=.
replace heartcon=1 if KC036<=3
replace heartcon=0 if KC036>=4 & KC036<.
label var heartcon "heart condition status of respondent"
label define HC 1 “yes”, modify
label define HC 0 “no”, modify
label values heartcon HC

UC036 HEART CONDITION
replace heartcon=1 if UC036<=3
replace heartcon=0 if UC036>=4 & UC036<.

KZ105 PREV WAVE R HAS HEART PROBLEMS
replace heartcon=1 if KZ105==1 & heartcon!=0
replace heartcon =0 if KZ105==0 & heartcon!=1

UZ105 PREV WAVE R HAS HEART PROBLEMS
replace heartcon=1 if UZ105==1 & heartcon!=0
replace heartcon =0 if UZ105==0 & heartcon!=1

KC040 HEART ATTACK
replace KC040=. if KC040>=8 & KC040<10
gen heartattack=.
replace heartattack =1 if KC040<=3
replace heartattack =0 if KC040>=4 & KC040<.
label var heartattack "heart attack status of respondent"
label define HA 1 "yes", modify
label define HA 0 "no", modify
label values heartattack HA

UC040 HEART ATTACK
replace heartattack =1 if UC040<=3
replace heartattack =0 if UC040>=4 & UC040<.

KC045 ANGINA
replace KC045=. if KC045>=8 & KC045<10
gen Angina=.
replace Angina =1 if KC045<=3
replace Angina =0 if KC045>=4 & KC045<.
label var Angina "Angina status of respondent"
label define angina 1 “Yes”, modify
label define angina 0 “No”, modify
label values Angina angina

KC048 CONGESTIVE HEART FAILURE
replace KC048=. if KC048>=8 & KC048<10
gen CHF=.
replace CHF =1 if KC048<=3
replace CHF =0 if KC048>=4 & KC048<.
label var CHF "CHF status of respondent"
label define chf 1 “Yes”, modify
label define chf 0 “No”, modify
label values CHF chf

UC048 CONGESTIVE HEART FAILURE
replace CHF =1 if UC048<=3
replace CHF =0 if UC048>=4 & UC048<.

KC053 STROKE
replace KC053=. if KC053>=8 & KC053<10
gen Stroke=.
replace Stroke =1 if KC053<=3
replace Stroke =0 if KC053>=4 & KC053<.
label var Stroke "Stroke status of respondent"
label define stroke 1 “Yes”, modify
label define stroke 0 “No”, modify
label values Stroke stroke

UC053 STROKE
replace Stroke =1 if UC053<=3
replace Stroke =0 if UC053>=4 & UC053<.

KZ106 PREV WAVE R HAS HAD STROKE

replace Stroke=1 if KZ106==1 & Stroke!=0
replace Stroke =0 if KZ106==0 & Stroke!=1

UZ106 PREV WAVE R HAS HAD STROKE
replace Stroke=1 if UZ106==1 & Stroke!=0
replace Stroke =0 if UZ106==0 & Stroke!=1

gen StrokeHD=.
replace StrokeHD=1 if Stroke==1 & heartcon==1|Angina==1|CHF==1|heartattack==1
replace StrokeHD=0 if StrokeHD==.
label var StrokeHD "Stroke with heart condition"
label define strokehd 1 "Yes"
label define strokehd 0 "otherwise"
label values StrokeHD strokehd

gen StrokeNoHD=.
replace StrokeNoHD=1 if Stroke==1 & heartcon==0 & Angina==. & CHF==.& heartattack==.
replace StrokeNoHD=0 if StrokeNoHD==.
label var StrokeNoHD "Stroke without heart condition"
label define strokenohd 1 "Yes"
label define strokenohd 0 "Otherwise", add
label values StrokeNoHD strokenohd

R. Physical Measure Variables

KC139 WEIGHT IN POUNDS
KC141 HEIGHT FEET
KC142 HEIGHT INCHES

```
rename (KC139)(Weight)
recode Weight (999=.) (998=.), copyrest gen(wgtlbs)
```

UC139 WEIGHT IN POUNDS

```
rename(UC139)(WeightEx)
recode WeightEx (999=.) (998=.), copyrest gen(wgtlbsEx)
rename (KC141)(HeightFeet)
recode KC142 (98=.)

gen feettoinches=.
replace feettoinches=(HeightFeet*12)
egen totalhtin=rowtotal(feettoinches KC142)


gen BMI=(wgtlbs/(totalhtin*totalhtin))*703

gen BMIcat=.
replace BMIcat=1 if BMI<18.5
replace BMIcat=2 if BMI>=18.5 & BMI<26
replace BMIcat=3 if BMI>25 & BMI<30
replace BMIcat=4 if BMI>=30 & MBI<.
label var BMIcat “BMI levels (lbs/in^2)*703”
label define bmi 1 “Low”
label define bmi 2 “Normal”, add
label define bmi 3 “Overweight”, add
label define bmi 4 “Obese”, add
label values BMIcat bmi

gen BMIRC=.
replace BMIRC=0 if BMIcat==1
replace BMIRC=0 if BMIcat==2
replace BMIRC=0 if BMIcat==3
replace BMIRC=1 if BMIcat==4

label var BMIRC “BMI Dichotomous Recode”
label define bmirc 0 “Low/Normal/Overweight”
label define bmirc 1 “Obese”, add
label values BMIRC bmirc
```

KI859 BLOODPRESSURE 1 SYSTOLIC
KI860 BLOODPRESSURE 1 DIASTOLIC
KI861 BLOODPRESSURE 1 Pulse
KI864 BLOODPRESSURE 2 SYSTOLIC
KI865 BLOODPRESSURE 2 DIASTOLIC
KI866 BLOODPRESSURE 2 Pulse
KI869 BLOODPRESSURE 3 Systolic
KI870 BLOODPRESSURE 3 DIASTOLIC
KI871 BLOODPRESSURE 3 Pulse

```
rename (KI859)(BPSystolic1)
rename (KI860)(BPDiastolic1)
rename (KI861)(Pulse1)
rename (KI864)(BPSystolic2)
rename (KI865)(BPDiastolic2)
rename (KI866)(Pulse2)
rename (KI869)(BPSystolic3)
rename (KI870)(BPDiastolic3)
rename (KI871)(Pulse3)

replace BPSystolic1=. if BPSystolic1==993| BPSystolic1==996| BPSystolic1==998| BPSystolic1==999
replace BPDiastolic1=. if BPDiastolic1==996| BPDiastolic1==998| BPDiastolic1==999
replace Pulse1=. if Pulse1==996| Pulse1==998| Pulse1==999
replace BPSystolic2=. if BPSystolic2==993| BPSystolic2==996| BPSystolic2==998| BPSystolic2==999
replace BPDiastolic2=. if BPDiastolic2==996| BPDiastolic2==998| BPDiastolic2==999
replace Pulse2=. if Pulse2==996| Pulse2==998| Pulse2==999
replace BPSystolic3=. if BPSystolic3==993| BPSystolic3==996| BPSystolic3==998| BPSystolic3==999
replace BPDiastolic3=. if BPDiastolic3==996| BPDiastolic3==998| BPDiastolic3==999
replace Pulse3=. if Pulse3==996| Pulse3==998| Pulse3==999

egen AverageSysBP= rowmean(BPSystolic1 BPSystolic2 BPSystolic3)
egen AverageDiaBP=rowmean (BPDiastolic1 BPDiastolic2 BPDiastolic3)
egen AveragePulse=rowmean(Pulse1 Pulse2 Pulse3)
```

```
gen RHypertensionDef=.
replace RHypertensionDef=0 if AverageSysBP<120 & AverageDiaBP<80
replace RHypertensionDef=1 if AverageSysBP>=120 & AverageSysBP<=139 & AverageDiaBP>=80 &
AverageDiaBP<=89
replace RHypertensionDef=2 if AverageSysBP>=140 & AverageSysBP<=159 & AverageDiaBP>=90 &
AverageDiaBP<=99
replace RHypertensionDef=3 if AverageSysBP>=160 & AverageSysBP<. & AverageDiaBP>=100 &
AverageDiaBP<.
label var RHypertensionDef “Respondent Physical Measure Hypertension Status”
label define rhyperdef 0 “Normal”, modify
label define rhyperdef 1 “Pre-hypertensive”, modify
label define rhyperdef 2 “Hbp Stage 1”, modify
label define rhyperdef 3 “Hbp Stage 2”, modify
label values RHypertensionDef rhyperdef
replace RHypertensionDef=2 if RHypertensionDef==3
label define rhyperdef 2 “Hypertensive”, modify
gen RPulseDef=.
replace  RPulseDef=0 if AveragePulse>=60 & AveragePulse<=100
replace  RPulseDef=1 if AveragePulse<60 | AveragePulse>101 & AveragePulse<.
label var RPulseDef “Respondent Pulse Rate”
label define rpulsedef 0 “Normal”, modify
label define rpulsedef 1 “Abnormal”, modify
label values RPulseDef rpulsedef

KCRP_IMP 2006 CRP (ug/mL) - Measured and imputed values
rename(KCRP_IMP)(CRPIMP2006)
replace CRPIMP2006=0 if CRPIMP2006<1.0
replace CRPIMP2006=1 if CRPIMP2006>=1.0 & CRPIMP2006<=3.0
replace CRPIMP2006=2 if CRPIMP2006>3.0 & CRPIMP2006<=.
label var CRPIMP2006 “R CRP level 2006”
label define crpimp06 0 “Normal”, modify
label define crpimp06 1 “Moderate risk”, modify
label define crpimp06 2 “High risk”, modify
label values CRPIMP2006 crpimp06
```

KCRP_ADJ 2006 NHANES equivalent CRP
rename(KCRP_ADJ)(CRPADJ2006)
replace CRPADJ2006=0 if CRPADJ2006<1.0
replace CRPADJ2006=1 if CRPADJ2006>=1.0 & CRPADJ2006<=3.0
replace CRPADJ2006=2 if CRPADJ2006>3.0 & CRPADJ2006<=.
label var CRPADJ2006 “R Adjusted CRP level 2006”
label define crpadj06 0 “Normal”, modify
label define crpadj06 1 “Moderate risk”, modify
label define crpadj06 2 “High risk”, modify
label values CRPADJ2006 crpadj06

rename(KCRPVT)(CRP2006)
replace CRP2006=0 if CRP2006<1.0
replace CRP2006=1 if CRP2006>=1.0 & CRP2006<=3.0
replace CRP2006=2 if CRP2006>3.0 & CRP2006<.
label var CRP2006 "R CRP level 2006"
label define crp06 0 "Normal", modify
label define crp06 1 "Moderate risk", modify
label define crp06 2 "High risk", modify
label values CRP2006 crp06

KBIOWGTR 2006 Respondent Weight for Biomarkers

gen AnyHC=.
replace AnyHC= 1 if heartattack==1| Angina==1 |CHF==1 |Stroke==1|heartcon==1
replace AnyHC= 0 if heartattack!=1 & Angina!=0 & CHF!=0 & Stroke!=0 & heartcon!=0
label var AnyHC "R has any heart-related disease"
label define AHC 1 "Yes"
label define AHC 0 "None", add
label values AnyHC AHC

gen DMA1C=.
replace DMA1C= 1 if diabetes==1 & A1CADJ2006<.

gen CatTCRC=.
replace CatTCRC=0 if CatTC==0|CatTC==1
replace CatTCRC=1 if CatTC==2
label var CatTCRC “Dichotomous Total Cholesterol 06”
label define cattcrc 0 “Good”, modify
label define cattcrc 1“Bad”, modify
label values CatTCRC cattcrc

```
gen CatHDLRC=.
replace CatHDLRC =0 if CatHDL==0| CatHDL ==1
replace CatHDLRC =1 if CatHDL ==2
label var CatHDLRC “Dichotomous HDL Cholesterol 06”
label define cahdlrc 0 “Good”, modify
label define cahdlrc 1“Bad”, modify
label values CatHDLRC cattcrc

gen DichCRP=.
replace DichCRP=0 if CRPADJ2006==0
replace DichCRP=1 if CRPADJ2006==1| CRPADJ2006==2
label var DichCRP “Dichotomous CRP 06”
label define dichcrp 0 “Normal”, modify
label define dichcrp 1“Abnormal”, modify
label values DichCRP dichcrp

gen DichA1C=.
replace DichA1C =0 if A1CADJ2006==0
replace DichA1C =1 if A1CADJ2006==1| A1CADJ2006==2
label var DichA1C “Dichotomous A1C 06”
label define dicha1c 0 “Normal”, modify
label define dicha1c 1“Abnormal”, modify
label values DichA1C dicha1c
gen RHTNRC=.
replace RHTNRC =0 if RHypertensionDef==0| RHypertensionDef==1
replace RHTNRC =1 if  RHypertensionDef ==2
label var RHTNRC “Dichotomous R HTN 06”
label define rhtnrc 0 “Normal”, modify
label define rhtnrc 1“Hypertensive”, modify
label values RHTNRC rhtnrc

gen CVDcase06=.
replace CVDcase06=1 if AnyHC==1
replace CVDcase06=0 if ANyHC==0
label var CVDcase06 "CVD cases 2006"
label define cvdcase06 1 "Case"
label define cvdcase06 0 "Control", add
label values CVDcase06 cvdcase06
```

KA099 NUMBER OF RESIDENT CHILDREN
rename (KA099)(NumResidentChildren)

KA100 COUNT OF NONRESIDENT KIDS
rename (KA100)(NumNonResChildren)

KA101 COUNT OF KIDS - NOT THEIR SPOUSES
rename (KA101)(CountofKids)

UA099 NUMBER OF RESIDENT CHILDREN
rename (UA099)(ExitNumResidentChildren)

UA100 COUNT OF NONRESIDENT KIDS
rename (UA100)(ExitNumNonResChildren)

UA101 COUNT OF KIDS - NOT THEIR SPOUSES
rename (UA101)(ExitCountofKids)

```
gen Catnumkids=.
replace Catnumkids=0 if CountofKids==0
replace Catnumkids=1 if  CountofKids==1
replace Catnumkids=2 if  CountofKids >=2 & CountofKids<5
replace Catnumkids=3 if  CountofKids >=5 & CountofKids<.
label variable Catnumkids "Categorical number of respondent children"
label define catnkids 0  "None", modify
label define catnkids 1 "One child", modify
label define catnkids 2 "2-4 children", modify
label define catnkids 3  "5+ children", modify
label values Catnumkids catnkids

replace Catnumkids=0 if ExitCountofKids ==0
replace Catnumkids=1 if  ExitCountofKids ==1
replace Catnumkids=2 if  ExitCountofKids >=2 & ExitCountofKids <5
replace Catnumkids=3 if  ExitCountofKids >=5 & ExitCountofKids <.
```

KB033 NUMBER CHILDREN EVER
rename (KB033)(NumberofChildrenEver)

KLB007 Q07. HAVE ANY CHILDREN
rename(KLB007)(HaveAnyChildren)
replace HaveAnyChildren =0 if HaveAnyChildren ==5
label var HaveAnyChildren “R. has children”
label define haveanychildren 0 “No”, modify
label define haveanychildren 1 “Yes”, modify
label values HaveAnyChildren haveanychildren

egen TotalChildren=rowtotal (CountofKids NumberofChildrenEver)

gen CatTotalChildren=.
replace CatTotalChildren =0 if TotalChildren ==0
replace CatTotalChildren =1 if TotalChildren ==1
replace CatTotalChildren =2 if TotalChildren >=2 & TotalChildren <5
replace CatTotalChildren =3 if TotalChildren >=5 & TotalChildren <.
label variable CatTotalChildren "Categorical total number of respondent children"
label define cattotkids 0 "None", modify
label define cattotkids 1 "One child", modify
label define cattotkids 2 "2-4 children", modify
label define cattotkids 3 "5+ children", modify
label values CatTotalChildren cattotkids

2006 HRS Insurance and HCU Variables

Medicare Variables

KN001 MEDICARE COVERAGE
KN047_1 BRANCHPNT-COVERD BY MEDICARE/ALL OTH- 1
KN047_2 BRANCHPNT-COVERD BY MEDICARE/ALL OTH- 2
KN047_3 BRANCHPNT-COVERD BY MEDICARE/ALL OTH- 3

```
gen MedicareCo=.
replace MedicareCo=0 if KN001==5
replace MedicareCo=1 if KN001==1|KN047_1==1|KN047_2==1|KN047_3==1
label var MedicareCo "Medicare Coverage"
label define Medicare 0 "No"
label define Medicare 1 "Yes", modify
label values MedicareCo Medicare
```

UN001 MEDICARE COVERAGE

```
replace MedicareCo=0 if UN001==5
replace MedicareCo=1 if UN001==1
```

KN004 MEDICARE PART B COVERAGE

```
gen MedicareCoB=.
replace MedicareCoB=0 if KN004==5
replace MedicareCoB=1 if KN004==1
label var MedicareCoB "Medicare Part B Coverage"
label define MedicareB 0 "No"
label define MedicareB 1 "Yes", add
label values MedicareCoB MedicareB
```

UN004 MEDICARE PART B COVERAGE

```
replace MedicareCoB=0 if UN004==5
replace MedicareCoB=1 if UN004==1
```

KN352 SIGNED UP MEDICARE RX COVERAGE

```
gen MedicareCoD=.
replace MedicareCoD=0 if KN352==5
replace MedicareCoD=1 if KN352==1
replace MedicareCoD=1 if KN352==3
label var MedicareCoD " Medicare Part D Coverage"
label define MedicareD 0 "No"
label define MedicareD 1 "Yes", add
 label values MedicareCoD MedicareD
```

Medicaid Variables

KN006 CURRENTLY COVERED BY MEDICAID

```
gen MedicaidCo=.
replace MedicaidCo=0 if KN006==5
replace Medicaid=1 if KN006==1
label var MedicaidCo "Medicaid Coverage"
 label define Medicaid 0 "No"
 label define Medicaid 1 "Yes", modify
 label values MedicaidCo Medicaid
```

UN006 CURRENTLY COVERED BY MEDICAID

```
replace MedicaidCo=0 if UN006==5
replace Medicaid=1 if UN006==1
```

KN009 MEDICARE/MEDICAID HMO

```
gen MMHMO=.
replace MMHMO=0 if KN009==5
replace MMHMO=1 if KN009==1
label var MMHMO "Medicare/Medicaid HMO"
label define mmhmo 0 "No"
 label define mmhmo 1 "Yes", add
 label values MMHMO mmhmo
```

UN009 MEDICARE/MEDICAID HMO

```
replace MMHMO=0 if UN009==5
replace MMHMO=1 if UN009==1
```

CHAMPUS Variables

KN007 CHAMPUS/CHAMPVA COVERAGE

```
gen ChampUs=.
replace ChampUs=0 if KN007==5
replace ChampUs=1 if KN007==1
label var ChampUs "ChampUS/ChampVA Coverage"
label define Champ 0 "No"
label define Champ 1 "Yes", add
label values ChampUs Champ
```

UN007 CHAMPUS/CHAMPVA COVERAGE
replace ChampUs=0 if UN007==5
replace ChampUs=1 if UN007==1

Private Health Insurance Variables

OBTAIN HI THRU CURRNT EMP/OWN BUSINESS-1
KN034_1 OBTAIN INS THRU FORMER EMPLOYER- 1
KN035_1 OBTAIN INS THRU HWP CURRENT EMPLOYER- 1
KN036_1 OBTAIN INS THRU HWP FORMER EMPLOYER- 1
KN033_2 OBTAIN HI THRU CURRNT EMP/OWN BUSINESS-2
KN034_2 OBTAIN INS THRU FORMER EMPLOYER- 2
KN035_2 OBTAIN INS THRU HWP CURRENT EMPLOYER- 2
KN036_2 OBTAIN INS THRU HWP FORMER EMPLOYER- 2
KN033_3 OBTAIN HI THRU CURRNT EMP/OWN BUSINESS-3
KN034_3 OBTAIN INS THRU FORMER EMPLOYER- 3
KN035_3 OBTAIN INS THRU HWP CURRENT EMPLOYER- 3
KN036_3 OBTAIN INS THRU HWP FORMER EMPLOYER- 3

gen PrivateHI=.
replace PrivateHI=0 if KN033_1==5| KN034_1==5| KN035_1==5| KN036_1==5| KN033_2==5| KN034_2==5| KN035_2==5| KN036_2==5| KN033_3==5| KN034_3==5| KN035_3==5| KN036_3==5
replace PrivateHI=1 if KN033_1==1| KN034_1==1| KN035_1==1| KN036_1==1| KN033_2==1| KN034_2==1| KN035_2==1| KN036_2==1| KN033_3==1| KN034_3==1| KN035_3==1| KN036_3==1
label var PrivateHI "Private Health Insurance Coverage"
label define PHI 0 "No"
label define PHI 1 "Yes", add
label values PrivateHI PHI

UN033_1 OBTAIN HI THRU CURRNT EMP/OWN BUSINESS-1
UN034_1 OBTAIN INS THRU FORMER EMPLOYER -1
UN035_1 OBTAIN INS THRU HWP CURRENT EMPLOYER- 1
UN036_1 OBTAIN INS THRU HWP FORMER EMPLOYER- 1
UN033_2 OBTAIN HI THRU CURRNT EMP/OWN BUSINESS-2
UN034_2 OBTAIN INS THRU FORMER EMPLOYER -2
UN035_2 OBTAIN INS THRU HWP CURRENT EMPLOYER- 2
UN036_2 OBTAIN INS THRU HWP FORMER EMPLOYER- 2
UN033_3 OBTAIN HI THRU CURRNT EMP/OWN BUSINESS-3
UN034_3 OBTAIN INS THRU FORMER EMPLOYER -3
UN035_3 OBTAIN INS THRU HWP CURRENT EMPLOYER- 3
UN036_3 OBTAIN INS THRU HWP FORMER EMPLOYER- 3

replace PrivateHI=0 if UN033_1==5| UN034_1==5| UN035_1==5| UN036_1==5| UN033_2==5| UN034_2==5| UN035_2==5| UN036_2==5| UN033_3==5| UN034_3==5| UN035_3==5| UN036_3==5
replace PrivateHI=1 if UN033_1==1| UN034_1==1| UN035_1==1| UN036_1==1| UN033_2==1| UN034_2==1| UN035_2==1| UN036_2==1| UN033_3==1| UN034_3==1| UN035_3==1| UN036_3==1

KN052_1 PRIVATE PLAN INSURANCE AN HMO- 1
KN052_2 PRIVATE PLAN INSURANCE AN HMO- 2
KN052_3 PRIVATE PLAN INSURANCE AN HMO- 3

gen PrivateHMO=.
replace PrivateHMO=0 if KN052_1==5| KN052_2==5| KN052_3==5
replace PrivateHMO=1 if KN052_1==1| KN052_2==1| KN052_3==1
label var PrivateHMO “Private insurance HMO”
label define privatehmo 0 “No”, modify
label define privatehmo 1 “Yes”, modify
label values PrivateHMO privatehmo

Long-term Care Variables

KN071 LTC INSURANCE

gen LTCInsurance=.
replace LTCInsurance=0 if KN071==5
replace LTCInsurance=1 if KN071==1
label var LTCInsurance “Long-term care insurance”
label define ltcins 0 “No”, modify
label define ltcins 1 “Yes”, modify
label values LTCInsurance ltcins

No Medical Insurance Variable

KN342 CONFIRM NO MEDICAL INSURANCE

gen NoHI=.
replace NoHI=0 if KN342==5
replace NoHI=1 if KN342==1
label var NoHI "No Health Insurance"
label define NHI 1 "Not Insured"
label define NHI 0 "Insured", add
label values NoHI NHI

KC223 HOW OFTEN VIGOROUS ACTIVITY
replace KC223=. if KC223>=8 & KC223<10
gen VigorAct=.
replace VigorAct=0 if KC223==4
replace VigorAct=1 if KC223>=2 & KC223<4
replace VigorAct=2 if KC223==1
replace VigorAct=2 if KC223==7
label var VigorAct "Amount of Vigorous Activity"
label define VA 0 "Never/Hardly Ever"
label define VA 1 "Once a Week/1-3 Times a Month", modify
label define VA 2 "More than Once a Week/Everyday", modify
label values VigorAct VA

KC224 HOW OFTEN MODERATE ACTIVITY
replace KC224=. if KC224>=8 & KC224<10
gen ModerAct=.
replace ModerAct=0 if KC224==4
replace ModerAct=1 if KC224>=2 & KC224<4
replace ModerAct=2 if KC224==1
replace ModerAct=2 if KC224==7
label var ModerAct "Amount of Moderate Activity"
label define ModA 0 "Never/Hardly Ever"
label define ModA 1 "Once a Week/1-3 Times a Month", modify
label define ModA 2 "More than Once a Week/Everyday", modify
label values ModerAct ModA

KC225 HOW OFTEN MILD ACTIVITY
gen MildActRC=.
replace MildActRC=0 if KC225==4
replace MildActRC=1 if KC225>=2 & KC225<4
replace MildActRC=2 if KC225==1
replace MildActRC=2 if KC225==7
label var MildActRC "Amount of Mild Activity"
label values MildActRC MA
label define MildActiv 0 "Never/Hardly Ever" modify
label define MildActiv 1 "Once a Week/1-3 Times a Month", modify
label define MildActiv 2 "More than Once a Week/Everyday", modify
label values MildActRC MildActiv

```
gen dichotomousPA=.
replace dichotomousPA=0 if VigorAct==0 & ModerAct==0 & MildActRC==0
replace dichotomousPA=1 if
VigorAct==1|VigorAct==2|ModerAct==1|ModerAct==2|MildActRC==1|MildActRC==2
label var dichotomousPA “Dichotomous Physical Activity”
label define PA2 0 “None”, modify
label define PA2 1 “Any”, modify
label values dichotomousPA PA2
```

Smoking & ETOH Variables

```
KC117 SMOKE CIGARETTES NOW
gen CurrentSmoker=.
replace CurrentSmoker=1 if KC117==1
replace CurrentSmoker=0 if KC117==5
label var CurrentSmoker “Respondent is a current smoker”
label define cigsnow 1 “Yes”, modify
label define cigsnow 0 “No”, modify
label values CurrentSmoker cigsnow

UC117 SMOKED CIGARETTES
replace CurrentSmoker=1 if UC117==1
replace CurrentSmoker=0 if UC117==5

KZ205 R REPORTED THAT S/HE EVER SMOKED
gen SmokerEver=.
replace SmokerEver =1 if KZ205==1
replace SmokerEver =0 if KZ205==5
label var SmokerEver “Respondent was ever a smoker”
label define cigsever 1 “Yes”, modify
label define cigsever 0 “No”, modify
label values SmokerEver cigsever

UZ205 R REPORTED THAT S/HE EVER SMOKED
replace SmokerEver =1 if UZ205==1
replace SmokerEver =0 if UZ205==5
```

```
gen EverCurrentSmoke=.
replace EverCurrentSmoke=0 if SmokerEver==0
replace EverCurrentSmoke=1 if SmokerEver==1 & CurrentSmoker==0
replace EverCurrentSmoke=2 if CurrentSmoker==1
label var EverCurrentSmoke "Triad Smoking Question"
label define evercurrsmoke 0 "Never"
label define evercurrsmoke 1 "Quit", add
label define evercurrsmoke 2 "Smoker", add
label values EverCurrentSmoke evercurrsmoke
```

2006 HRS Loss Codes

Loss of Child Variables

KB034 NUMBER LIVING CHILDREN
gen LossofChild=.
replace LossofChild=TotalChildren-KB034
replace LossofChild=1 if LossofChild >=1 & LossofChild <.
replace LossofChild=0 if LossofChild<=0 & LossofChild<1
label define LoC 1 "Loss", modify
label define LoC 0 "Alive", modify
label values LossofChild LoC
label var LossofChild "Child(ren) of Respondent Has Died"

KLB037A Q37A. HAS A CHILD OF YOURS EVER DIED
rename(KLB037A)(ChildEverDied)
replace LossofChild =1 if ChildEverDied==1
replace LossofChild =0 if ChildEverDied==5

Loss of Mother Variables

KF001 MOTHER ALIVE
gen MotherAlive=.
replace MotherAlive=0 if KF001==1
replace MotherAlive=1 if KF001==5
label var MotherAlive “Mother of R is alive”
label define MA 0 “Alive”, modify
label define MA 1 “Dead”, modify
label values MotherAlive MA

KZ013_R PREV WAVE MOTHER LIVING

gen PWMotherAlive=.
replace PWMotherAlive =0 if KZ013_R==1
replace PWMotherAlive =1 if KZ013_R ==5
label var PWMotherAlive “Mother of R is alive PW”
label define PWMA 0 “Alive”, modify
label define PWMA 1 “Dead”, modify
label values PWMotherAlive PWMA

Loss of Father Variables

KF011 FATHER ALIVE

```
gen FatherAlive=.
replace FatherAlive =0 if KF011==1
replace FatherAlive =1 if KF011==5
label var FatherAlive “Father of R is alive”
label define FA 0 “Alive”, modify
label define FA 1 “Dead”, modify
label values FatherAlive FA
```

KZ015_R PREV WAVE FATHER LIVING

```
gen PWFatherAlive=.
replace PWFatherAlive =0 if KZ015_R==1
replace PWFatherAlive =1 if KZ015_R ==5
label var PWFatherAlive “Father of R is alive PW”
label define PWFA 0 “Alive”, modify
label define PWFA 1 “Dead”, modify
label values PWFatherAlive PWFA
```

Loss of Spouse/Partner Variables

KZ081 PREV WAVE S/P DIE DURING STUDY

```
gen SPPDied=.
replace SPPDied=1 if KZ080==5|KZ081==1
replace SPPDied=0 if r_married==1
label var SPPDied “Mortality status of spouse/partner”
label define sppd 1 “Dead”, modify
label define sspd 0 “Alive”, modify
```

Respondent Death

EXDEATHYR YEAR OF DEATH

```
replace  RespVitalStat=1 if EXDEATHYR>2005 & EXDEATHYR<2008
```

NYEAR NDI Year of Death

```
replace  RespVitalStat=1 if NYEAR>2005 & NYEAR <2008
```

KALIVE 2006 Vital Status

```
gen RespVitalStat=.
replace  RespVitalStat=0 if KALIVE==1|KALIVE==2
replace  RespVitalStat=1 if KALIVE==5|KALIVE==6
replace  RespVitalStat=0 if KALIVE==1|KALIVE==2
```

UA123 DATE OF DEATH- YEAR
replace RespVitalStat=1 if UA123>2005 & UA123<2008
UA133M1M CAUSE OF DEATH-MASKED- 1
UA133M2M CAUSE OF DEATH-MASKED- 2

gen RESPCOD=.
replace RESPCOD =0 if UA133M1M >110 & UA133M1M <120| UA133M1M >130 & UA133M1M <140| UA133M1M >140 & UA133M1M <150| UA133M1M >160 & UA133M1M <170| UA133M1M >170 & UA133M1M <180| UA133M1M > UA133M1M <190| UA133M1M >189 & UA133M1M <197| UA133M1M >589 & UA133M1M <600| UA133M1M >600 & UA133M1M <609| UA133M2M >110 & UA133M2M <120| UA133M2M >130 & UA133M2M <140| UA133M2M >140 & UA133M2M <150| UA133M2M >160 & UA133M2M <170| UA133M2M >170 & UA133M2M <180| UA133M2M >180 & UA133M2M <190| UA133M2M >189 & UA133M2M <197| UA133M2M >589 & UA133M2M <600| UA133M2M >600 & UA133M2M <609
replace RESPCOD =1 if UA133M1M >100 & UA133M1M <104| UA133M2M >100 & UA133M2M
replace RESPCOD =2 UA133M1M >120 & UA133M1M <130 UA133M2M >120 & UA133M2M <130
label var RESPCOD “Respondent cause-of-death”
label define respcod 0 “All other causes”, modify
label define respcod 1 “Cancer NOS”, modify
label define respcod 2 “Heart disease NOS”, modify
label values RESPCOD respcod

2006 SES Code

KH020 HOME PRESENT VALUE
rename(KH020)(HomePresentValue)
replace HomePresentValue=. if HomePresentValue==99999998| HomePresentValue==99999999

gen CatHomePresentValue=.
replace CatHomePresentValue=0 if HomePresentValue>=0 & HomePresentValue<=10000
replace CatHomePresentValue=1 if HomePresentValue>10000 & HomePresentValue<=75000
replace CatHomePresentValue=2 if HomePresentValue>75000 & HomePresentValue<=150000
replace CatHomePresentValue=3 if HomePresentValue>150000 & HomePresentValue<=500000
replace CatHomePresentValue=4 if HomePresentValue>500000 & HomePresentValue<=1000000
replace CatHomePresentValue=5 if HomePresentValue>1000000 & HomePresentValue<.
label var CatHomePresentValue “Categorical present home value”
label define cathomepresentvalue 0 “$10,000 or less”, modify
label define cathomepresentvalue 1 “Between $10,000 - $75,000”, modify
label define cathomepresentvalue 2 “Between $75,000 - $150,000”, modify
label define cathomepresentvalue 3 “Between $150,000 - $500,000”, modify
label define cathomepresentvalue 4 “Between $500,000 - $1,000,000”, modify
label define cathomepresentvalue 5 “Over $1,000,000”, modify
label values CatHomePresentValue cathomepresentvalue

KH016 MOBILE HOME PRESENT VALUE
rename(KH016)(MobileHomePresentValue)
replace MobileHomePresentValue =. if MobileHomePresentValue ==999998| MobileHomePresentValue ==999999
gen CatMobileHomePresentValue =.
replace CatMobileHomePresentValue =0 if MobileHomePresentValue >=0 & MobileHomePresentValue <=10000
replace CatMobileHomePresentValue =1 if MobileHomePresentValue >10000 & MobileHomePresentValue <=50000
replace CatMobileHomePresentValue =2 if MobileHomePresentValue >50000 & MobileHomePresentValue <=100000
replace CatMobileHomePresentValue =3 if MobileHomePresentValue >100000 & MobileHomePresentValue <=250000
replace CatMobileHomePresentValue =4 if MobileHomePresentValue >250000 & MobileHomePresentValue <.
label var CatMobileHomePresentValue “Categorical present mobile home value”
label define catmobhomepresentvalue 0 “$10,000 or less”, modify
label define catmobhomepresentvalue 1 “Between $10,000 - $50,000”, modify
label define catmobhomepresentvalue 2 “Between $50,000 - $100,000”, modify
label define catmobhomepresentvalue 3 “Between $100,000 - $250,000”, modify
label define cathomepresentvalue 4 “Over $250,000”, modify
label values CatMobileHomePresentValue catmobhomepresentvalue

KH025 AMOUNT OF PAYMENT ON FIRST MORTGAGE
rename(KH025)(Amtpayfirstmortgage)
replace Amtpayfirstmortgage=. if Amtpayfirstmortgage==9999998| Amtpayfirstmortgage==9999999
gen Catamtpayfirstmort=.
replace Catamtpayfirstmort =0 if Amtpayfirstmortgage >=0 & Amtpayfirstmortgage <=5000
replace Catamtpayfirstmort =1 if Amtpayfirstmortgage >5000 & Amtpayfirstmortgage <=10000
replace Catamtpayfirstmort =2 if Amtpayfirstmortgage >10000 & Amtpayfirstmortgage <.
label var Catamtpayfirstmort “Categorical mortgage payments”
label define catamtpayfirstmort 0 “$5,000 or less”, modify
label define catamtpayfirstmort 1 “Between $5,000 - $10,000”, modify
label define catamtpayfirstmort 2 “Over $10,000”, modify
label values Catamtpayfirstmort catamtpayfirstmort

KH166 DOLLAR VALUE SECOND HOME
rename(KH166)(SecHomePresentValue)
replace SecHomePresentValue =. if SecHomePresentValue ==99999998| SecHomePresentValue ==99999999

gen CatSecHomePresentValue=.
replace CatSecHomePresentValue =0 if SecHomePresentValue >=0 & SecHomePresentValue <=10000
replace CatSecHomePresentValue =1 if SecHomePresentValue >10000 & SecHomePresentValue <=75000
replace CatSecHomePresentValue =2 if SecHomePresentValue >75000 & SecHomePresentValue <=150000
replace CatSecHomePresentValue =3 if SecHomePresentValue >150000 & SecHomePresentValue <=500000
replace CatSecHomePresentValue =4 if SecHomePresentValue >500000 & SecHomePresentValue <=1000000
replace CatSecHomePresentValue =5 if SecHomePresentValue >1000000 & SecHomePresentValue <.
label var CatSecHomePresentValue “Categorical present second home value”
label define catsechomepresentvalue 0 “$10,000 or less”, modify
label define catsechomepresentvalue 1 “Between $10,000 - $75,000”, modify
label define catsechomepresentvalue 2 “Between $75,000 - $150,000”, modify
label define catsechomepresentvalue 3 “Between $150,000 - $500,000”, modify
label define catsechomepresentvalue 4 “Between $500,000 - $1,000,000”, modify
label define catsechomepresentvalue 5 “Over $1,000,000”, modify
label values CatSecHomePresentValue catsechomepresentvalue

KH181 MORTGAGE INCLUDE TAX - SECOND HOME
rename(KH181)(LoanPayInculdesTaxSec)
replace LoanPayInculdesTaxSec =. if LoanPayInculdesTaxSec ==8| LoanPayInculdesTaxSec ==9
replace LoanPayInculdesTaxSec =0 if LoanPayInculdesTaxSec ==5
label var LoanPayInculdesTaxSec "2nd home mortgage payment includes tax"
label define loanpayincltaxsec 0 "No, neither", modify
label define loanpayincltaxsec 1 "Taxes only", modify
label define loanpayincltaxsec 2 "Insurance only", modify
label define loanpayincltaxsec 3 "Both", modify
label values LoanPayInculdesTaxSec loanpayincltaxsec

Education Variables

KB014 R HIGHEST LEVEL OF EDUCATION
gen reducat=.
replace reducat=0 if KB014>=0 & KB014<12
replace reducat=1 if KB014==12
replace reducat=2 if KB014>12 & KB014<17
replace reducat=3 if KB014==17
label var reducat "categorical education of respondent"
label define REDUCAT 0 "<High School", modify
label define REDUCAT 1 "High School Diploma", modify
label define REDUCAT 2 "Some/Completed College", modify
label define REDUCAT 3 "Graduate Degree", modify
label values reducat REDUCAT

KZ216 R YEARS OF EDUCATION
gen reducat=.
replace reducat=0 if KZ216>=0 & KZ216<12
replace reducat=1 if KZ216==12
replace reducat=2 if KZ216>12 & KZ216<17
replace reducat=3 if KZ216==17

DEGREE Highest Degree of Education

replace reducat=0 if DEGREE==0
replace reducat=1 if DEGREE==1| DEGREE==2
replace reducat=2 if DEGREE==3| DEGREE==4| DEGREE==9
replace reducat=3 if DEGREE==5| DEGREE==6

SCHLYRS Number of Years in School
replace reducat=0 if SCHLYRS==0
replace reducat=0 if SCHLYRS >0 & SCHLYRS<=11
replace reducat=1 if SCHLYRS ==12
replace reducat=2 if SCHLYRS>12 & SCHLYRS < 17
replace reducat=3 if SCHLYRS ==17

SES Mobility Variables

KB020 RATE FAMILY FINANCIAL SITUATION – SES
gen rsesaschild=.
replace rsesaschild =0 if KB020==5
replace rsesaschild =1 if KB020==6
replace rsesaschild =2 if KB020==3
replace rsesaschild =3 if KB020==1
label var rsesaschild “Respondent Childhood SES”
label define RSESC 0 “Poor”, modify
label define RSESC 1 “Varied”, modify
label define RSESC 2 “About Average”, modify
label define RSESC 3 “Well-Off”, modify
label values rsesaschild RSESC

UB020 RATE FAMILY FINANCIAL SITUATION – SES
replace rsesaschild =0 if UB020==5
replace rsesaschild =1 if UB020==6
replace rsesaschild =2 if UB020==3
replace rsesaschild =3 if UB020==1

KE093 DOLLARS TRANSFER FROM CHILD
rename (KE093)(AmtTransferredFromChildren)
replace AmtTransferredFromChildren =. if AmtTransferredFromChildren ==999998|
AmtTransferredFromChildren ==999999

```
gen AmtTransferredFromKids=.
replace AmtTransferredFromKids =0 if AmtTransferredFromChildren ==0
replace AmtTransferredFromKids =1 if AmtTransferredFromChildren >0 & AmtTransferredFromChildren
<1000
replace AmtTransferredFromKids =2 if AmtTransferredFromChildren >=1000 &
AmtTransferredFromChildren <10000
replace AmtTransferredFromKids =3 if AmtTransferredFromChildren >=10000 &
AmtTransferredFromChildren <=25000
replace AmtTransferredFromKids =4 if AmtTransferredFromChildren >25000 &
AmtTransferredFromChildren <=100000
replace AmtTransferredFromKids =5 if AmtTransferredFromChildren >100000 &
AmtTransferredFromChildren <.
label var AmtTransferredFromKids “Amount of money transferred to children”
label define amttransfromkids 0 “None”, modify
label define amttransfromkids 1 “Under $1000”, modify
label define amttransfromkids 2 “Between $1000 and $9,999”, modify
label define amttransfromkids 3 “Between $10,000 and $24,999”, modify
label define amttransfromkids 4 “Between $25,000 and $99,999”, modify
label define amttransfromkids 5 “Over $100,000”, modify
label values AmtTransferredFromKids amttransfromkids

UE093 DOLLARS TRANSFER FROM CHILD
rename (UE093)(ExAmtTransferredFromChildren)
replace ExAmtTransferredFromChildren =. if ExAmtTransferredFromChildren ==999998|
ExAmtTransferredFromChildren ==999999

replace AmtTransferredFromKids =0 if ExAmtTransferredFromChildren ==0
replace AmtTransferredFromKids =1 if ExAmtTransferredFromChildren >0 &
ExAmtTransferredFromChildren <1000
replace AmtTransferredFromKids =2 if ExAmtTransferredFromChildren >=1000 &
ExAmtTransferredFromChildren <10000
replace AmtTransferredFromKids =3 if ExAmtTransferredFromChildren >=10000 &
ExAmtTransferredFromChildren <=25000
replace AmtTransferredFromKids =4 if ExAmtTransferredFromChildren >25000 &
ExAmtTransferredFromChildren <=100000
replace AmtTransferredFromKids =5 if ExAmtTransferredFromChildren >100000 &
ExAmtTransferredFromChildren <.
```

KV008 AMT INCOME HAVE
rename(KV008)(AmtIncomeHaveAftRet)
replace AmtIncomeHaveAftRet =. if AmtIncomeHaveAftRet ==999999| AmtIncomeHaveAftRet ==999998
replace AmtIncomeHaveAftRet =0 if AmtIncomeHaveAftRet >=0 & AmtIncomeHaveAftRet <=150000
replace AmtIncomeHaveAftRet =1 if AmtIncomeHaveAftRet >150000 & AmtIncomeHaveAftRet <.
label var AmtIncomeHaveAftRet "Amount of income R will have after retirement"
label define incomehave 0 "$150,000 or less", modify
label define incomehave 1 "Over $150,000", modify
label values AmtIncomeHaveAftRet incomehave

KV010 AMT SAVINGS WHEN RETIRE-AMT
rename(KV010)(AmtSavingsWhenRet)
replace AmtSavingsWhenRet =. if AmtSavingsWhenRet ==9999999| AmtSavingsWhenRet ==9999998
replace AmtSavingsWhenRet =0 if AmtSavingsWhenRet >=0 & AmtSavingsWhenRet <=175000
replace AmtSavingsWhenRet =1 if AmtSavingsWhenRet >175000 & AmtSavingsWhenRet <.
label var AmtSavingsWhenRet "Amount of savings R will have after retirement"
label define savingshave 0 "$175,000 or less", modify
label define savingshave 1 "Over $175,000", modify
label values AmtSavingsWhenRet incomehave

KLB045 Q45. CURRENTLY WORKING
rename(KLB045)(RCurrentlyWorking)
replace RJobStatus =0 if RCurrentlyWorking ==5
replace RJobStatus=1 if RCurrentlyWorking==1

KZ123 PREV WAVE R CURRENTLY WORKING
KZ124 PREV WAVE R RETIRED

replace RJobStatus =4 if KZ124==1
replace RJobStatus =1 if KZ123==1 & RJobStatus!=4

Income and Asset Variables

KQ015 R AMOUNT FROM WORK SELF EMPL LCY
KQ020 R AMOUNT FROM WAGES AND SALARY LCY
KQ025 R AMOUNT FROM PROF PRAC OR TRADE LCY
KQ030 R AMOUNT FROM TIP BONUS COMMISSION LCY
KQ035 R AMOUNT FROM WORK 2ND JOB LCY
KQ066 R AMOUNT FROM UNEMPLOYMENT - LCY
KQ076 R AMOUNT FROM WORKERS COMP LCY
KQ085 R AMOUNT OF SS INCOME - LAST MONTH

```
replace KQ015=. if KQ015==99999998|KQ015==99999999
replace KQ020=. if KQ020==99999998| KQ020==99999999
replace KQ025=. if KQ025==99999998| KQ025==99999999
replace KQ030=. if KQ030==99999998| KQ030==99999999
replace KQ035=. if KQ035==99999998| KQ035==99999999
replace KQ066=. if KQ066==99999998| KQ066==99999999
replace KQ076=. if KQ076==9999998| KQ076==9999999
replace KQ085=. if KQ085==9998| KQ085==9999
gen RAnnualSSIncome=KQ085*12
```

UJ032 AMOUNT OF SALARY

```
rename(UJ032)(AmtofSalary)
replace AmtofSalary =. if AmtofSalary ==999999998| AmtofSalary ==999999999
```

UJ039 AMOUNT OF NET PROFITS/EARNINGS

```
rename(UJ039)(AmtofEarnings)
replace AmtofEarnings =. if AmtofEarnings ==999999998| AmtofEarnings ==999999999
```

KQ040 SP AMOUNT FROM SELF EMPL INCOME LCY
KQ045 SP AMOUNT FROM WAGES AND SALARY LCY
KQ050 SP AMOUNT FROM PROF PRAC TRADE LCY
KQ055 SP AMOUNT FR TIP BONUS COMMISS LCY
KQ060 SP AMOUNT FROM WORK 2ND JOB LCY
KQ070 SP AMOUNT FROM UNEMPLOYMENT - LCY
KQ080 SP AMOUNT FROM WORKERS COMP LCY
KQ084 SP SOCIAL SECURITY INCOME

```
replace KQ040=. if KQ040==99999998| KQ040==99999999
replace KQ045=. if KQ045==99999998| KQ045==99999999
replace KQ050=. if KQ050==99999998| KQ050==99999999
replace KQ055=. if KQ055==99999998| KQ055==99999999
replace KQ060=. if KQ060==99999998| KQ060==99999999
replace KQ070=. if KQ070==99999998| KQ070==99999999
replace KQ080=. if KQ080==9999998| KQ080==9999999
replace KQ084=. if KQ084==8| KQ084==9
```

KQ106 WHO RECEIVED INC FROM SSI LAST MONTH
KQ107 AMOUNT RECEIVED FROM SSI LAST MONTH

```
replace KQ107=. if KQ107==9998| KQ107==9999

gen AnnualSSIIncome=KQ107*12
gen RAnnualSSIIncome= AnnualSSIIncome if KQ106==1
gen SPAnnualSSIIncome= AnnualSSIIncome if KQ106==2
```

KQ114 WHO RECEIVED INC FR WELFARE NOT SSI LCY
KQ115 AMOUNT FROM WELFARE LCY
replace KQ115=. if KQ115==999998| KQ115==999999

gen RWellfareAmt=KQ115 if KQ114==1
gen SPWellfareAmt= KQ115 if KQ114==2

KQ121 R AMT FR VETERAN BENEFITS - LAST MONTH
KQ127 SP AMT FR VETERAN BENEFITS - LAST MONTH
gen RVetBenAmt=KQ121*12
gen SPVetBenAmt=KQ127*12

egen RIncome= rowtotal(KQ015 KQ020 KQ025 KQ030 KQ035 KQ066 KQ076 RAnnualSSIncome RAnnualSSIIncome RWellfareAmt RVetBenAmt)

egen SPIncome= rowtotal(KQ040 KQ045 KQ050 KQ055 KQ060 KQ070 KQ080 KQ084 SPAnnualSSIIncome SPWellfareAmt SPVetBenAmt)

KQ133 REAL ESTATE ASSET
rename(KQ133)(RealEstateAsset)
replace RealEstateAsset=. if RealEstateAsset==8| RealEstateAsset==9
replace RealEstateAsset=0 if RealEstateAsset==5
replace RealEstateAsset=1 if RealEstateAsset==2
label var RealEstateAsset “R has real estate asset”
label define realestateasset 0 “No”, modify
label define realestateasset 1 “Yes”, modify
label values RealEstateAsset realestateasset

KQ134 REAL ESTATE ASSET AMT
rename(KQ134)(RealEstateAssetAmt)
replace RealEstateAssetAmt=. if RealEstateAssetAmt==99999999| RealEstateAssetAmt=99999998

KQ138 RENTAL INCOME FROM THIS PROPERTY
rename(KQ138)(RentalIncome)
replace RentalIncome=. if RentalIncome==8| RentalIncome==9
replace RentalIncome=0 if RentalIncome==5
label var RentalIncome “Rental income from property”
label define rentalincome 0 “No”, modify
label define rentalincome 1 “Yes”, modify
label define RentalIncome rentalincome

KQ143 RENTAL INCOME AMOUNT – LCY
rename(KQ143)(RentalIncomeAmt)
replace RentalIncomeAmt =. if RentalIncomeAmt ==9999998| RentalIncomeAmt ==9999999

KQ147 BUSINESS OR FARM ASSETS
rename(KQ147)(BusinessFarmAssets)
replace BusinessFarmAssets =. if BusinessFarmAssets ==8| BusinessFarmAssets ==9
replace BusinessFarmAssets =0 if BusinessFarmAssets ==5
replace BusinessFarmAssets=1 if BusinessFarmAssets==2
label var BusinessFarmAssets “Business farm assests”
label define busfarmasset 0 “No”, modify
label define busfarmasset 1 “Yes”, modify
label define BusinessFarmAssets busfarmasset

KQ148 BUSINESS OR FARM EQUITY AMOUNT
rename(KQ148)(BusFarmEquityAmt)
replace BusFarmEquityAmt =. if BusFarmEquityAmt ==99999998| BusFarmEquityAmt ==99999999

KQ152 BUSINESS OR FARM INCOME
rename(KQ152)(BusinessFarmIncome)
replace BusinessFarmIncome =. if BusinessFarmIncome ==8| BusinessFarmIncome ==9
replace BusinessFarmIncome =0 if BusinessFarmIncome ==5
label var BusinessFarmIncome “Business farm income”
label define busfarminc 0 “No”, modify
label define busfarminc 1 “Yes”, modify
label define BusinessFarmIncome busfarminc

KQ157 BUSINESS OR FARM INC – LCY
rename(KQ157)(BusFarmIncAmt)
replace BusFarmIncAmt =. if BusFarmIncAmt ==9999998| BusFarmIncAmt ==9999999

KQ162 IRA OR KEOGH
rename(KQ162)(IRAorKEOGH)
replace IRAorKEOGH =. if IRAorKEOGH ==8| IRAorKEOGH ==9
replace IRAorKEOGH =0 if IRAorKEOGH ==5| IRAorKEOGH==2
label var IRAorKEOGH “R has IRA or Keogh”
label define ira 0 “No”, modify
label define ira 1 “Yes”, modify
label define IRAorKEOGH ira

KQ165_1 WHO HAS IRA ACCOUNTS -1
KQ166_1 AMOUNT IN IRA ACCOUNT -1
KQ165_2 WHO HAS IRA ACCOUNTS -2
KQ166_2 AMOUNT IN IRA ACCOUNT -2
KQ165_3 WHO HAS IRA ACCOUNTS -3
KQ166_3 AMOUNT IN IRA ACCOUNT -3

KQ183 WHO HAS OTHER IRA ANNUITIES
KQ190 INC FROM OTHER IRA ANNUITY AMT
rename(KQ190)(IRAAnnuityIncome)
replace IRAAnnuityIncome=. if IRAAnnuityIncome==99999998| IRAAnnuityIncome=99999999

replace KQ166_1=. if KQ166_1==99999998| KQ166_1==99999999
replace KQ166_2=. if KQ166_2==99999998| KQ166_2==99999999
replace KQ166_3=. if KQ166_3==99999998| KQ166_3==99999999

egen RIRAAmt= rowtotal(KQ166_1 KQ166_2 KQ166_3)
replace RIRAAmt=. if KQ165_1==1 & KQ165_2==1 & KQ165_3==1
egen SPIRAAmt= rowtotal(KQ166_1 KQ166_2 KQ166_3)
replace SPIRAAmt=. if KQ165_1==2 & KQ165_2==2 & KQ165_3==2

KQ215 PENSION RETIREMENT INCOME
rename(KQ215)(PensionIncome)
replace PensionIncome =. if PensionIncome ==8| PensionIncome ==9
replace PensionIncome =0 if PensionIncome ==5
label var PensionIncome “Receive Pension Income”
label define pensioninc 0 “No”, modify
label define pensioninc 1 “Yes”, modify
label define PensionIncome pensioninc

KQ217 R INCOME FR MORE THAN ONE PENSION
rename(KQ217)(PensionIncomeOver1)
replace PensionIncomeOver1=. if PensionIncomeOver1==8| PensionIncomeOver1==9
replace PensionIncomeOver1=0 if PensionIncomeOver1==5
label var PensionIncomeOver1 “Receive income from >1 Pension”
label define pension1plus 0 “No”, modify
label define pension1plus 1 “Yes”, modify
label define PensionIncomeOver1 pension1plus

KQ227_1 R AMOUNT IN PENSION ACCT -1
KQ227_2 R AMOUNT IN PENSION ACCT -2
replace KQ227_1=. if KQ227_1==99999998| KQ227_1==99999999
replace KQ227_2=. if KQ227_2==99999998| KQ227_2==99999999

egen RPensionAmt= rowtotal(KQ227_1 KQ227_2)

KQ243 SP PENSION
rename(KQ243)(SPPensionIncomeOver1)
replace SPPensionIncomeOver1=. if SPPensionIncomeOver1==8| SPPensionIncomeOver1==9
replace SPPensionIncomeOver1=0 if SPPensionIncomeOver1==5
label var SPPensionIncomeOver1 “Spouse receives income from >1 Pension”
label define sppension1plus 0 “No”, modify
label define sppension1plus 1 “Yes”, modify
label define SPPensionIncomeOver1 sppension1plus

KQ253_1 SP AMOUNT IN PENSION ACCT -1
KQ253_2 SP AMOUNT IN PENSION ACCT -2

replace KQ253_1=. if KQ253_1==99999998| KQ253_1==99999999
replace KQ253_2=. if KQ253_2==99999998| KQ253_2==99999999

egen SPPensionAmt= rowtotal(KQ253_1 KQ253_2)

KQ278_1 R AMT FROM ANNUITY - LAST MONTH -1
KQ278_2 R AMT FROM ANNUITY - LAST MONTH -2
replace KQ278_1=. if KQ278_1==99999998| KQ278_1==99999999
replace KQ278_2=. if KQ278_2==99999998| KQ278_2==99999999
gen RAnnualAnnuityAmt1= KQ278_1*12
gen RAnnualAnnuityAmt2= KQ278_2*12
egen RAnnualAnnuityAmt=rowtotal(RAnnualAnnuityAmt1 RAnnualAnnuityAmt2)

KQ298_1 SP AMT FROM ANNUITY - LAST MONTH -1
KQ298_2 SP AMT FROM ANNUITY - LAST MONTH -2
replace KQ298_1=. if KQ298_1==99999998| KQ298_1==99999999
replace KQ298_2=. if KQ298_2==99999998| KQ298_2==99999999
gen SPAnnualAnnuityAmt1= KQ298_1*12
gen SPAnnualAnnuityAmt2= KQ298_2*12
egen SPAnnualAnnuityAmt=rowtotal(SPAnnualAnnuityAmt1 SPAnnualAnnuityAmt2)

KQ317 STOCKS TOTAL VALUE
rename(KQ317)(StockTotValue)
replace StockTotValue=. if StockTotValue==99999998| StockTotValue==99999999

KQ326 STOCK INCOME AMOUNT – LCY
rename(KQ326)(StockIncome)
replace StockIncome =. if StockIncome==9999998| StockIncome==9999999

KQ331 BOND ASSETS TOTAL VALUE
rename(KQ331)(BondAssetTotValue)
replace BondAssetTotValue =. if BondAssetTotValue ==99999998| BondAssetTotValue ==99999999

KQ340 BOND INCOME AMOUNT – LCY
rename(KQ340)(BondIncomeAmt)
replace BondIncomeAmt =. if BondIncomeAmt==9999998| BondIncomeAmt==9999999

KQ345 CHECKING TOTAL VALUE
rename(KQ345)(CheckingTotValue)
replace CheckingTotValue =. if CheckingTotValue==99999998| CheckingTotValue==99999999

KQ354 CHECKING INCOME AMOUNT – LCY
rename(KQ354)(CheckingIncomeAmt)
replace CheckingIncomeAmt =. if CheckingIncomeAmt==9999998| CheckingIncomeAmt==9999999

KQ357 CDS GOVT SAVINGS TBILLS TOTAL VALUE
rename(KQ357)(TbillsTotValue)
replace TbillsTotValue =. if TbillsTotValue ==99999998| TbillsTotValue ==99999999

KQ366 CDS INCOME AMOUNT – LCY
rename(KQ366)(CDsIncomeAmt)
replace CDsIncomeAmt =. if CDsIncomeAmt ==9999998| CDsIncomeAmt ==9999999

KQ371 TRANSPORTATION TOTAL VALUE
rename(KQ371)(TransportTotValue)
replace TransportTotValue=. if TransportTotValue==9999998| TransportTotValue==9999999

KQ376 OTHER ASSETS TOTAL VALUE
rename(KQ376)(OtherAssetsTotValue)
replace OtherAssetsTotValue =. if OtherAssetsTotValue==99999998| OtherAssetsTotValue==99999999

KQ396 OTHER SOURCES OF INCOME AMOUNT – LCY
rename(KQ396)(OtherSourcesIncomeAmt)
replace OtherSourcesIncomeAmt =. if OtherSourcesIncomeAmt ==9999998| OtherSourcesIncomeAmt ==9999999

KQ483_1 R OR SP IF LUMP SUM RECEIVED -1
KQ488_1 LUMP SUM AMOUNT RECEIVED -1

KQ483_2 R OR SP IF LUMP SUM RECEIVED -2
KQ488_2 LUMP SUM AMOUNT RECEIVED -2

KQ483_3 R OR SP IF LUMP SUM RECEIVED -3
KQ488_3 LUMP SUM AMOUNT RECEIVED -3

```
gen LumpSumRec=.
replace LumpSumRec=0 if KQ483_1==5| KQ483_2==5| KQ483_3==5
replace LumpSumRec=1 if KQ483_1==1| KQ483_2==1| KQ483_3==1
label var LumpSumRec “R or S/P received a lump sum payment”
label define lsp 0 “No”, modify”
label define lsp 1 “Yes”, modify
label values LumpSumRec lsp

replace KQ488_1=. if KQ488_1==9999998| KQ488_1==9999999
replace KQ488_2=. if KQ488_2==9999998| KQ488_2==9999999
replace KQ488_3=. if KQ488_3==9999998| KQ488_3==9999999

egen LumpSumAmt=rowtotal(KQ488_1 KQ488_2 KQ488_3)
```

KQ472 VALUE ASSETS NOT PREV REPORTED

```
rename(KQ472)(AssestValueNPR)
replace AssestValueNPR=. if AssestValueNPR==99999998| AssestValueNPR==99999999
```

KZ153 VALUE MOBILE HOME - MIN
KZ154 VALUE MOBILE HOME – MAX

```
replace CatMobileHomePresentValue =0 if KZ153|KZ154 >=0 & KZ153|KZ154 <=10000
replace CatMobileHomePresentValue =1 if KZ153|KZ154 >10000 & KZ153|KZ154 <=50000
replace CatMobileHomePresentValue =2 if KZ153|KZ154 >50000 & KZ153|KZ154 <=100000
replace CatMobileHomePresentValue =3 if KZ153|KZ154 >100000 & KZ153|KZ154 <=250000
replace CatMobileHomePresentValue =4 if KZ153|KZ154 >250000 & KZ153|KZ154 <.
```

KZ155 VALUE MAIN HOME - MIN
KZ156 VALUE MAIN HOME – MAX

```
replace CatHomePresentValue=0 if KZ155|KZ156>=0 & KZ155|KZ156<=10000
replace CatHomePresentValue=1 if KZ155|KZ156>10000 & KZ155|KZ156<=75000
replace CatHomePresentValue=2 if KZ155|KZ156>75000 & KZ155|KZ156<=150000
replace CatHomePresentValue=3 if KZ155|KZ156>150000 & KZ155|KZ156<=500000
replace CatHomePresentValue=4 if KZ155|KZ156>500000 & KZ155|KZ156<=1000000
replace CatHomePresentValue=5 if KZ155|KZ156>1000000 & KZ155|KZ156<.
```

KZ157 AMT OWE MAIN 1ST MORTGAGE - MIN
KZ158 AMT OWE MAIN 1ST MORTGAGE – MAX

replace Catamtpayfirstmort =0 if KZ157|KZ158 >=0 & KZ157|KZ158 <=5000
replace Catamtpayfirstmort =1 if KZ157|KZ158 >5000 & KZ157|KZ158 <=10000
replace Catamtpayfirstmort =2 if KZ157|KZ158 >10000 & KZ157|KZ158 <.

KZ163 VALUE 2ND HOME - MIN
KZ164 VALUE 2ND HOME – MAX

replace CatSecHomePresentValue =0 if KZ163|KZ164 >=0 & KZ163|KZ164 <=10000
replace CatSecHomePresentValue =1 if KZ163|KZ164 >10000 & KZ163|KZ164 <=75000
replace CatSecHomePresentValue =2 if KZ163|KZ164 >75000 & KZ163|KZ164 <=150000
replace CatSecHomePresentValue =3 if KZ163|KZ164 >150000 & KZ163|KZ164 <=500000
replace CatSecHomePresentValue =4 if KZ163|KZ164 >500000 & KZ163|KZ164 <=1000000
replace CatSecHomePresentValue =5 if KZ163|KZ164 >1000000 & KZ163|KZ164 <.

KZ167 AMT BUSINESS/FARM - MIN
KZ168 AMT BUSINESS/FARM – MAX

gen CatBusFarmValue=.
replace CatBusFarmValue =0 if KZ167|KZ168>=0 & KZ167|KZ168<=10000
replace CatBusFarmValue =1 if KZ167|KZ168>10000 & KZ167|KZ168<=75000
replace CatBusFarmValue =2 if KZ167|KZ168>75000 & KZ167|KZ168<=150000
replace CatBusFarmValue =3 if KZ167|KZ168>150000 & KZ167|KZ168<=500000
replace CatBusFarmValue =4 if KZ167|KZ168>500000 & KZ167|KZ168<=1000000
replace CatBusFarmValue =5 if KZ167|KZ168>1000000 & KZ167|KZ168<.
label var CatBusFarmValue “Categorical business farm value”
label define catbusfarmvalue 0 “$10,000 or less”, modify
label define catbusfarmvalue 1 “Between $10,000 - $75,000”, modify
label define catbusfarmvalue 2 “Between $75,000 - $150,000”, modify
label define catbusfarmvalue 3 “Between $150,000 - $500,000”, modify
label define catbusfarmvalue 4 “Between $500,000 - $1,000,000”, modify
label define catbusfarmvalue 5 “Over $1,000,000”, modify
label values CatBusFarmValue catbusfarmvalue

KZ169 AMT IRA-1 - MIN
KZ170 AMT IRA-1 - MAX
KZ171 AMT IRA-2 - MIN
KZ172 AMT IRA-2 - MAX
KZ173 AMT IRA-3 - MIN
KZ174 AMT IRA-3 – MAX

egen TotalRIRAAmt= rowtotal(RIRAAmt KZ169 KZ171 KZ173)

KZ175 AMT STOCKS - MIN
KZ176 AMT STOCKS – MAX

egen TotalStockValue= rowtotal(KZ175 StockTotValue)

KZ177 AMT BONDS - MIN
KZ178 AMT BONDS – MAX

egen TotalBondValue= rowtotal(KZ177 BondAssetTotValue tValue)

KZ179 AMT CHECK/SAVE - MIN
KZ180 AMT CHECK/SAVE – MAX

egen TotalCheckSaveValue= rowtotal(KZ179 CheckingTotValue)

KZ181 AMT CDS - MIN
KZ182 AMT CDS – MAX

egen TotalCDValue= rowtotal(KZ181 TbillsTotValue)

KZ183 TRANSPORTATION - MIN
KZ184 TRANSPORTATION – MAX

egen TotalTransportValue= rowtotal(KZ183 TransportTotValue)

KZ185 AMT OTHER ASSETS - MIN
KZ186 AMT OTHER ASSETS – MAX

egen TotalOtherAssetValue= rowtotal(KZ185 OtherAssetsTotValue)

KZ187 AMT TRUSTS - MIN
KZ188 AMT TRUSTS – MAX

egen TotalTrustValue= rowtotal(KZ187 TrustValue)

TrustValue
KZ189 AMT DEBTS - MIN
KZ190 AMT DEBTS – MAX

egen RDebtAmt= rowtotal(KZ189 DebtAmount)

KZ198 REAL ESTATE - MIN
KZ199 REAL ESTATE – MAX

egen RealEstateValue= rowtotal(KZ198 RealEstateAssetAmt)

egen RIncome= rowtotal(KQ015 KQ020 KQ025 KQ030 KQ035 KQ066 KQ076 RAnnualSSIncome RAnnualSSIIncome RWellfareAmt RVetBenAmt RentalIncomeAmt BusFarmIncAmt IRAAnnuityIncome StockIncome BondIncomeAmt CheckingIncomeAmt CDsIncomeAmt OtherSourcesIncomeAmt LumpSumAmt)

egen SPIncome= rowtotal(KQ040 KQ045 KQ050 KQ055 KQ060 KQ070 KQ080 KQ084 SPAnnualSSIIncome SPWellfareAmt SPVetBenAmt)

egen RAssets= rowtotal(RealEstateAssetAmt BusFarmEquityAmt RIRAAmt RPensionAmt RAnnualAnnuityAmt StockTotValue BondAssetTotValue CheckingTotValue TbillsTotValue TransportTotValue OtherAssetsTotValue AssestValueNPR)

egen SPAssets= rowtotal (SPIRAAmt SPPensionAmt SPAnnualAnnuityAmt)

KQ446 R OR SP FILE INCOME TAX RETURN – LCY
rename(KQ446)(FiledTaxReturn)
replace FiledTaxReturn =. if FiledTaxReturn ==8| FiledTaxReturn ==9
replace FiledTaxReturn =0 if FiledTaxReturn ==5
label var FiledTaxReturn “R or Spouse filed a tax return LCY”
label define taxreturnfiled 0 “No”, modify
label define taxreturnfiled 1 “Yes”, modify
label define FiledTaxReturn taxreturnfiled

KQ448 ITEMIZED MEDICAL DEDUCTIONS
rename(KQ448)(MedicalDeductions)
replace MedicalDeductions =. if MedicalDeductions ==8| MedicalDeductions ==9
replace MedicalDeductions =0 if MedicalDeductions ==5
label var MedicalDeductions “Itemized medical deductions”
label define mededuct 0 “No”, modify
label define mededuct 1 “Yes”, modify
label define MedicalDeductions mededuct

KQ449 AMT ITEMIZED MEDICAL
rename(KQ449)(AmtMedDeductions)
replace AmtMedDeductions =. if AmtMedDeductions==9999998| AmtMedDeductions==9999999

Debt Variables
KQ478 R OR SP DEBTS AMOUNT
rename(KQ478)(DebtAmount)
replace DebtAmount =. if DebtAmount ==9999998| DebtAmount ==9999999

egen RSPTotalNetWorth= rowtotal(RTotalNetWorth SPTotalNetWorth)

```
egen TotalDebt= rototal (DebtAmount Amtpayfirstmortgage)

egen TotalNetWorth= diff(RSPTotalNetWorth TotalDebt)

gen TWealthQuintiles=.
replace  TWealthQuintiles = 4 if TotalNetWorth>0 & TotalNetWorth<=40000
replace  TWealthQuintiles = 3 if TotalNetWorth>40000 & TotalNetWorth<=175000
replace  TWealthQuintiles = 2 if TotalNetWorth>175000 & TotalNetWorth<=500000
replace  TWealthQuintiles = 1 if TotalNetWorth>500000 & TotalNetWorth<=1200000
replace  TWealthQuintiles = 0 if TotalNetWorth>1200000 & TotalNetWorth<.
label var TWealthQuintiles “Net Worth Quintiles”
label define TNWQ 4 “Bottom Quintile”, modify
label define TNWQ 3 “2nd Quintile”, modify
label define TNWQ 2 “3rd Quintile”, modify
label define TNWQ 1 “4th Quintile”, modify
label define TNWQ 0 “Top Quintile”, modify
label values TWealthQuintiles TNWQ


gen TotalNetWorth= RSPTotalNetWorth- TotalDebt


gen HRSWealthQuintiles=.
replace  HRSWealthQuintiles = 4 if TotalNetWorth<=8305
replace  HRSWealthQuintiles = 3 if TotalNetWorth>8305 & TotalNetWorth<=33553
replace  HRSWealthQuintiles = 2 if TotalNetWorth>33553 & TotalNetWorth<=94172
replace  HRSWealthQuintiles = 1 if TotalNetWorth>94172 & TotalNetWorth<=236544
replace  HRSWealthQuintiles = 0 if TotalNetWorth>236544 & TotalNetWorth<.
label var HRSWealthQuintiles “ HRS Net Worth Quintiles”
label define HRSNWQ 4 “Bottom Quintile”, modify
label define HRSNWQ 3 “2nd Quintile”, modify
label define HRSNWQ 2 “3rd Quintile”, modify
label define HRSNWQ 1 “4th Quintile”, modify
label define HRSNWQ 0 “Top Quintile”, modify
label values HRSWealthQuintiles HRSNWQ


pctile TotalNWDecile = TotalNetWorth, nquantiles(11) genp(TotalNWpercentages)

gen HRSWealthDeciles=.
replace  HRSWealthDeciles = 9 if TotalNetWorth >=-2191356 & TotalNetWorth<=400.5
replace  HRSWealthDeciles = 8 if TotalNetWorth >400.5 & TotalNetWorth <=11001
replace  HRSWealthDeciles = 7 if TotalNetWorth >11001 & TotalNetWorth <=25565
replace  HRSWealthDeciles = 6 if TotalNetWorth >25565 & TotalNetWorth <=53101
replace  HRSWealthDeciles = 5 if TotalNetWorth >53101 & TotalNetWorth <=94172
replace  HRSWealthDeciles = 4 if TotalNetWorth >94172 & TotalNetWorth <=164990
```

```
replace  HRSWealthDeciles = 3 if TotalNetWorth >164990 & TotalNetWorth <=287366
replace  HRSWealthDeciles = 2 if TotalNetWorth >287366 & TotalNetWorth <=555401
replace  HRSWealthDeciles = 1 if TotalNetWorth >555401 & TotalNetWorth <=1252251
replace  HRSWealthDeciles = 0 if TotalNetWorth >1252251 & TotalNetWorth <.
label var HRSWealthDeciles " HRS Net Worth Deciles"
label define HRSNWD 9 "Bottom Decile", modify
label define HRSNWD 8 "2nd Decile", modify
label define HRSNWD 7 "3rd Decile", modify
label define HRSNWD 6 "4th Decile", modify
label define HRSNWD 5 "5th Decile", modify
label define HRSNWD 4 "6th Decile", modify
label define HRSNWD 3 "7th Decile", modify
label define HRSNWD 2 "8th Decile", modify
label define HRSNWD 1 "9th Decile", modify
label define HRSNWD 0 "Top Decile", modify
label values HRSWealthDeciles HRSNWD


replace KQ014=. if KQ014==8| KQ014==9
replace KQ014=0 if KQ014==5

replace KQ019=. if KQ019==8| KQ019==9
replace KQ019=0 if KQ019==5

replace KQ085=. if KQ085==8| KQ085==9
replace KQ085=0 if KQ085==5

replace KQ084=. if KQ084==8| KQ084==9
replace KQ084=0 if KQ084==5

replace KQ113=. if KQ113==8| KQ113==9
replace KQ113=0 if KQ113==5

replace KQ119=. if KQ119==8| KQ119==9
replace KQ119=0 if KQ119==5

replace KQ162=. if KQ162==8| KQ162==9
replace KQ162=0 if KQ162==5


replace KQ138=. if KQ138==8| KQ138==9
replace KQ138=0 if KQ138==5

replace KQ152=. if KQ152==8| KQ152==9
```

```
replace KQ152=0 if KQ152==5

replace KQ316=. if KQ316==8| KQ316==9
replace KQ316=0 if KQ316==5

replace KQ330=. if KQ330==8| KQ330==9
replace KQ330=0 if KQ330==5

replace KQ344=. if KQ344==8| KQ344==9
replace KQ344=0 if KQ344==5

replace KQ356=. if KQ356==8| KQ356==9
replace KQ356=0 if KQ356==5

replace KQ375=. if KQ375==8| KQ375==9
replace KQ375=0 if KQ375==5

replace KQ395=. if KQ395==8| KQ395==9
replace KQ395=0 if KQ395==5

replace KQ375=. if KQ375==8| KQ375==9
replace KQ375=0 if KQ375==5

replace KQ482_1=. if KQ482_1==8| KQ482_1==9
replace KQ482_1=0 if KQ482_1==5

replace KQ133=. if KQ133==8| KQ133==9
replace KQ133=0 if KQ133==5

replace KQ147=. if KQ147==8| KQ147==9
replace KQ147=0 if KQ147==5

replace KQ215=. if KQ215==8| KQ215==9
replace KQ215=0 if KQ215==5


egen IncomeAssestAnswered= rowtotal(KQ014 KQ019 KQ014 KQ085 KQ014 KQ084 KQ113 KQ119
KQ138 KQ152 KQ162 KQ316 KQ330 KQ344 KQ356 KQ375 KQ395 KQ482_1 KQ215 KQ147)
```

```
KLB043
gen JobLadder=.
replace JobLadder=0 if KLB043>7 & KLB043<.
replace JobLadder=1 if KLB043>3 & KLB043<8
replace JobLadder=2 if KLB043>0 & KLB043<4
label var JobLadder "Occupational Prestige"
label define JL06 0 "High"
label define JL06 1 "Middle", add
label define JL06 2 "Low", add
label values JobLadder JL06
```

Code for Table 2.1

```
tabulate AnyHC HRSWQRC, chi2 miss row
tabulate Angina HRSWQRC, chi2 miss row
tabulate CHF HRSWQRC, chi2 miss row
tabulate heartattack HRSWQRC, chi2 miss row
tabulate StrokeHD HRSWQRC, chi2 miss row
tabulate StrokeNoHD HRSWQRC, chi2 miss row
tabulate BMIcat HRSWQRC, chi2 miss row
tabulate EverCurrentSmoke HRSWQRC, chi2 miss row
tabulate dichotomousPA HRSWQRC, chi2 miss row
tabulate AnyHI HRSWQRC, chi2 miss row
tabulate reducat HRSWQRC, chi2 miss row
tabulate Gender HRSWQRC, chi2 miss row
tabulate raceWE HRSWQRC, chi2 miss row
tabulate ragecat HRSWQRC, chi2 miss row
tabulate JobLadderRC HRSWQRC, chi2 miss row
```

Code for Table 2.2

```
tabulate CatTC HRSWQRC, chi2 miss row
tabulate CatHDL HRSWQRC, chi2 miss row
tabulate hypertension HRSWQRC, chi2 miss row
tabulate RHypertensionDef HRSWQRC, chi2 miss row
tabulate diabetes HRSWQRC, chi2 miss row
tabulate CRP2006 HRSWQRC, chi2 miss row
tabulate A1CADJ2006 HRSWQRC, chi2 miss row
```

Code for Table 2.4 & 2.5

```
cc AnyHC SecondQvsBottomQ
cc AnyHC ThirdQvsBottomQ
cc AnyHC FourthQvsBottomQ
cc AnyHC TopQvsBottomQ

cc StrokeHD SecondQvsBottomQ
cc StrokeHD ThirdQvsBottomQ
cc StrokeHD FourthQvsBottomQ
cc StrokeHD TopQvsBottomQ

cc StrokeNoHD SecondQvsBottomQ
cc StrokeNoHD ThirdQvsBottomQ
cc StrokeNoHD FourthQvsBottomQ
cc StrokeNoHD TopQvsBottomQ

cc CHF SecondQvsBottomQ
cc CHF ThirdQvsBottomQ
cc CHF FourthQvsBottomQ
cc CHF TopQvsBottomQ

cc Angina SecondQvsBottomQ
cc Angina ThirdQvsBottomQ
cc Angina FourthQvsBottomQ
cc Angina TopQvsBottomQ

cc heartattack SecondQvsBottomQ
cc heartattack ThirdQvsBottomQ
cc heartattack FourthQvsBottomQ
cc heartattack TopQvsBottomQ

logistic AnyHC i.HRSWQRC rage2 Gender raceWE i.reducat JobLadderRC [pweight = KWGTHH]
logistic StrokeHD i.HRSWQRC rage2 Gender raceWE i.reducat JobLadderRC [pweight = KWGTHH]
logistic StrokeNoHD i.HRSWQRC rage2 Gender raceWE i.reducat JobLadderRC [pweight = KWGTHH]
logistic CHF i.HRSWQRC rage2 Gender raceWE i.reducat JobLadderRC [pweight = KWGTHH]
logistic Angina i.HRSWQRC rage2 Gender raceWE i.reducat JobLadderRC [pweight = KWGTHH]
logistic heartattack i.HRSWQRC rage2 Gender raceWE i.reducat JobLadderRC [pweight = KWGTHH]

logistic AnyHC i.HRSWQRC rage2 Gender raceWE i.reducat hypertension diabetes i.BMIcat
dichotomousPA AnyHI i.EverCurrentSmoke  i.CatTC [pweight = KWGTHH]

logistic StrokeHD i.HRSWQRC rage2 Gender raceWE i.reducat hypertension diabetes i.BMIcat
dichotomousPA AnyHI i.EverCurrentSmoke  i.CatTC [pweight = KWGTHH]
```

logistic StrokeNoHD i.HRSWQRC rage2 Gender raceWE i.reducat hypertension diabetes i.BMIcat dichotomousPA AnyHI i.EverCurrentSmoke i.CatTC [pweight = KWGTHH]

logistic CHF i.HRSWQRC rage2 Gender raceWE i.reducat hypertension diabetes i.BMIcat dichotomousPA AnyHI i.EverCurrentSmoke i.CatTC [pweight = KWGTHH]

logistic Angina i.HRSWQRC rage2 Gender raceWE i.reducat hypertension diabetes i.BMIcat dichotomousPA AnyHI i.EverCurrentSmoke i.CatTC [pweight = KWGTHH]

logistic heartattack i.HRSWQRC rage2 Gender raceWE i.reducat hypertension diabetes i.BMIcat dichotomousPA AnyHI i.EverCurrentSmoke i.CatTC [pweight = KWGTHH]

test 1.HRSWQRC 2.HRSWQRC 3.HRSWQRC 4.HRSWQRC

the overall effect of net worth on CVD diagnosis is significant (X^2=94.66, d.f. = 4, p<0.0001)

Sample Longitudinal coding

```
gen baserage=.
replace baserage=1 if ragecat==1
replace baserage=1 if rage08cat==1 & ragecat==.
replace baserage=1 if rage10cat==1 & ragecat==. & rage08cat==.
replace baserage=2 if ragecat==2
replace baserage=2 if rage08cat==2 & ragecat==.
replace baserage=2 if rage10cat==2 & ragecat==. & rage08cat==.
replace baserage=3 if ragecat==3
replace baserage=3 if rage08cat==3 & ragecat==.
replace baserage=3 if rage10cat==3 & ragecat==. & rage08cat==.
replace baserage=4 if ragecat==4
replace baserage=4 if rage08cat==4 & ragecat==.
replace baserage=4 if rage10cat==4 & ragecat==. & rage08cat==.
replace baserage=5 if ragecat==5
replace baserage=5 if rage08cat==5 & ragecat==.
replace baserage=5 if rage10cat==5 & ragecat==. & rage08cat==.
replace baserage=6 if ragecat==6
replace baserage=6 if rage08cat==6 & ragecat==.
replace baserage=6 if rage10cat==6 & ragecat==. & rage08cat==.
replace baserage=7 if ragecat==7
replace baserage=7 if rage08cat==7 & ragecat==.
replace baserage=7 if rage10cat==7 & ragecat==. & rage08cat==.
replace baserage=8 if ragecat==8
replace baserage=8 if rage08cat==8 & ragecat==.
replace baserage=8 if rage10cat==8 & ragecat==. & rage08cat==.
label var baserage "Baseline categorical age of R"
```

```
label define baseage 1 "50-54 years"
label define baseage 2 "55-59 years", add
label define baseage 3 "60-64 years", add
label define baseage 4 "65-69 years", add
label define baseage 5 "70-74 years", add
label define baseage 6 "75-79 years", add
label define baseage 7 "80-84 years", add
label define baseage 8 "85+ years", add
label values baserage baseage

gen baseHI=.
replace baseHI =0 if AnyHI06==0
replace baseHI =0 if AnyHI08==0 & AnyHI06==.
replace baseHI =0 if AnyHI10==0 & AnyHI06==. & AnyHI08==.
replace baseHI =1 if AnyHI06==1
replace baseHI =1 if AnyHI08==1 & AnyHI06==.
replace baseHI =1 if AnyHI10==1 & AnyHI06==. & AnyHI08==.
label var baseHI "Baseline health insurance status"
label define basehi 0 "Not insured"
label define basehi 1 "Insured", add
label values baseHI basehi

gen basePA=.
replace basePA =0 if dichotomousPA==0
replace basePA =0 if dichotomousPA08==0 & dichotomousPA ==.
replace basePA =0 if dichotomousPA010 ==0 & dichotomousPA ==. & dichotomousPA08==.
replace basePA =1 if dichotomousPA ==1
replace basePA =1 if dichotomousPA08 ==1 & dichotomousPA ==.
replace basePA =1 if dichotomousPA010 ==1 & dichotomousPA ==. & dichotomousPA08 ==.
label var basePA "Baseline physical activity status"
label define basepa 0 "Not active"
label define basepa 1 "Active", add
label values basePA basepa



 gen baseSmoking=.
replace baseSmoking=0 if EverCurrentSmoke==0
replace baseSmoking=0 if EverCurrentSmoke08 ==0 & EverCurrentSmoke==.
replace baseSmoking=0 if EverCurrentSmoke10 ==0 & EverCurrentSmoke ==. & EverCurrentSmoke08 ==.
replace baseSmoking =1 if EverCurrentSmoke ==1
replace baseSmoking =1 if EverCurrentSmoke08 ==1 & EverCurrentSmoke ==.
replace baseSmoking =1 if EverCurrentSmoke10==1 & EverCurrentSmoke ==. & EverCurrentSmoke08 ==.
replace baseSmoking =2 if EverCurrentSmoke ==2
```

```
replace baseSmoking =2 if EverCurrentSmoke08 ==2 & EverCurrentSmoke ==.
replace baseSmoking =2 if EverCurrentSmoke10==2 & EverCurrentSmoke ==. & EverCurrentSmoke08 ==.
label var baseSmoking "Baseline smoking status status"
label define basesmoke 0 "Never"
label define basesmoke 1 "Quit", add
label define basesmoke 2 "Current", add
label values baseSmoking basesmoke

gen baseBMI=.
replace baseBMI =1 if BMIcat==1
replace baseBMI =1 if BMIcat08 ==1 & BMIcat ==.
replace baseBMI =1 if BMIcat10 ==1 & BMIcat ==. & BMIcat08 ==.
replace baseBMI =2 if BMIcat ==2
replace baseBMI =2 if BMIcat08 ==2 & BMIcat ==.
replace baseBMI =2 if BMIcat10 ==2& BMIcat ==. & BMIcat08 ==.
replace baseBMI =3 if BMIcat ==3
replace baseBMI =3 if BMIcat08 ==3 & BMIcat ==.
replace baseBMI =3 if BMIcat10 ==3 & BMIcat ==. & BMIcat08 ==.
replace baseBMI =4 if BMIcat ==4
replace baseBMI =4 if BMIcat08 ==4 & BMIcat ==.
replace baseBMI =4 if BMIcat10 ==4 & BMIcat ==. & BMIcat08 ==.
label var baseBMI "Baseline BMI status"
label define basebmi 1 "Underweight"
label define  basebmi 2 "Normal", add
label define basebmi 3 "Overweight", add
label define basebmi 4 "Obese", add
label values baseBMI basesmoke




gen baseHTN=.
replace baseHTN =0 if HTN06==0
replace baseHTN =0 if HTN08 ==0 & HTN06==.
replace baseHTN =0 if HTN10 ==0 & HTN06==. & HTN08 ==.
replace baseHTN =1 if HTN06==1
replace baseHTN =1 if HTN08 ==1 & HTN06==.
replace baseHTN =1 if HTN10 ==1 & HTN06==. & HTN08 ==.
replace baseHTN =2 if HTN06==2
replace baseHTN =2 if HTN08 ==2 & HTN06==.
replace baseHTN =2 if HTN10 ==2 & HTN06==. & HTN08 ==.
```

```
label var baseHTN "Baseline HTN status"
label define basehtn 0 "Normotensive"
label define basehtn 1 "Controlled HTN", add
label define basehtn 2 "Uncontrolled HTN", add
label values baseHTN basehtn

gen baseDM=.
replace baseDM =0 if DM06==0
replace baseDM =0 if DM08 ==0 & DM06==.
replace baseDM =0 if DM10 ==0 & DM06==. & DM08 ==.
replace baseDM =1 if DM06==1
replace baseDM =1 if DM08 ==1 & DM06==.
replace baseDM =1 if DM10 ==1 & DM06==. & DM08 ==.
replace baseDM =2 if DM06==2
replace baseDM =2 if DM08 ==2 & DM06==.
replace baseDM =2 if DM10 ==2 & DM06==. & DM08 ==.
label var baseDM "Baseline DM status"
label define basedm 0 "Normal"
label define basedm 1 "Controlled DM", add
label define basedm 2 "Uncontrolled DM", add
label values baseDM basedm
```