Essays on the Complexities of Social Inequalities and Health Disparities

by

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Duke University

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Dissertation submitted in partial fulfillment of
the requirements for the degree of Doctor
of Philosophy in the Department of
Sociology in the Graduate School
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2020

ABSTRACT

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Abstract

In this dissertation, I conduct three studies focusing on differences in social groups and their health outcomes or opinions related to medical practices. In Chapter 1, I outline each study and its findings.

Chapter 2 focuses on the Great Recession in the United States (2007–2009) and how this crisis is associated with health disparities. In this chapter, I use nine waves spanning 16 years (1998-2014) of the RAND version of the Health and Retirement Study (HRS) to examine disparities in cardiovascular disease, stroke, or related death (e.g., circulatory disease) among Americans ages 50 and older to determine whether these health disparities among different educational groups narrowed, widened, or remained constant during and after the Great Recession. In general, findings from discrete-time hazard analyses suggest that the disparities remained relatively constant with some (nonsignificant) evidence of some narrowing between the most educated and least educated groups.

Chapter 3 examines whether there is symmetry in the effects of certain health behaviors—smoking, drinking, weight management—on cardiovascular disease, stroke, or related death between socioeconomic groups. This chapter also uses nine waves (1998–2014) of the RAND HRS. Discrete-time hazard regression analyses indicate that while those with more education maintain better health outcomes regardless of health

behaviors, the effects of health behaviors are not equally distributed. Poor weight management and higher numbers of daily cigarettes are associated with a greater increased risk for those with more education than for those with less. The effects of heavy drinking, however, are less severe for the those with the most education compared to those with the least education.

Chapter 4 studies the role of social change by investigating trends in approval for euthanasia among cohorts in the United States and how those trends are influenced by cohort replacement and religious attitudes. This chapter uses 16 waves of the General Social Survey (1985–2014) and estimates differences in approval ratings between cohorts using logistic regression models. Results show that baby boomers are significantly more likely to approve of euthanasia than either their predecessors or successors, suggesting a cohort effect. Individuals belonging to more conservative religious groups and displaying higher levels of religiosity are less likely to approve. With the meaningful effect of cohorts on approval for euthanasia, findings suggest that as baby boomers age and as the population becomes less religious, approval for euthanasia might increase again.

Dedication

To Kylie and Jack. Thanks for making all of this worth it.

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1. Introduction

In this dissertation, I seek to gain a better understanding of current social inequalities in education and their association with health disparities today. To do this, I investigate three areas of interest to social scientists studying health: (1) economic inequality and financial crises, (2) socioeconomic inequality and health behaviors, and (3) cohort differences in beliefs about medical practices. In these three quantitative studies, I examine how various measures of social inequalities affect disparities in health outcomes and practices. My research interests and questions are driven by the larger idea that health outcomes and practices differ among social groups. In my first study, I focus on the idea that a person's advantage or disadvantage increases over time and is associated with disparities in risk of heart disease, stroke, and death. In my second study, I seek to understand how different levels of education and health behaviors associate with disparities in risks of heart disease, stroke, and death. In my final study, I investigate the role of cohorts, as well as political and religious identity, on individuals' opinions of euthanasia.

The first study uses nine waves, spanning 16 years (1998–2014), of the Health and Retirement Study to study the effects of the Great Recession on health disparities in the United States between older Americans of different educational statuses. To do this, I use theories derived from a cumulative inequality approach (Ferraro and Shippee 2009; Ferraro, Shippee, and Schafer 2009), which describes how the accumulation of resources

over time leads to better health outcomes for those who are well-to-do and increasing inequalities over time. In this chapter, I use discrete-time hazard modeling and control for the Great Recession to determine respondents' risk of heart disease, stroke, or related death (e.g., circulatory disease) as they age, and if these risks differ by educational status. This project builds upon and adds to previous research on health and the Great Recession by providing a longitudinal approach that includes more recent data, since many previous studies use data immediately following the recession in 2010.

My second study also uses nine waves (1998–2014) of the Health and Retirement Study to study disparities in heart disease, stroke, and related death. In this study, I focus on whether the effects of potentially harmful health behaviors—smoking, drinking, unhealthy BMI—are the same for people at different levels of education. Much is known about the differences in the adoption of health behaviors among those of different socioeconomic statuses and education levels (e.g., Thoits 2006; Short and Mollborn 2015; Hagger and Hamilton 2020). However, much less is known about how the same practices in health behaviors might affect people of different socioeconomic and educational statuses (e.g., Pampel 2009; Pampel, Krueger, and Denney 2010; Umberson, Crosnoe, and Reczek 2010; Shaw et al. 2014; Brunello et al. 2016). In this chapter, I build upon the previous literature by using a more nuanced measure of smoking (number of cigarettes) and accounting for sex differences in drinker status.

My final study uses 16 waves (1985–2014) of the General Social Survey to investigate changing attitudes towards end-of-life care practices, specifically the practice of euthanasia, and the role that cohort replacement and religious ideology play in influencing these attitudes. With an aging population and rising costs of healthcare, many Americans are wondering how to solve the ethical dilemma of ending a person's life versus allowing someone to suffer needlessly (Livne 2014). Previous research has shown that major shifts in attitudinal changes are driven by cohort replacement rather than individuals changing as they age (Elder and George 2016). In my research, I examine whether differing attitudes in approval for euthanasia are a result of cohort effects and how secularization—a cohort effect—accounts for these changes.

2. The Great Recession, Cardiovascular Disease, Stroke, and Death

As of this writing in the summer of 2020, the COVID-19 pandemic threatens to plunge the world into another global economic downturn (Gopinath 2020). The United States has seen a substantial increase in unemployment and plummeting stock market values since March 2020. Early reports indicate that the socially disadvantaged are being hit the hardest by the COVID-19 pandemic (CDC 2020c), which fits patterns previously found by social scientists and health researchers (e.g., McKee 2011; Marmot and Bell 2012; McInerney, Mellor, and Nicholas 2013; Burgard and Kalousova 2015). Since the data for this current pandemic is still in flux, my current study examines health inequalities during and after the preceding economic crisis, the Great Recession (2007–2009), to determine whether disparities among advantaged and disadvantaged groups narrowed, widened, or stayed constant.

2.1 Background

In late 2007, the subprime mortgage bubble in the United States burst, with many long-lasting repercussions. The housing market plummeted: more than 15 percent of home mortgages defaulted and housing prices fell 30 percent (Federal Reserve Economic Data 2017). The crash in the housing market in turn affected the stock market, as the Dow Jones Industrial Average dropped more than 50 percent (Amadeo 2017). In 2008, at the height of this recession, the unemployment rate was the highest it had been in nearly

30 years. However, the unemployment rate varied based on differences in individuals' social conditions. Lower-paying and labor-intensive jobs like construction and manufacturing saw the highest increases in unemployment, while higher paying industries like finance and health services saw more modest declines (Bureau of Labor Statistics 2012). The Great Recession also disproportionately hurt those with less education. At the peak of the recession, those with less than a high school degree had an unemployment rate of 15 percent, while those with a bachelor's degree or higher did not even reach 5 percent unemployment (Hout and Cumberworth 2012).

The research on financial crises dovetails with extant literature on health and financial stability and gives insights into why and how an event like the Great Recession can lead to worse health. Research shows that unexpected job loss, forced unemployment, and/or declines in income lead to higher levels of psychological stress, increased risk for cardiovascular disease, worse self-rated health, and increased mortality rates (Catalano et al. 2011; Dupre et al. 2012; Burgard, Ailshire, and Kalousova 2013; Black, Devereux, and Salvanes 2015). Increased psychological stress during financial difficulty significantly contributes to adverse health outcomes. Transitioning from adequate to inadequate employment (Tausig and Fenwick 1999), only having unstable or short-term jobs (Ferrie et al. 2002; Kalil et al. 2010; Dupre et al. 2012), and suffering loss of income can increase the risk of poor mental health.

Furthermore, financial instability is connected to increased general morbidity (Eliason and Storrie 2009; Catalano et al. 2011), and psychological stress experienced during financial difficulty increases the risk of cardiovascular disease at the individual level (Gallo et al. 2004; Lee et al. 2004; Gallo et al. 2006). From a health perspective, a high unemployment rate is concerning because Americans' health insurance is largely tied to their jobs (Holahan 2011). Therefore, when individuals lose their jobs, they also end up losing access to their insurance networks and must choose between paying extreme premiums for coverage or rationing healthcare (Hartman et al. 2010; Mortensen and Chen 2013).

However, there are some counterintuitive findings when analyzing financial crises and health outcomes. When macroeconomic conditions worsen, obesity, tobacco use, and mortality rates (except suicide) decline, while levels of physical activity increase (Ruhm 2005; Burgard et al. 2013). Some possible explanations for these changes are that there are fewer vehicles on the road and thus fewer auto accidents, there are fewer on-the-job accidents, people have more time for exercise, more time for sleep, and less disposable income to purchase alcohol and tobacco (de la Fuente et al. 2014; He 2016). Other explanations for these findings and how a recession might affect lower- and higher-socioeconomic status (SES) groups differently are that disposable incomes decrease and lower-SES groups are less able to afford cigarettes and alcohol, these groups are also less likely to purchase fresh produce and more likely to purchase fast

food when money is tight (Burgard et al. 2013). While there might be some counterintuitive findings for physical health during financial crises, findings for mental health tend to be as expected.

Recent studies looking specifically at the short-term impacts of the Great Recession indicate that overall rates of several health indicators worsened. For example, mental health worsened to the point that some regions of the country saw an increase in suicide during and following the Great Recession (Modrek et al. 2013; Stuckler et al. 2015). Another study found that mortality rates in the United States are increasing for all causes of death among those with less than a four-year degree (Case and Deaton 2020); while this study does not directly attribute this increase to the Great Recession but rather to socioeconomic inequality and healthcare inequality, the financial crisis did affect socioeconomic disparities (Smeeding 2012). Research on countries impacted by the Great Recession outside the United States saw an increase in levels of poor self-rated health, higher prevalence of cardiovascular disease, and an increase in infectious diseases (Astell-Burt and Feng 2013; Vandoros et al. 2013; Simou and Koutsogeorgou 2014; Toffolutti and Suhrcke 2014). There are similar findings for health outcomes in the United States during and after the Great Recession. However, there is less research that directly investigates the longer-term health impacts of the Great Recession.

The studies specific to health and the Great Recession all have limitations. McInerney and Mellor (2012) found that unemployment during a recession is associated

with worse self-rated health, higher rates of depression, and higher mortality rates for individuals age 65 and older. However, this study is limited in that only one of their three datasets included data from any time during the Great Recession; therefore, these findings are more applicable to financial crises and unemployment in general than to the Great Recession itself. In another promising study, Deaton (2012) found that, from 2008 to 2010, overall measures of subjective well-being reflected changes in the stock market regardless of whether individuals owned stocks. Once again, the study is limited in scope because it only examined outcomes through 2010. Finally, McInerney, Mellor, and Nicholas (2013) specifically investigated the impact of the stock market crash in October 2008 on mental health for older adults. Their finding that those who began with higher levels of stock holdings experienced the highest increase in depressive symptoms suggests that the shock of the crash had a more direct and negative impact on these individuals than it did on those with fewer assets. Again, the scope is limited since the researchers only include the 2008 wave of the Health and Retirement Study and compared respondents surveyed before the October crash to themselves surveyed after. Ultimately, the long-term health impacts of the Great Recession are still unclear (Burgard et al. 2013; Burgard and Kalousova 2015).

However, despite the relatively short time frame examined, these studies do indicate that the health effects of the Great Recession vary depending on where individuals were in their life course. The impact of economic conditions and crises on

health has been an essential pillar of studies in the life course since Glen Elder's seminal book, *Children of the Great Depression* (1974/1999), which illustrated how the timing of a crisis could profoundly influence future health outcomes depending on an individual's age when it occurred. For example, men who experience a recession between ages 45 and 49 are more likely to suffer cognitive decline after 50 than those who were younger during a downturn (Leist, Hessel, and Avendano 2014). The timing of a recession within the life course also affects people's ability to recover financially. The nearer people are to retirement age when the recession hits, the less time they have to recoup their losses, leaving them with fewer financial resources available for their healthcare as well as increased psychological distress (Butrica, Smith, and Toder 2010; Deaton 2012; McInerney et al. 2013).

2.1.1 Social Inequality and Health Disparities

According to data from the Survey of Consumer Finances and the Census Bureau, wealth and income inequality have increased since the Great Recession (Smeeding 2012). However, during the Great Recession itself (2007–2009), there was some compression between income groups that slightly narrowed a few of these inequalities (Smeeding 2012; Kochhar and Cilluffo 2017). These compressions were more noticeable when comparing inequalities between those with low incomes and those with middle incomes, and less apparent among disparities between upper-income and either low- or middle-income groups. Those with the highest incomes lost the most in absolute

terms of wealth, but individuals in these high-income brackets were better able to recover following the recession due to their remaining wealth and incomes (Kochhar and Cilluffo 2017). Those in the middle-income groups were much more reliant on their housing as a part of their wealth; therefore, in proportional terms, those in the middle lost the most and had the hardest time recovering. The lowest-income groups were also hurt by the recession, but since they had fewer assets to begin with, they did not lose as much in either absolute or relative terms compared to those in middle-income groups, resulting in a compression in the level of inequality (Smeeding 2012; Kochhar and Cilluffo 2017).

Researchers have found that socioeconomic inequalities (e.g., education, income, or socioeconomic status inequality) are linked to health outcomes; in other words, those with higher education, incomes or overall higher status in society have better health and lower mortality rates than those of lower incomes or status (Marmot 1994; Braveman 2006; Marmot and Bell 2012). While there are health disparities between wealthier and poorer countries, Marmot (2005a) notes that there are also extreme and growing disparities between the highest and lowest socioeconomic groups in wealthy countries with high inequality. One striking example: for individuals living in two counties just 12 miles apart in the Washington DC area, there is a 20-year difference in life expectancy between rich white men and poor black men (Marmot 2005b; Marmot 2006).

In an analysis of income inequality and population health, Wilkinson and Pickett (2008) find that larger income inequality is strongly associated with mortality gradients and that a more equal income distribution benefited the mortality rates in both wealthy and poor countries. One review of 155 papers researching the relationship between income inequality and population health concludes that income distribution is related to health and can even serve as a measure of social class differences (Wilkinson and Pickett 2006). These researchers also show that nearly every measure of well-being, including heart disease and mortality, is affected less by the wealth of a society and more by how unequal a society is (Wilkinson and Pickett 2010).

One theory that specifically considers social inequality and health outcomes is cumulative inequality (CI), which suggests that social systems create health inequalities between social groups and that these inequalities continue to accumulate and expand across the life course (Elder 1994; Ferraro and Shippee 2009). Those individuals with the most socioeconomic resources (e.g., education) accumulate more resources and subsequently have better health outcomes than those with fewer resources (Ferraro and Shippee 2009; Ferraro et al. 2009). Ferraro and Shippee (2009) outline five axioms related to CI: (1) social systems generate inequality, which is displayed over the life course; (2) disadvantage increases exposure to risk, while advantage increases exposure to opportunity; (3) life course trajectories are shaped by the accumulation of risk, resources,

and agency; (4) perception of life trajectories influences subsequent trajectories; and (5) CI may lead to premature mortality.

Applying the axioms outlined above to the Great Recession, many of the social systems that generated inequalities were exacerbated during the Great Recession. As noted previously, social groups who were already at a disadvantage (e.g., those with less education) were disproportionally affected. For instance, the practice of providing subprime mortgages—which was mainly responsible for the financial crisis—targeted disadvantaged groups and encouraged them to purchase homes that they could not afford (Rugh and Massey 2010). Even though health disparities existed before the financial crisis, once the recession hit, disadvantaged groups—especially racial and ethnic minorities—were much more exposed to the risks of unemployment and displaced housing than their advantaged counterparts (Pfeffer, Danziger, and Schoeni 2013).

This shock in the market and society could have altered life course trajectories of both the advantaged and disadvantaged groups (McInerney et al. 2013). However, even before the recession, disadvantaged groups were more likely to have accumulated risks while advantaged groups were more likely to have accumulated resources, which in turn affects how individuals in these groups handled the crisis. Ultimately, since CI may lead to premature mortality, the stress and strain of the Great Recession could have had

greater effects on those who had fewer resources or less time to recover, leading to an earlier death than their resource- and time-rich counterparts.

As with their different interpretations of individual- versus aggregate-level effects of recessions, scholars have drawn opposing conclusions in light of these findings. Some researchers have speculated that pre-existing health inequalities will worsen (McKee 2011; Karanikolos et al. 2013; Burgard and Kalousova 2015) and that health disparities will increase following the Great Recession, since those with higher rates of unemployment, lower incomes, and less education were more vulnerable to adverse health outcomes than their more advantaged counterparts (Charles and DeCicca 2008). In contrast, other researchers suggest that health inequalities might narrow following the Great Recession based on evidence from past recessions and the possibility that those with greater resources might have experienced more considerable relative losses (Valkonen et al. 2000; Kachi et al. 2013; McInerney et al. 2013).

Another explanation for why health disparities might narrow between those with more advantage and those with less advantage is the idea of "status syndrome," (Marmot 2005b; Marmot 2006; Marmot & Bell 2012). Status syndrome suggests that in addition to the effect of social determinants on health disparities, there is a social gradient among individuals in society that is strongly correlated with health as well. This means that although status in society is relative and perceived, if status is perceived as lower, risk for poor health and mortality is higher (Marmot 2005b; Marmot 2006).

During the Great Recession, it is possible that those who started with more advantage who lost much of their advantage relative to their less-advantage counterparts would suffer a status loss and thus increase their risk of poor health outcomes.

In this study, I use a CI perspective in investigating health outcomes across educational groups who were closer to retirement age when the Great Recession hit. I seek to understand whether individuals who had less education at the time the recession hit were more vulnerable than their more educationally-advantaged counterparts to adverse health outcomes, specifically cardiovascular disease, stroke, and death due related disease (i.e., cardiovascular, circulatory, or blood conditions). Comparing health changes since the Great Recession in disadvantaged groups relative to their advantaged counterparts provides a glimpse into how advantage and disadvantage might operate differently depending on life stage and education (Butrica et al. 2010; McInerney et al. 2013).

2.1.2 Research Question

Did health disparities between advantaged and disadvantaged groups narrow, widen, or stay constant during and after the Great Recession?

2.2 Methods

2.2.1 Sample

For this study, I use nine waves of the RAND Health and Retirement Study (HRS) from 1998 to 2014 to assess the effects of the Great Recession on cardiovascular

disease, stroke, or related death (e.g., circulatory disease) across education groups. The HRS is a nationally representative longitudinal survey of adults in the United States over age 50 and their spouses that has been collected biennially since 1992. The initial sample from 1992 to 2014 includes 37,495 individuals. However, since the HRS initially consisted of two studies that merged in 1998, I restrict my analyses to the 1998 to 2014 waves in order to use uniform variables of interest in each wave (Sonnega et al. 2014). I also restrict my analyses to include only those respondents who joined the study in or before 2006 so that each respondent has data before, during, and after the Great Recession—assuming they remain in the study. I further reduce the sample to include only one person per household and eliminate spouses of respondents and others who are younger than 50. Finally, any respondent not assigned to an HRS Cohort (e.g., AHEAD cohort or CODA cohort) is not included in the sample, leaving and initial sample of 14,207 respondents.

After reviewing the initial sample, there were few missing data on time-invariant covariates: 7 (0.05%) were missing data on race/ethnicity, 5 (0.04%) on Hispanic ethnicity, and 1 on both non-Hispanic white and other race. I imputed missing race/ethnicity as other race and missing Hispanic as non-Hispanic ethnicity. In addition, 2 (0.01%) were missing data on educational attainment, and these were imputed with the modal category (high school or equivalent).

For my analyses, the data are structured in a long format consisting of two-year intervals spanning survey waves. In this structure, there were no time-variant covariates with missing data that could not be imputed. My remaining sample of consists of 66,173 interval records. I further restrict the sample data to include only respondents who are at risk for cardiovascular disease, stroke, or related death due to related disease (e.g. circulatory disease), meaning they have yet to report an incidence of cardiovascular disease or stroke before entering the sample, limiting my analytical sample to 10,345 respondents that contributed 55,897 interval records.

2.2.2 Measures

Dependent Variable. My outcome variable for this study is diagnosis with cardiovascular disease or stroke or death due to related illnesses (i.e., circulatory system disease). The first measure in this outcome is cardiovascular disease, which I use for several reasons. First, it is the leading cause of death for both men and women across most racial and ethnic groups in the United States (CDC 2017; CDC 2019). Second, while individuals of all ages are at risk of heart disease, the risk increases with age, and adults 65 and older are at the greatest risk. The mean age of my sample is about 70, so cardiovascular disease is very relevant to my sample population (NIH 2018). Finally, heart disease is very costly to treat the United States. In 2013, hospital costs related to cardiovascular disease were more than $43 billion (Torio and Moore 2016), while total costs including hospitalization, rehabilitation, medicines, and more in 2014 and 2015

reached nearly $1 billion per day (Benjamin et al. 2019). To determine whether respondents have had cardiovascular disease, the HRS asks "whether or not a doctor ever told the Respondent s/he had these conditions . . . heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems" (Bugliari et al. 2019). Respondents then have the choice of either yes or no. I eliminate respondents that indicate having been diagnosed by a physician with heart disease in or prior to the 1998 wave (3,093), which yields a sample where everyone is at risk for the outcome when they enter. Once respondents indicate that they have one of these conditions, I code them as yes in each subsequent wave (no cardiovascular disease=0; yes cardiovascular disease=1).

The second measure in the outcome is stroke. Stroke is closely related to cardiovascular disease in terms of risk factors and possible prevention and interventions (CDC 2020f). Additionally, strokes are the fifth leading cause of death in the United States (CDC 2020h). As with cardiovascular disease, the HRS asks respondents whether they ever had a stroke, giving them the choice of yes or no. I eliminate respondents that indicate having had a stroke in or before the 1998 wave (623) to ensure that no one in the sample begins with the condition. Once a respondent indicates that they have had a stroke, I code them as yes in each subsequent wave (no stroke=0; yes stroke=1).

The final measure of this outcome variable is cause of death due to cardiovascular disease or stroke related illness (i.e., circulatory system disease). The HRS

codes deaths due to cardiovascular disease, circulatory, and blood conditions together in its cause of death data. When respondents die, the HRS collects data on their death (e.g., when, where, death certificate, and cause of death) by interviewing a proxy for the deceased respondent. The proxy is typically a surviving spouse or family member who answers a series of questions about the time, location, and cause of the respondent's death. This information is available to researchers in the RAND HRS public file. Given the age of this sample and the high rates at which cardiovascular disease and stroke lead to death, it is important to include this cause of death measure to try to capture all respondents who may have suffered from these illnesses but died between waves without receiving a diagnosis. If respondents' death is due to one of these causes, they are included in this measure (COD=1).

Using these three measures (cardiovascular disease, stroke, and cause of death), I create one dichotomous outcome indicating whether a respondent, in a given wave of the study, has been diagnosed with heart disease or stroke or died due to circulatory system disease prior to the most recent wave of the study (no outcome=0; yes outcome=1).

Independent and Control Variables. Respondents' educational attainment is a categorial measure created by the RAND HRS based on years of education. Respondents are recorded as having less than a high school diploma, a high school diploma or equivalent, some college but no degree, or a bachelor's degree or more.

Other key variables in these analyses include an indicator of the Great Recession and respondents' age. The Great Recession began in 2007, but there was no HRS survey in 2007; therefore, study waves before the recession hit (waves 1998–2006=0) are compared to waves after the recession hit (waves 2008–2014=1). *Age* is a continuous variable measured for each respondent in every wave and ranges from 50 to just over 106 years. In the analyses, I interact age with the recession indicator to estimate the effect of the recession on respondents' health as they age.

I control for several other sociodemographic variables, including sex, race/ethnicity, marital status, and current region of the country. Sex is measured as a dummy variable (male=1; female=0). Race/ethnicity is measured as a categorical variable with non-Hispanic white (reference category), non-Hispanic black (=1), non-Hispanic other (=2), and Hispanic (=3). Marital status is measured as currently married/partnered (=1) or not currently married (=0). Current region of the country is measured at the time of the survey interview and is a dummy variable of South (=1) and non-South (=0).

2.2.3 Analyses

To estimate differences in risk of cardiovascular disease, stroke, and death due to related diseases between SES groups, I use discrete-time hazard regression models. Models are estimated separately by educational categories to obtain a slope of the adjusted log odds for each educational group by age, and slopes are then compared to each other. In each educational group, estimated models include recession, age, an

interaction between age and recession (to see the effect of the Great Recession on trajectories over time), sex, race/ethnicity, marital status, and region of the country. To test for multicollinearity, I estimate OLS models and calculate the variance inflation factors (VIFs) for each covariate in the full model. All VIF estimates are below 1.5, which is well below the common threshold of 10, indicating that multicollinearity is not a concern.

2.3 Results

Descriptive statistics for my sample are presented in Table 1. Some key descriptive statistics are as follows. First, those with the least education have the highest prevalence of cardiovascular disease, stroke, related death, and the combined outcome, while those with the most education have the lowest prevalence in each respective measure. Second, approximately 42% of this sample is male, and the overwhelming majority of this sample is non-Hispanic white (73%), which is important because the rates of cardiovascular disease and stroke are higher for men

Table 1. Descriptive Statistics HRS, 1998-2014

	Less than High School		High School or Equivalent		Some College, no Degree		Four-Year Degree or More		Full Sample	
	Mean / %	Range / Total	Mean / %	Range / Total	Mean / %	Range / Total	Mean / %	Range / Total	Mean / %	Range / Total
Outcome										
CVD	0.047	641	0.046	915	0.046	510	0.040	452	0.050	2,518
Stroke	0.021	282	0.017	344	0.016	177	0.015	171	0.017	974
Death	0.018	248	0.009	174	0.008	85	0.007	81	0.011	588
Combined Outcome	0.083	1,125	0.069	1,377	0.066	740	0.060	677	0.070	3,919
Age	72.635	50.167 to 106.583	70.285	50 to 101.667	69.482	50.167 to 102.583	69.088	50.083 to 103.083	70.454	50 to 106.830
Male	0.378	5,140	0.383	7,615	0.402	4,494	0.556	6,379	0.421	23,528
Female	0.622	8,442	0.617	12,265	0.597	6,648	0.444	5,014	0.579	32,369
Race										
Non-Hispanic white	0.485	6,585	0.792	15,744	0.782	8,713	0.855	9,651	0.728	40,693
Non-Hispanic black	0.261	3,540	0.137	2,727	0.134	1,498	0.090	1,016	0.157	8,781
Non-Hispanic other	0.022	308	0.016	310	0.023	255	0.029	330	0.022	1,203
Hispanic	0.232	3,149	0.055	1,099	0.061	676	0.026	296	0.093	5,220
Married	0.431	5,858	0.534	10,608	0.567	6,322	0.643	7,261	0.538	30,049
Not Married	0.569	7,724	0.466	9,272	0.433	4,820	0.357	4,032	0.462	25,848
South	0.515	6,992	0.374	7,441	0.360	4,012	0.385	4,352	0.408	22,797
Not South	0.485	6,590	0.626	12,439	0.640	7,130	0.615	6,941	0.592	33,100
n	13,582		19,880		11,142		11,293		55,897	

Note. HRS = RAND Health & Retirement Study

than women and higher for non-Hispanic blacks than for non-Hispanic whites and Hispanics (Benjamin et al. 2018; Heron 2018; CDC 2019).

Table 2 shows the results for all four of the estimated discrete-time hazard regression models.[1] The results from all the control variables are as expected. For all four models, the positive or negative effect of the control variables are generally as expected, although most are not statistically significant. The coefficient for male is positive and significant in each educational category, as is the coefficient for age.

Table 2. Discrete-Time Hazard Regression for CVD, Stroke, or Related Death (n=10,345; 55,897 interval records)

	Model 1	Model 2	Model 3	Model 4
	Less than HS	HS/GED	Some College	BA/S+
Recession	1.460*	1.343**	0.731	-0.513
Age	0.045***	0.052***	0.053***	0.050***
Age*Recession	-0.022**	-0.018*	-0.011	0.006
Male	0.212**	0.281***	0.295***	0.321***
Race/Ethnicity				
Non-Hispanic White	REF	REF	REF	REF
Non-Hispanic Black	-0.099	0.008	-0.130	0.179
Non-Hispanic Other	0.198	-0.669*	0.040	-0.365
Hispanic	-0.320***	-0.413**	-0.175	-0.125
Married	-0.106	-0.121†	-0.039	0.008
South	-0.006	0.145*	0.025	0.022
Constant	-5.679***	-6.454***	-6.453***	-6.462***
n	13,582	19,880	11,142	11,293

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

[1] Here, I present Tables and Figures from the results of my primary models. Additionally, I estimated several supplementary analyses to investigate my research question. These analyses include models by education groups that do control on income, wealth, or either control on both; analyses by education groups that examine each health outcome (CVD, stroke, or related death) on its own. I also estimate an OLS regression by education group of an additive outcome. Other supplementary analyses include discrete-time hazard models by wealth quintiles. *Wealth* is a measure of respondents' net value of their total wealth, which is a sum of wealth components available in the HRS minus debts. In general, results from all models do not show any differences that suggest different results or findings from the models presented in this chapter. Results for supplementary analyses are available in Appendix A.

In all four models, the coefficient for age has a positive and significant effect, which is expected since the risk of cardiovascular disease, stroke, and death all increase with age. The coefficient for the interaction between age and recession is negative in the three lowest-education groups and positive in the highest education group; however, this effect is only significant for those with less than a high school diploma and those with a high school diploma or equivalent. In Figure 1, I report adjusted log odds from Models 1, 2, 3, and 4. Figure 1 shows the trajectory for each educational category from ages 50 to 98, including constants pre-recession. The pattern shows that pre-recession, there would be very little narrowing in this health disparity as people age, with the biggest narrowing happening late in life between those with less than a high school diploma and those with some college.

Table 3. Predicted Marginal Effects of Interactions Between Age and Recession by Education Level

	Less than HS		HS/GED		Some College		BA/S+	
Age	Pre-Recess.	Post-Recess.	Pre-Recess.	Post-Recess.	Pre-Recess.	Post-Recess.	Pre-Recess.	Post-Recess.
50	0.0306***	0.0440***	0.0230***	0.0356***	0.0235***	0.0275***	0.0225***	0.0185***
55	0.0381***	0.0492***	0.0297***	0.0421***	0.0304***	0.0334***	0.0287***	0.0243***
60	0.0473***	0.0551***	0.0383***	0.0496***	0.0392***	0.0409***	0.0364***	0.0319***
65	0.0587***	0.0616***	0.0492***	0.0585***	0.0504***	0.0498***	0.0462***	0.0417***
70	0.0726***	0.0689***	0.0630***	0.0687***	0.0646***	0.0605***	0.0584***	0.0544***
75	0.0894***	0.0769***	0.0803***	0.0807***	0.0824***	0.0734***	0.0736***	0.0706***
80	0.1097***	0.0858***	0.1019***	0.0944***	0.1046***	0.0887***	0.0924***	0.0913***
85	0.1339***	0.0956***	0.1285***	0.1103***	0.1319***	0.1068***	0.1154***	0.1171***
90	0.1624***	0.1064***	0.1607***	0.1284***	0.1650***	0.1281***	0.1431***	0.1491***
95	0.1956***	0.1182***	0.1991***	0.1489***	0.2045***	0.1529***	0.1762***	0.1880***

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

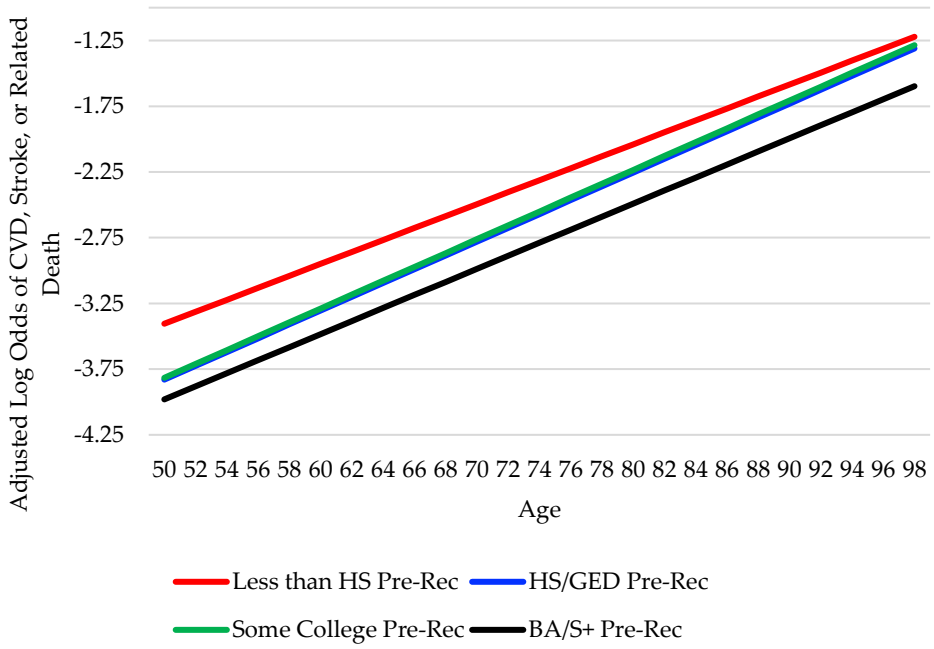

Figure 1. Adjusted Log Odds of CVD, Stroke, or Related Death by Age and Education Group pre-Great Recession

In Figure 2, I show the trajectories for all education categories from ages 50 to 98, including constants, but I also include the coefficients for the recession and age by recession interaction. While the pattern in Figure 2 is similar to the pattern in Figure 1, due to the aging population, there are important differences between the categories in Figure 2. First, the age trajectories for post-Great Recession, the education categories at age 50 are further apart, with the most educated having a much lower risk cardiovascular disease, stroke, or death than the other categories. However, when looking at age trajectories for post-recession, the three lower education categories have a shallower slope as they age (Figure 2) than their original slopes (Figure 1). Second, beginning around age 74 and older, the large disparity that

existed between the groups at age 50 is much smaller and remains that way as age continues to increase. Third, post-recession age trajectories highlight the narrowing between those with less than a high school diploma, some college, and at least a college degree, while the disparity between those with less than a high school degree and those with high school degree or equivalent narrows only slightly and remains relatively parallel. Figure 3 overlays Figures 1 and 2 and shows the disparities between education categories when showing pre- and post-recession age trajectories.

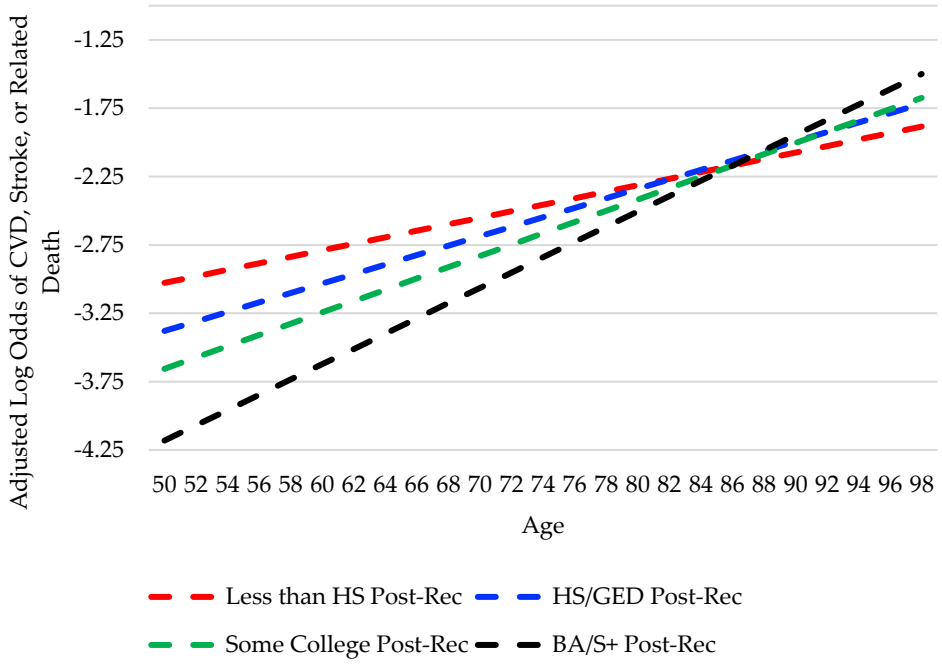

Figure 2. Adjusted Log Odds of CVD, Stroke, or Related Death by Age and Education Group post-Great Recession

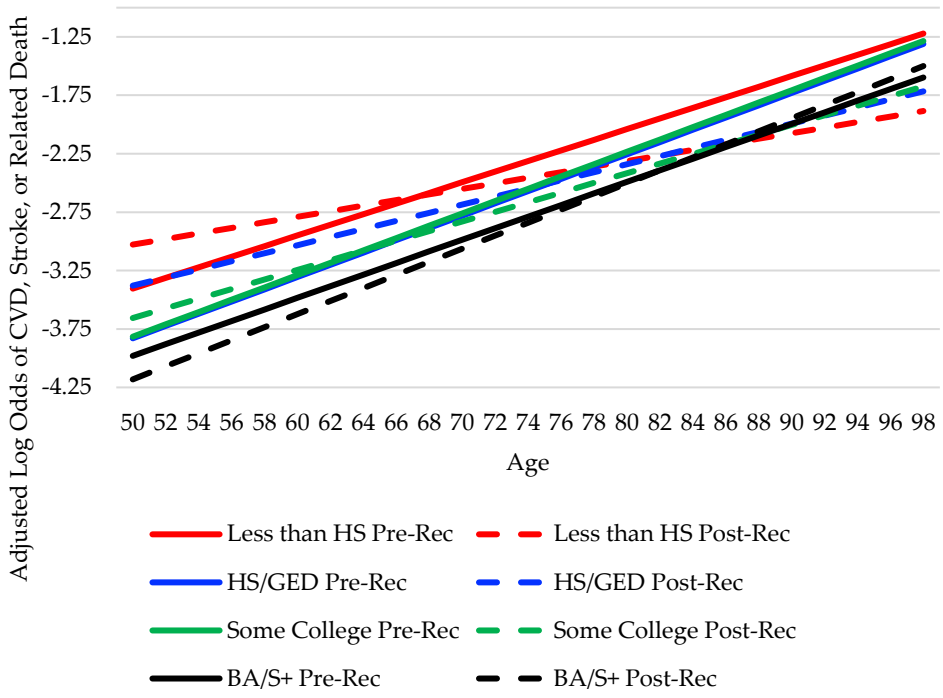

Figure 3. Adjusted Log Odds of CVD, Stroke, or Related Death by Age and Education Group pre- and post-Great Recession

The remaining figures show the comparison of trajectories for each educational category, both pre- and post-recession. In examining the trajectories for those with less than a high school diploma (Figure 4) and those with a high school degree or equivalent (Figure 5), the trajectories that show post-recession are shallower than those that show pre-recession, and there is a crossover in the trajectories as the groups get older. Figure 6 displays the trajectory for those with some college but no degree. Similar to the groups with less education in Figures 4 and 5, when looking at post-Great Recession, the trajectory for those with some college but no degree is shallower than when looking at trajectories before the crisis. However, compared to the less-educated groups, those with

some college but no degree have a narrower difference in trajectories at the oldest ages. Finally, Figure 7 shows the trajectories for the most-educated group, those with at least a four-year degree. Unlike the four previous education groups, the two trajectories run almost parallel, and the line controlling for the recession is slightly steeper than the non-recession line. The shallower trajectories and negative coefficients for age by recession interaction in the most-educated group suggests that, when accounting for differences in education, the Great Recession somehow is associated with slightly reduced risk of heart disease, stroke, or related death (see Table 2). In other words, in the most-educated group, respondents' risk continuously increases as they age; it just increases slower.

While looking at the trajectories in the figures is useful and can give some sense of the possible effect of the Great Recession on health disparities in cardiovascular disease, stroke, and related death, ultimately only two of the coefficients reported for the recession or age by recession interaction in Models 1, 2, 3, or 4 are statistically significant: those with less than a high school diploma and those with some college but no degree (see Table 2). With few of these effects being significant, this study cannot conclusively state what effect, if any, the financial crisis had on these health inequalities.

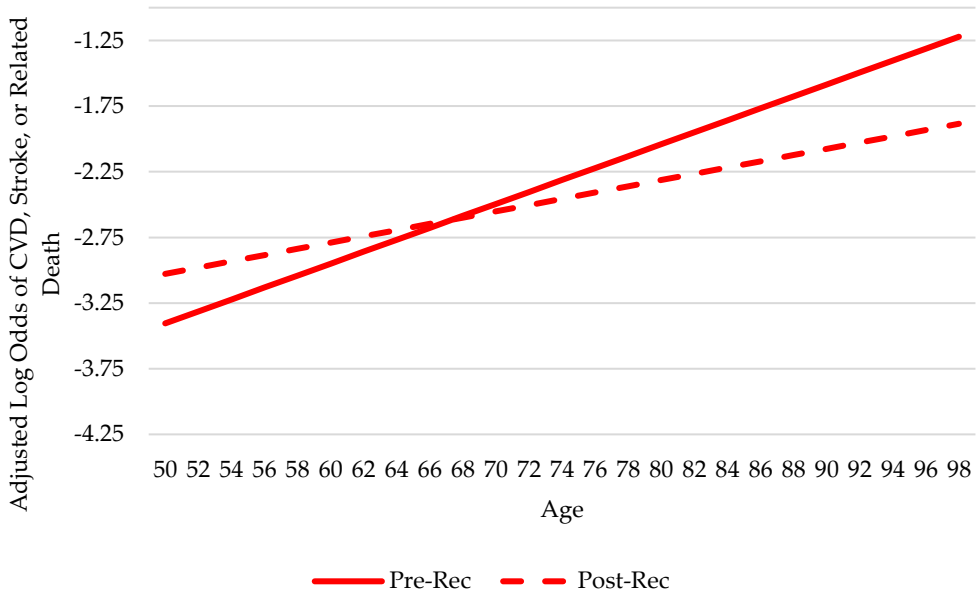

Figure 4. Adjusted Log Odds of CVD, Stroke, or Related Death by Age for Less than High School Diploma pre- and post-Great Recession

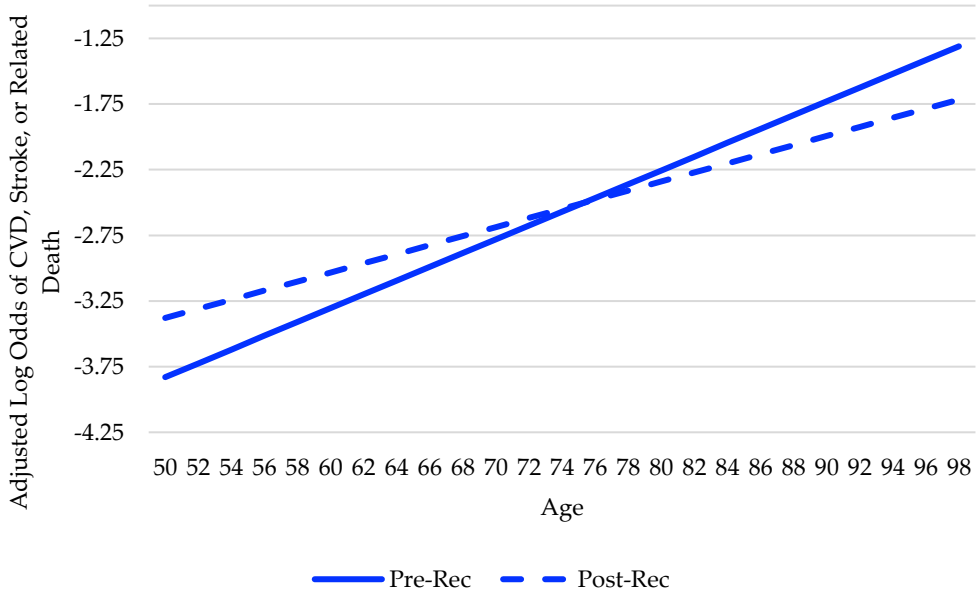

Figure 5. Adjusted Log Odds of CVD, Stroke, or Related Death by Age for High School or Equivalent pre- and post-Great Recession

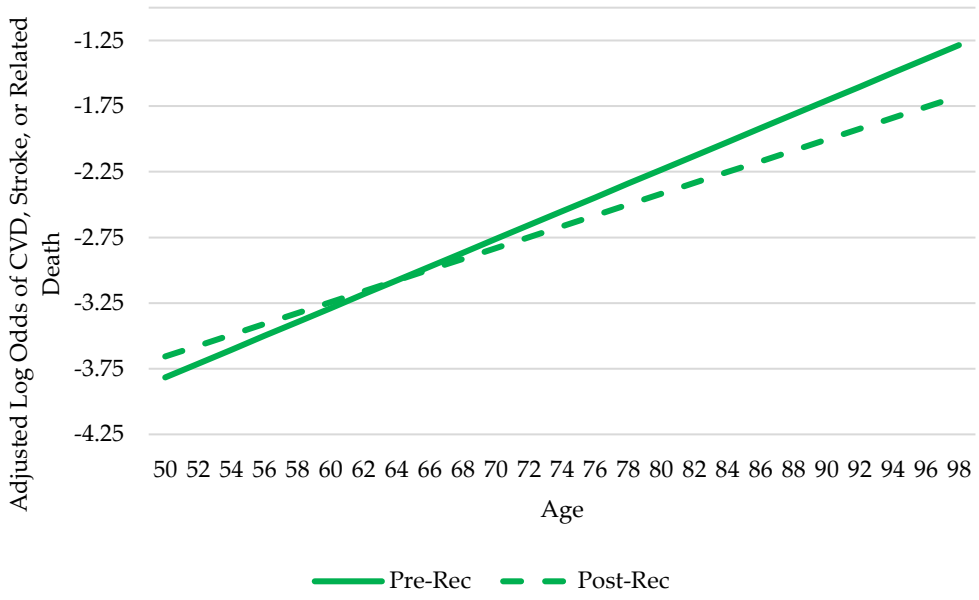

Figure 6. Adjusted Log Odds of CVD, Stroke, or Related Death by Age for Some College, no Degree pre- and post-Great Recession

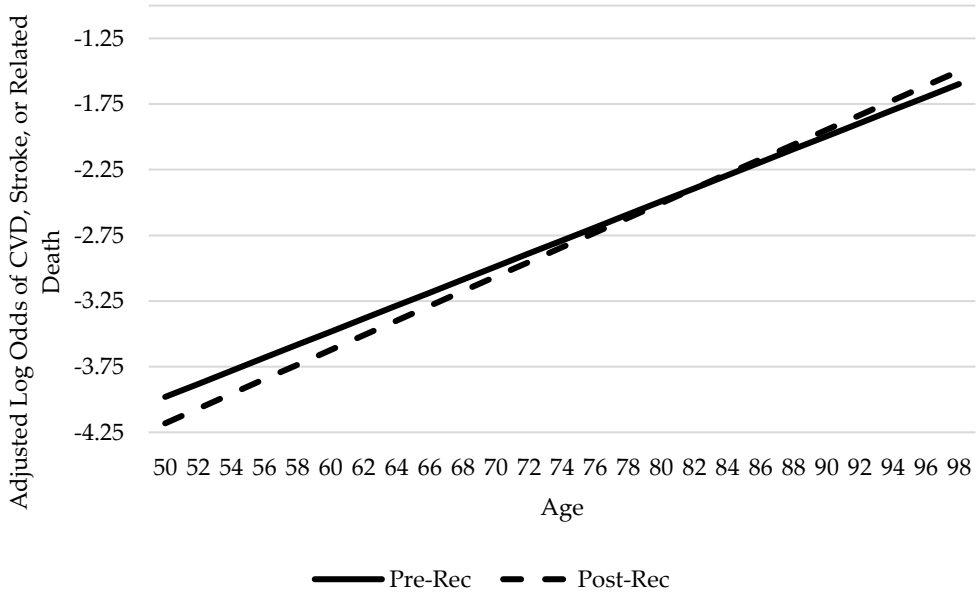

Figure 7. Adjusted Log Odds of CVD, Stroke, or Related Death by Age for Four-Year Degree or More pre- and post-Great Recession

2.4 Discussion

The effects of financial crises on health are of great interest to scholars. By using panel data and more recent data, this study examines how the Great Recession correlates with already existing health disparities and adds to existing research on the association of the Great Recession on cardiovascular disease, stroke, and related death in the United States. This study focused on the effects of the Great Recession—specifically, whether disparities in cardiovascular disease, stroke, or related death between education groups in the United States narrowed, widened, or remained constant. Findings from this study suggest some evidence indicating the health disparities that existed between these groups before the Great Recession did narrow slightly.

While previous research found that there was compression between education groups that temporarily reduced overall health inequalities during and shortly after the recession, this study does not suggest that the inequalities in risk for cardiovascular disease, stroke, and related death significantly reduced during that same period. One possible explanation is that this sample is of older Americans and that the financial crisis did not change their health trajectories as much as it changed younger Americans' health trajectories. Another explanation is that that the amount of time since the Great Recession is not long enough to have gathered sufficient data to determine the effects on cardiovascular disease and stroke for entire social groups.

This study used a cumulative inequality (CI) perspective to investigate how people near retirement age with fewer resources, less education, or lower socioeconomic status might be more vulnerable to adverse health outcomes than their more advantaged counterparts (Ferraro and Shippee 2009; Ferraro et al. 2009). The first axiom of CI is that social systems generate inequality and that this is displayed over the life course. In this study, respondents are in the late-middle to late stages of their life courses, and the social systems (e.g., education, employment, unequal opportunity) have been working in their lives for decades. By the time the Great Recession arrived, these inequalities were already entrenched both in terms of respondents' finances and health. Other axioms of CI are that disadvantage increases the risk to exposure, while advantage increases exposure to opportunity, and that life course trajectories are shaped by the accumulation of risk, resources, and agency. Findings here indicate that those who were at a more considerable disadvantage before the financial crisis had increased exposure to poorer health, specifically in terms of cardiovascular disease. At the same time, those who had been better off financially were more protected than their less advantaged counterparts.

Previous researchers, using theories and frameworks such as Fundamental Cause Theory and Cumulative Inequality, hypothesized that health inequalities during and after the Great Recession would worsen (McKee 2011; Karanikolos et al. 2013; Burgard and Kalousova 2015). An early study found that those who were socially

disadvantaged leading up to the crisis were prone to worse health than those who were advantaged (Charles and DeCicca 2008). Findings from this present study supports the work of these previous scholars. Individuals who were more socially disadvantaged in terms education consistently saw higher rates of cardiovascular disease before, during, and after the Great Recession. While some previous research (Valkonen et al. 2000; Kachi et al. 2013; McInerney et al. 2013) speculated that health inequalities could perhaps narrow, even temporarily, during or after the recession or other similar crisis, this study finds some evidence to support previous scholarship.

It is possible that, given the relative financial stability and older ages of the participants in this sample, there is not enough variation to detect meaningful changes in the health inequalities that might be present in the population at large. Another possibility is that many of the risk factors for cardiovascular disease and stroke (e.g., diet, exercise, smoking, chronic stress) accrue over several years. While these health conditions could be triggered by a short period of stress such as the Great Recession, if respondents were not already high-risk, they would be less likely to experience heart disease by acute stress experienced during the recession (Steptoe and Kivimäki 2013; Lagraauw, Kuiper, and Bot 2015). While psychological stress is a significant risk factor for heart disease and stroke, it would appear from this study that sudden and acute financial stress alone might not be enough to shift inequalities of whole social groups.

This study and its findings are not without limitations. First, this study focuses only on circulatory system diseases. While cardiovascular disease, stroke, and related death are important health outcomes and are among the leading causes of death in the United States, the onset of heart disease or stroke might not be sudden enough to be altered by the stress of the financial crises. Additionally, the data rely on respondents' self-reports of being told by a physician that they have heart disease or stroke, since access to medical files is not available to confirm the accuracy of these reports. Other health outcomes that could possibly detect more nuanced changes include, but are not limited to, self-rated health, depressive symptoms, and biological markers of stress, such as cortisol levels. An additional limitation is that the age of respondents in this sample would qualify many respondents for Medicare in the United States, giving them continued access to healthcare during the recession, which younger generations would not have had. A younger sample controlling on access to insurance and healthcare may yield different results. Broadening the markers looked at could also reveal more about the effects of the recession on health outcomes (Seeman et al. 2018). Despite these limitations, this study does further the field's understanding of how a large financial crisis like the Great Recession might affect older segments of the population. Finally, this study does not directly measure the effects of the Great Recession, but simply controls for the time period. The fallout from the financial crisis included many stressors

including, but not limited to, unemployment, loss of insurance, loss of retirement savings, increased debt, and increased harmful behaviors.

In conclusion, findings in this study indicate that although the Great Recession in the United States did change levels of socioeconomic inequality and could have altered some trajectories of health inequalities, overall the health inequalities of older Americans did not drastically change in terms of heart disease, stroke, and related deaths. This study adds to the field by using more recent longitudinal data to better estimate the impact of the financial crisis now that the United States has had time to recover. Now that researchers have access to the cross-sectional and panel data covering a full decade since the Great Recession ended, it is possible to investigate a myriad of different populations, risk factors, controls, health outcomes, and interventions so that policymakers can better navigate future economic downturns, like the one currently on the horizon in the summer of 2020.

3. The Effects of Socioeconomic Status and Health Behaviors on Health Disparities in Cardiovascular Disease, Stroke, and Related Death

Health outcomes have well-established links to socioeconomic status (SES) and education (e.g., Link and Phelan 1995; Link et al. 1998; Phelan et al. 2004; Phelan, Link, and Tehranifar 2010; Link et al. 2017). In general, these links indicate that people with less education have worse health than their counterparts with more education. Researchers have found consistent health disparities between SES and education groups using various health outcomes, including self-rated health (e.g., Luo and Waite 2005; Haas 2008; Bauldry et al. 2012), psychological distress and other mental illness (Pearlin et al. 1981; Horwitz et al. 2001; Pearlin et al. 2005; Kahn and Pearlin 2006; Pearlin 2009), and risks of cardiovascular disease and mortality (Adler and Newman 2002; Cutler, Deaton, and Lleras-Muney 2006; BeLue, Francis, and Colaco 2009). In addition to the disparities in health outcomes, there are also distinct differences among less and more educated groups in the distribution of health behaviors, or the "personal actions that influence health, disability, and mortality" (Umberson et al. 2010:140; see also Pampel et al. 2010; Short and Mollborn 2015).

While research has established the relationships between (1) education and health outcomes and (2) education and health behaviors, less is understood about whether specific health behaviors have differential effects on health for different levels of education (Pampel 2009; Pampel et al. 2010). In this study, I investigate the interaction

between education and health behaviors on cardiovascular disease, stroke, and related death. Examining this interaction will help explain whether the same behaviors are more harmful for those with less education than for those with more education or if there is symmetry in the effects between the groups.

3.1 Background

Research shows that education is a major predictor of health disparities because it correlates strongly with health outcomes for several reasons (Ross and Wu 1995; Ross and Wu 1996; Link et al. 2017). More education leads to increased social-psychological resources such as stronger social networks, higher social support, and greater sense of self control (Ross and Wu 1995; Ross and Wu 1996; Thoits 2010). Higher levels of educational attainment also lead to higher incomes and other economic resources like more stable employment, more wealth, and better health insurance (Holahan 2011; Vilorio 2016). Finally, educational groups have shown differences in their health behaviors; for example, those with less education are more likely to smoke, and those with higher education are more likely to drink moderately (Pampel and Rogers 2004; Ronksley et al. 2011).

There are stark contrasts in health behaviors between individuals with lower- and higher-educational attainment, which have been the subject of multiple studies (e.g., Cockerham 2005; Thoits 2006; Abel and Frohlich 2012; Cawley 2015; Short and Mollborn 2015; Brunello et al. 2016; Hagger and Hamilton 2020). Cockerham (2005) drew on the

agency-structure debate to frame what he called a "health lifestyle theory," suggesting that society is beginning to view health as an achievement and not merely as luck. In other words, people have come to realize they can maintain or even improve their health by making choices and performing specific behaviors, such as eating nutritious food and exercising. While making choices has often gone overlooked in health research, personal agency plays a significant role in determining a person's coping behaviors and subsequent health.

Individuals are subject to two types of selection processes, self-selection and social-selection, which both lead to agency (Thoits 2006). Further research indicates that people's social position and social capital also leads to their ability to exercise agency on behalf of their health. Scholars suggest that education and social capital also link to group norms and behaviors that distinguish in-group individuals from other groups (Abel and Frohlich 2012). Indeed, many health behaviors follow a "social determinants" framework, meaning that many of the behaviors that people engage in throughout their lives are often driven by their social background and status (Short and Mollborn 2015). Finally, homophily of groups leads to the adoption of similar health behaviors, and homophily between people of a similar health status also leads to the adoption of similar health behaviors (Centola 2011).

While there is often homophily among SES groups, some researchers believe that SES or education itself leads to adverse health behaviors; for example, for people with

lower-SES or less education, the experience of deprivation and inequality could lead to negative health behaviors as a coping mechanism (Pampel et al. 2010). Others suggest that since those with less education are already more likely to experience worse health and lower life expectancy, they have less to gain by investing resources into positive health behaviors (Cutler and Lleras-Muney 2006). A more recent study finds preliminary support that sociodemographic factors, especially income and education, have a strong correlation with participating in the same health behaviors (Hagger and Hamilton 2020). Sudano and Baker (2006) investigated the roles of education, health behaviors, and health insurance on existing health disparities between racial/ethnic groups in the United States and conclude that while health behaviors vary by education and racial/ethnic groups, this does not explain the enduring effects of education and SES on health outcomes. In other words, despite these variations there are many other social factors that contribute to health disparities. These studies share a common assumption that less education leads to adverse health behaviors, and some recommend more research to better understand the interconnected relationship between education, health behaviors, and health outcomes (Pampel 2009; Pampel et al. 2010; Umberson et al. 2010).

Most studies that investigate the relationship between health behaviors and SES control for some measure of SES like education or income. However, few studies specifically explore the interaction between health behaviors and measures of SES, like education (Cutler and Lleras-Muney 2010; Pampel et al. 2010). It is plausible to expect

that there is an interaction between health behaviors and SES measures, like education. As noted above, health behaviors could be used as a coping mechanism to deal with a person's social status (Pampel et al. 2010). One of the studies that investigated the interaction of education and health behaviors used data from two European datasets—the Survey of Health, Ageing, and Retirement in Europe (SHARE) and the English Longitudinal Study of Ageing (ELSA)—together consisting of 14 countries (Brunello et al. 2016). In their study, Brunello and colleagues (2016) studied self-rated health and focused specifically on the association of years of education with smoking, drinking, body mass index (BMI), and physical activity. Their results show that health behaviors mediated the effect of education on the health gradient for both men and women in their study. However, this study is limited in that it does not account for multiple measures of SES (e.g., wealth) and only captures limited behaviors (e.g., cigarette smoking as "current or non-current smoker" and drinking as "almost every day"). These measures are relatively crude and do not allow for estimation of a dose-response effect.

A similar study using American data from the Health and Retirement Study (HRS) focused on the degree to which health behaviors influence social health disparities (Shaw et al. 2014). Shaw and colleagues (2014) focus on smoking, drinking, and BMI. However, instead of focusing on self-rated health and education, Shaw and colleagues use mortality as their outcome variable and use wealth as their only measure of SES. Despite these shifts, they also find that these health behaviors contribute

moderately to social health disparities in the United States. The study by Shaw and colleagues (2014) also has limitations: their measure of smoking is limited to "never, current, or former," which does not allow for any variation in the number of cigarettes that current smokers might smoke in a day. Furthermore, an individual who drinks more than seven alcoholic drinks per week is identified as a "heavy drinker," regardless of sex, despite guidelines identifying heavy drinkers as females who drink seven or more servings per week and males who drink 15 or more servings per week (CDC 2020b; National Institute on Alcohol Abuse and Alcoholism n.d.).

This present study looks to build on these previous studies by interacting education with health behaviors and using more nuanced measures of health behaviors in order to better understand the correlation between education and health behaviors on health disparities today.

3.1.1 Health Behaviors of Interest

Prior researchers have investigated a variety of health behaviors; the most commonly studied are smoking, alcohol consumption, and weight management captured as BMI (Pampel and Rogers 2004; Krueger and Chang 2008; Cutler and Lleras-Muney 2010). Researchers focus on these particular health behaviors because of they are among the leading contributors to cardiovascular disease in the United States (CDC 2018a; CDC 2018b; CDC 2018c) and make outsized contributions to mortality (Mokdad et al. 2004; Cutler and Lleras-Muney 2010). I follow in this tradition by selecting

smoking, alcohol consumption, and BMI as the health behaviors of interest in this present study.

Smoking. Smoking is one of the most explicit examples of the differences in health behaviors between people with less education and more education. People with more education are less likely to smoke at all, and those who do smoke generally smoke fewer cigarettes than their less-educated counterparts (Pampel 2003; Pampel and Rogers 2004; Pampel 2009). One explanation is that those with more education could be more aware of the dangers of smoking, even though these dangers should be public knowledge. Or it simply could be that smoking is considered a status symbol and a way for lower-educated individuals to separate themselves from those with more education and higher social status (Johnson and Hoffman 2000).

Alcohol Consumption. Regarding alcohol consumption, individuals with more education are more likely to drink alcohol in moderation and are less likely to abuse alcohol than those with less education (Darrow et al. 1992; Ross and Wu 1995). A recent study found that while there are stark differences in alcohol-consumption patterns across educational attainment and subsequent health outcomes; ultimately, however, there was not enough evidence to support the claim that the average quantity of alcohol consumed accounts for these differences. The study ended with a call for further research to investigate drinking patterns (Probst et al. 2020). Several researchers have found an inverse relationship between excessive alcohol consumption and education

(Marmot 1997; Keyes and Hasin 2008; Huckle, You, and Casswell 2010; Shimotsu et al. 2012). Excessive drinking is more common among individuals with less education, which is particularly noteworthy because excessive alcohol consumption is linked to high blood pressure and cardiovascular disease, while the moderate drinking associated with individuals with more education has been found help reduce the risk of cardiovascular disease (Di Castelnuovo et al. 2010; Ronksley et al. 2011).

BMI. There is a strong link between education and disparities in weight and obesity, measured through BMI (Botoseneanu and Liang 2011). In the United States, the rate of adult obesity as measured by BMI has doubled since the 1980s (Flegal et al. 2016), with 38% of adults considered obese as of 2014. This sharp rise is concerning because obese individuals have an increased risk for diabetes (Alberti, Sutton, and Baer 2014), cognitive impairment (Thorpe and Ferraro 2004), cardiovascular disease (Harris et al. 1997), and mortality (Thorpe and Ferraro 2004). Gaps between education groups are often captured by differences in BMI of people with different levels of education. Studies have found that there are significant differences in BMI as well as a variety of social measures (e.g., sex, race/ethnicity; Clarke et al. 2009) and that a consistent correlation is found between education and BMI. Individuals with more education are more likely to have a BMI in the healthy range, while individuals with less education have a higher prevalence of BMIs that are overweight or obese (Clarke et al. 2009; Ailshire and House 2011).

Smoking, alcohol consumption, and BMI are also of interest to this project due to their relationship with heart disease, stroke, and related death. Smoking is considered to be a major cause of cardiovascular disease and is estimated to cause nearly a quarter of cardiovascular disease-related deaths (U.S. Department of Health and Human Services 2014; CDC 2020g). Smoking also significantly increases the risk of stroke (CDC 2020g). While moderate levels of alcohol consumption have been associated with reducing the risk for cardiovascular disease and stroke (Di Castelnuovo et al. 2010; Ronksley et al. 2011), studies have also found evidence to support that either abstaining from alcohol or excessively drinking can increase a person's risk for cardiovascular disease or stroke (Piano 2017). An unhealthy BMI is also linked with increasing a person's risk for cardiovascular disease and stroke (Carbone et al. 2019; (CDC 2020d; CDC 2020e). Not only are those with BMIs that are considered obese at the greatest risk of cardiovascular disease, stroke, and premature death, but there is strong evidence that losing weight—lowering BMI—reduces the risk of cardiovascular disease and mortality (NHLBI 1998).

3.1.2 Research Question

Do the same health behaviors—smoking, drinking, and BMI—have the same effects on cardiovascular disease, stroke, and death due to related disease for people with low levels and high levels of education?

3.2 Methods

3.2.1 Sample

For this study, I use nine waves of the RAND Health and Retirement Study (HRS) from 1998 to 2014 to assess the effect of health behaviors on cardiovascular disease, stroke, or related death (e.g., circulatory disease) by education. The HRS is a nationally representative longitudinal survey of adults in the United States over age 50 that has been conducted biennially since 1992. The primary sample from 1992 to 2014 includes 37,495 individuals. However, since the HRS initially consisted of two studies that merged in 1998, I restrict my analyses to the 1998 to 2014 waves in order to use uniform variables of interest in each wave (Sonnega et al. 2014). After reducing the sample to one person per household and eliminating those who were not a member of an HRS cohort, my initial sample has 25,328 respondents.

Of the remaining sample, there were few missing data on time-invariant covariates: 45 (0.24%) were missing data on race/ethnicity, 26 (0.14%) were missing on Hispanic ethnicity, 13 (0.07%) were missing on other race, 4 (0.02%) were missing on non-Hispanic white, and 2 (0.01%) were missing on non-Hispanic black (0.01%). I imputed missing race as "other race" and missing Hispanic as non-Hispanic ethnicity. In addition, 35 (0.19%) were missing data on educational attainment, and these were imputed with the modal category (high school or equivalent).

For the analyses below, the data are structured in a long format consisting of two-year intervals spanning survey waves. In this structure, there were few time-variant covariates with missing data that could not be imputed: BMI 1,008 (1.43%) and if a respondent ever had cancer 146 (0.21%). The covariates with missing data were deleted, resulting in a remaining sample of 69,517 interval records. I further restrict the sample data to include only respondents who are at risk for cardiovascular disease, stroke, or death due to related causes (e.g., circulatory disease), meaning they have yet to report an incidence of cardiovascular disease or stroke before entering the sample. Finally, to reduce bias in my sample, I estimate propensity scores and limit my sample to respondents with propensity scores between 0.006 and 0.546, limiting my analytical sample to 12,642 participants contributing 58,226 interval records.

3.2.2 Measures

Dependent Variable. My outcome variable for this study is a diagnosis with cardiovascular disease, stroke, or death due to related illnesses (i.e., circulatory system disease). The first item in this measure is cardiovascular disease. Heart disease is the leading cause of death in the United States for men and women across most racial and ethnic groups (CDC 2017; CDC 2019). Additionally, while individuals of all ages are at risk for cardiovascular disease, the risk increases with age, and those 65 and older are at the greatest risk. The mean age of my sample is approximately 65, so cardiovascular disease is relevant to this population (NIH 2018). To determine whether participants in

the sample have had cardiovascular disease, the HRS asks "whether or not a doctor ever told the Respondent s/he had these conditions . . . heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems" (Bugliari et al. 2019). Respondents then have the choice of either yes or no. I eliminate any respondent that indicates having heart disease in or before the 1998 wave (2,984) to ensure that no one in the sample begins with this condition. Once respondents indicate that they have one of these conditions, I code them as *yes* in each subsequent wave (no cardiovascular disease=0; yes cardiovascular disease=1).

The second item in the outcome is stroke. Stroke is closely related to cardiovascular disease in terms of risk factors and possible prevention and interventions (CDC 2020f), and strokes are the fifth leading cause of death in the United States (CDC 2020h). Similar to cardiovascular disease, the HRS asks respondents whether they have ever had a stroke, giving them the choice of either yes or no. I eliminate any respondent that indicates having had a stroke in or before the 1998 wave (606) to ensure that no one in the sample begins with this condition. Once respondents indicate that they had a stroke, I code them as yes in each subsequent wave (no Stroke=0; yes Stroke=1).

The final measure of this outcome variable is cause of death due to related illness (i.e., circulatory system disease). The HRS codes deaths due to cardiovascular disease, circulatory, and blood conditions together in their cause of death data. When respondents die, the HRS collects data on their death (e.g., when, where, death

certificate, and cause of death) via proxy interviewee. Typically, the proxy is a surviving spouse or relative of the original respondent. This information is available to researchers in the RAND HRS public file. Given the age of this sample and the high rates at which cardiovascular disease and stroke lead to death, it is important to include this cause of death measure to try to capture all respondents who may have suffered from these illnesses but died between waves without receiving a diagnosis. If respondents' cause of death is one of these causes, they are included in this measure (COD=1).

Using these three measures (cardiovascular disease, stroke, and cause of death), I create one dichotomous outcome indicating whether a respondent, in a given wave of the study, has been diagnosed with heart disease or stroke or died due to circulatory system disease before the most recent wave of the study (no outcome=0; yes outcome=1).

Independent and Control Variables. In this study, I use three health behaviors: smoking, measured in daily cigarettes; alcohol consumption, measured in weekly averages; and healthy weight, measured by BMI. In the initial survey, there was a skip pattern for the number of cigarettes smoked daily as it was only asked of respondents who identified as cigarette smokers (7%). Those who were skipped on this measure were imputed as smoking 0 cigarettes per day. Daily cigarettes smoked is measured in two ways for two different sets of analyses. First, as a categorical measure with 0 cigarettes per day (=0), 1 to 10 cigarettes per day (=1), 11 to 20 cigarettes per day (=20), and 21 or more cigarettes per day (=3). Second, daily cigarettes smoked is measured as a

continuous variable ranging from 0 to 70. I also control whether respondents are former smokers (=1).

Weekly alcohol consumption is a composite of two different measures: the number of days per week a respondent drinks alcohol multiplied by the number of drinks per day the respondent consumes on days s/he consumes alcohol. As with cigarette smoking, there is a skip pattern. Only those who identified as drinkers were asked how many days per week and how many drinks per day they consumed. Those who were skipped were imputed as drinking 0 alcoholic beverages per week. This results in three categories of drinkers: non-drinkers (=0), moderate drinkers (=1), and heavy drinkers (=2). In this study, female respondents were coded as moderate drinkers if they consumed between 1 and 7 drinks per week and as heavy drinkers if they consumed 8 or more. Male respondents were coded as moderate drinkers if they had between 1 and 14 drinks per week and as heavy drinkers if they had 15 or more (CDC 2020b; National Institute on Alcohol Abuse and Alcoholism n.d.). For additional analyses, I also measure weekly alcohol consumption as a continuous variable ranging from 0 to 182 drinks per week.

The third health behavior, healthy weight, is measured by BMI. For one set of analyses, respondents are placed into four possible weight categories: BMI under 18.5 are underweight (=1), BMI $\geq$ 18.5 and $<$ 25 are healthy/normal weight (=2), BMI $\geq$ 25 and

< 30 are overweight (=3), or BMI ≥ 30 are *obese* (=4) (CDC 2020a; NHLBI n.d.). For additional analyses, BMI is measured as a continuous variable ranging from 7 to 76.6.

This study uses educational obtainment as a measure of SES. Educational obtainment is a categorical variable based on years of education as reported in the RAND HRS. Respondents are categorized as having less than a high school diploma, a high school diploma or equivalent, some college but no degree, or a bachelor's degree or more. In additional analyses, education is measured as a continuous variable in years of education ranging from 0 to 17 years.

I control for several sociodemographic variables, including age, sex, race/ethnicity, marital status, and current region of the country. Income is the respondents' reported income, which is log-transformed. Age is a continuous measure based on respondents' age at the start of each wave. Sex is measured as a dummy variable (male=1; female=0). Race/ethnicity is measured as a categorical variable with non-Hispanic white (reference category), non-Hispanic black (=1), non-Hispanic other (=2), and Hispanic (=3). Marital status is measured as currently married/partnered (=1) or not currently married (=0). Current region of the country is measured at the time of the survey interview and is a dummy variable of South (=1) and non-South (=0). Due to the high cancer rate among smokers, I also control whether respondents ever had cancer (=1).

3.2.3 Analyses

To estimate differences in risk of cardiovascular disease, stroke, and death due to related diseases between SES groups, I estimate discrete-time hazard regression models. First, I estimate models stratified by educational attainment (see Models 1, 2, 3, and 4 in Table 4). Next, I estimate a another discrete time-hazard regression with education and all three health behaviors measured as continuous variables, and I include interaction terms between education and all three health behaviors as well (see Model 5 in Table 5). To test for multicollinearity, I estimate OLS models and calculate the variance inflation factors (VIFs) for each covariate in the full model. All but two VIF estimates are below 1.5, and the remaining two (age and cohort) are below 5, which is well below the common threshold of 10. These results indicate that multicollinearity is not a concern in these analyses.

3.3 Results

Descriptive statistics for my population sample are presented in Table 4. Those with the least education have the highest prevalence of cardiovascular disease, stroke, related death, and the combined outcome. In contrast, those with the most education have the lowest prevalence in each measure. The vast majority of respondents, nearly 90% of respondents in this survey, do not smoke cigarettes or smoke less than one cigarette per day. Respondents with less than a high school degree are the most likely to smoke, while those with at least a four-year degree are the least likely to smoke. Of the

respondents who drink alcohol weekly, less than 6% are considered heavy drinkers. Unlike smoking, those with the least education are the least likely to drink and are also the least likely to be heavy drinkers. Those with a college degree are most likely to be moderate drinkers, which is expected; however, they are also the most likely to be heavy drinkers. Overall, 32% of the sample has a healthy BMI. Those with the highest levels of education are most likely to have a healthy weight or be overweight, and the least likely to be obese. The least-educated respondents in this sample are the most likely to be underweight or obese. Approximately 42% of the sample is male, and the majority of the sample, about 69%, is non-Hispanic white.

Table 5 displays the results for the first four discrete-time hazard models.[1] In Models 1, 2, 3, and 4, I stratify by education in the discrete-time hazard models to estimate whether or not the health behaviors have the same effect on different levels of SES. Table 6 displays the results for an additional discrete-time hazard model in which education and health behaviors are measured as continuous variables, and interactions between education and all three health behaviors are included. Table 6 also includes

[1] Presented here are results from my primary models. I estimated several supplementary models, which include discrete-time hazard models for CVD, stroke, or related death that include controls for wealth and income, or neither. I also estimated discrete-time hazard models for each of the three outcomes—CVD, stroke, or related death—on their own; as well as an OLS regression with an accumulative outcome measure. I also estimated discrete-time hazard models by wealth quintiles. Results from the supplementary analyses do suggest any meaningful differences to the findings presented in this chapter. Results for supplementary analyses are available in Appendix B.

predicted marginal effects of the interactions at each year of education and their level of statistical significance.

The first health behavior of interest is smoking, as measured by reported daily cigarettes. In Models 1, 2, 3, and 4 (see Table 5), the coefficient for smoking 1 to 10 cigarettes per day is positive and significant for all four different education groups. The coefficients for smoking 11 to 20 and smoking 21 or more cigarettes per day are also positive in each education group but are not significant. For those who smoke the most cigarettes, 21 or more per day, those with some college have the largest coefficient and those with at least a four-year degree have the smallest coefficient. While it is expected that smoking any number of cigarettes would increase the risk of cardiovascular disease, stroke, or related death, what is unexpected is that the coefficient for smoking 1 to 10 cigarettes is largest for the two highest-education groups. In Model 5 (see Table 6), the coefficients for the continuous measures of cigarette smoking and for the interaction between education and smoking are not statistically significant. The predicted marginal effects of the interactions from Model 5 (see Table 6) show similar patterns found in Models 1, 2, 3, and 4. The predicted marginal effects from Model 5 show the effects of smoking are relatively constant as years of education and number of cigarettes increase.

Figure 8 displays the predicted margins of cardiovascular disease, stroke, or related death of daily cigarettes across education groups. As expected, in Figure 8, those with the least education have the highest risk of cardiovascular disease, stroke, or

related death, in each cigarette category. However, for those with high school or equivalent and those with at least a four-year degree, their risk of cardiovascular disease, stroke, or related death appears to flatten after smoking 1 to 10 cigarettes per day. Figure 9 displays the predicted margins of cardiovascular disease, stroke, or related death from Model 5 of daily cigarettes by years of education. As expected, and similar to Figure 8, those with the least education remain at the highest risk of cardiovascular disease, stroke or related death, while those with the most education have the least risk, regardless of how many cigarettes one smokes. Unlike Figure 8, in Figure 9, the risk increases for all levels of education as number of cigarettes increases, and there is some narrowing in risk disparities when people are smoking more than 30 cigarettes each day.

Table 4. Descriptive Statistics HRS, 1998 to 2014

	Less than High School		High School or Equivalent		Some College, No Degree		Four-Year Degree or More		Full Sample	
	Mean / %	Range / Total	Mean / %	Range / Total	Mean / %	Range / Total	Mean / %	Range / Total	Mean / %	Range / Total
Outcomes										
CVD	0.052	738	0.050	999	0.052	624	0.044	524	0.050	2,885
Stroke	0.023	328	0.019	376	0.020	242	0.016	188	0.020	1,134
Death	0.017	244	0.009	181	0.008	94	0.006	76	0.010	595
Combined Outcome	0.087	1,241	0.074	1,488	0.075	898	0.064	752	0.075	4,379
Daily Cigarettes										
0	0.872	12,438	0.894	18,007	0.892	10,693	0.945	11,172	0.898	52,310
1–10	0.095	1,349	0.071	1,435	0.073	878	0.037	439	0.071	4,101
11–20	0.023	1,349	0.024	474	0.024	282	0.011	135	0.021	1,216
21+	0.010	147	0.011	232	0.011	139	0.007	81	0.010	599
Cigarettes (cont.)									1.141	0-70
Drinker Status										
Non	0.815	11,617	0.703	14,170	0.622	7,455	0.518	6,128	0.676	39,370
Moderate	0.148	2,106	0.245	4,931	0.321	3,848	0.407	4,810	0.270	15,695
Heavy	0.037	536	0.052	1,047	0.057	689	0.075	889	0.054	3,161
Alcohol (cont.)									2.410	0-182
BMI										
Underweight	0.028	395	0.022	436	0.018	215	0.018	218	0.022	1,264
Normal/Healthy	0.298	4,258	0.317	6,385	0.320	3,845	0.357	4,226	0.321	18,714
Overweight	0.376	5,359	0.386	7,782	0.383	4,590	0.407	4,811	0.387	22,542
Obese	0.298	4,247	0.275	5,575	0.279	3,341	0.218	2,572	0.270	15,706
BMI (cont.)									27.413	7-76.6
Education (years)									12.262	0-17
Age	66.576	50 to 98.385	64.801	50 to 93.846	63.442	50 to 94.692	63.369	50 to 95.154	64.665	50–98.385
Male	0.395	5,635	0.381	7,670	0.413	4,952	0.457	5,410	0.424	24,674
Female	0.605	8,624	0.619	12,478	0.587	7,040	0.543	6,417	0.576	33,552
Race/Ethnicity										
Non-Hispanic White	0.457	6,512	0.752	15,146	0.719	8,628	0.814	9,625	0.686	39,911
Non-Hispanic Black	0.263	3,746	0.157	3,167	0.181	2,169	0.110	1,302	0.178	10,384
Non-Hispanic Other	0.023	329	0.019	374	0.023	274	0.035	419	0.024	1,396
Hispanic	0.257	3,672	0.072	1,461	0.077	921	0.041	481	0.112	6,535
Had Cancer	0.116	1,658	0.134	2,708	0.141	1,687	0.151	1,785	0.135	7,838
Former Smoker	0.404	5,763	0.417	8,402	0.440	5,271	0.443	5,233	0.424	24,669
Married/Partnered	0.431	6,151	0.515	10,381	0.527	6,318	0.622	7,359	0.519	30,309
Not Married	0.569	8,108	0.485	9,767	0.473	5,674	0.378	4,468	0.481	28,017
South	0.503	7,085	0.379	7,638	0.370	4,431	0.379	4,481	0.407	23,724
Not South	0.497	7,174	0.621	12,510	0.630	7,561	0.621	7,346	0.593	34,503
n	14,259		20,148		11,992		11,827		58,226	

Note. HRS = RAND Health & Retirement Study

Table 5. Discrete-Time Hazard Models for CVD, Stroke, or Death Due to Related Disease (n=12,642; 58,226 interval records)

	Model 1	Model 2	Model 3	Model 4
	Less than HS	HS/GED	Some College	BA/S+
Age	0.027***	0.050***	0.042***	0.052***
Cohort	-0.006	0.010†	0.009	0.011
Male	0.263***	0.347***	0.307***	0.306***
Race/Ethnicity				
Non-Hispanic White	REF	REF	REF	REF
Non-Hispanic Black	-0.074	0.016	0.131	0.094
Non-Hispanic Other	0.286	-0.444†	-0.095	-0.034
Hispanic	-0.298***	-0.318**	-0.199	-0.193
Married	-0.157*	-0.175*	-0.104	-0.039
South	-0.081	0.220***	0.025	-0.028
Cancer	-0.173†	0.019	-0.094	0.045
Former Smoker	0.061	0.074	0.134†	0.148†
Daily Cigarettes				
0	REF	REF	REF	REF
1–10	0.427***	0.358***	0.491***	0.435*
11–20	0.275	0.339†	0.340	0.400
21+	0.399	0.333	0.423	0.299
Drinker Status				
Moderate	REF	REF	REF	REF
Non	0.301**	0.084	0.296***	0.231**
Heavy	0.122	0.038	0.233	-0.014
BMI				
Healthy/Normal	REF	REF	REF	REF
Underweight	0.021	0.204	0.030	0.064
Overweight	0.030	0.057	-0.027	0.040
Obese	0.294***	0.303***	0.299***	0.311**
Constant	-4.329***	-6.528***	-6.053***	-6.891***
n	14,259	20,148	11,992	11,827

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 6. Discrete-Time Hazard Models for CVD, Stroke, or Death Due to Related Disease & Predicted Marginal Effects of Interactions Between Education and Health Behaviors (n=12,642; 58,226 interval records)

	Model 5				
Education	-0.015	**Predicted Marginal Effects of Interactions**			
Age	0.043***	Education	Smoking	Drinking	BMI
Cohort	0.005	0	0.0013	0.0001	0.0023**
Male	0.287***	1	0.0013	-2.4800	0.0023**
Race/Ethnicity		2	0.0013	-0.0001	0.0023**
Non-Hispanic White	REF	3	0.0014†	-0.0001	0.0022***
Non-Hispanic Black	0.037	4	0.0014*	-0.0002	0.0022***
Non-Hispanic Other	-0.022	5	0.0014**	-0.0002	0.0022***
Hispanic	-0.268***	6	0.0014**	-0.0002	0.0021***
Married	-0.153***	7	0.0014**	-0.0003	0.0021***
South	0.054†	8	0.0014***	-0.0003	0.0021***
Cancer	-0.046	9	0.0014***	-0.0004	0.0020***
Former Smoker	0.043	10	0.0014***	-0.0004†	0.0020***
Daily Cigarettes	0.017	11	0.0014***	-0.0005*	0.0020***
Weekly Alcohol	0.001	12	0.0014***	-0.0005*	0.0020***
BMI	0.029**	13	0.0014***	-0.0005**	0.0019***
Education*Cigarettes	0.001	14	0.0014***	-0.0006**	0.0019***
Education*Alcohol	-0.001	15	0.0014***	-0.0006*	0.0019***
Education*BMI	-0.001	16	0.0014***	-0.0006*	0.0019***
Constant	-6.133***	17	0.0014***	-0.0007*	0.0018***
n	58,229				

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

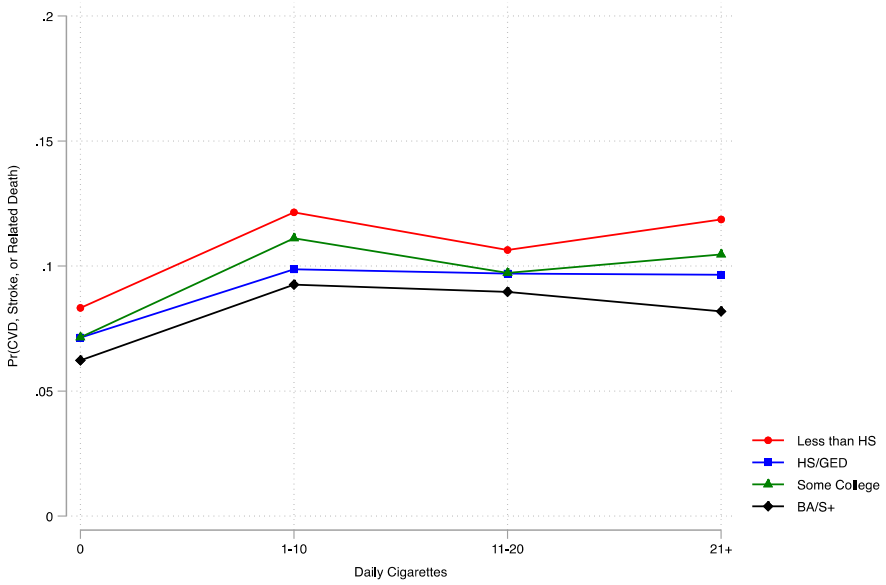

Figure 8. Predicted Margins of CVD, Stroke, or Related Death by Daily Cigarettes across Education Groups

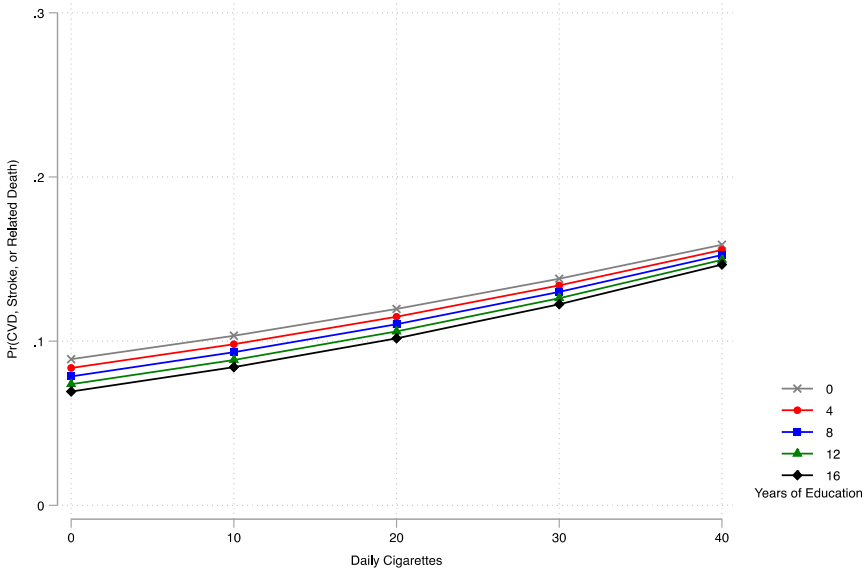

Figure 9. Predicted Margins of CVD, Stroke, or Related Death by Daily Cigarettes and Years of Education

The second health behavior of interest is alcohol consumption or drinking. In Models 1, 2, 3, and 4 (see Table 5), I compare moderate drinkers to non-drinkers and heavy drinkers. In each model, non-drinkers are at greater risk for cardiovascular disease, stroke, and related death than moderate drinkers. This is not unexpected, as there is research suggesting that moderate amounts of alcohol consumption can improve heart health. However, while moderate consumption of alcohol is statistically significant for most education groups, it is not significant for those with a high school degree or equivalent (see Model 2, Table 5). In Model 2, neither coefficient for drinker status is significant, and both are relatively small, so it is unclear why those with a high school degree or equivalent would see relatively little association in the risk of alcohol consumption and risk of cardiovascular disease, stroke, and related death while the three other education groups do. The pattern found here suggests that there is a greater health benefit by moderately drinking for the least educated than for the other three groups. In Model 5 (see Table 6), the coefficients for the continuous measure of weekly alcoholic drinks and interaction between years of education and alcohol consumption are both small and not statistically significant. The predicted marginal effects of the interactions indicate that the risk of cardiovascular disease, stroke, or related death is relatively constant across years of education. However, similar to Models 1, 2, 3, and 4, the predicted marginal effects from Model 5 show the risk of cardiovascular disease, stroke, or related death does decrease as education increases among heavy drinkers.

In Figure 10, I display the predicted margins of cardiovascular disease, stroke, or related death by drinking status across years of education categories. As expected, in all three categories of drinking, the least educated have the highest risk of cardiovascular disease, stroke, or related death, and the most educated have the lowest risk. Consistent with the results seen in Table 5, the risk of heart disease, stroke, or related death for those with a high school degree or equivalent seems unaffected by drinker status. In Figure 9, it seems that both abstaining from drinking and heavy drinking is most harmful for those with the less than a high school degree and some college, while the risk for cardiovascular disease, stroke, and related death plateaus for those with at least a four-year degree. Figure 11 displays the predicted margins of cardiovascular disease, stroke, or related death from Model 5 of weekly alcohol drinks consumed by years of education. As expected, and like Figure 10, those with the least education maintain the highest risk of cardiovascular disease, stroke, or related death regardless of how many alcoholic drinks they consume in a week. Also similar to Figure 10, in Figure 11, those with the most education continue to see a decrease in the risk of cardiovascular disease, stroke, or related death even when consuming heavy amounts of alcoholic drinks on a weekly basis, and the disparity in risk between those with the least and most education increases.

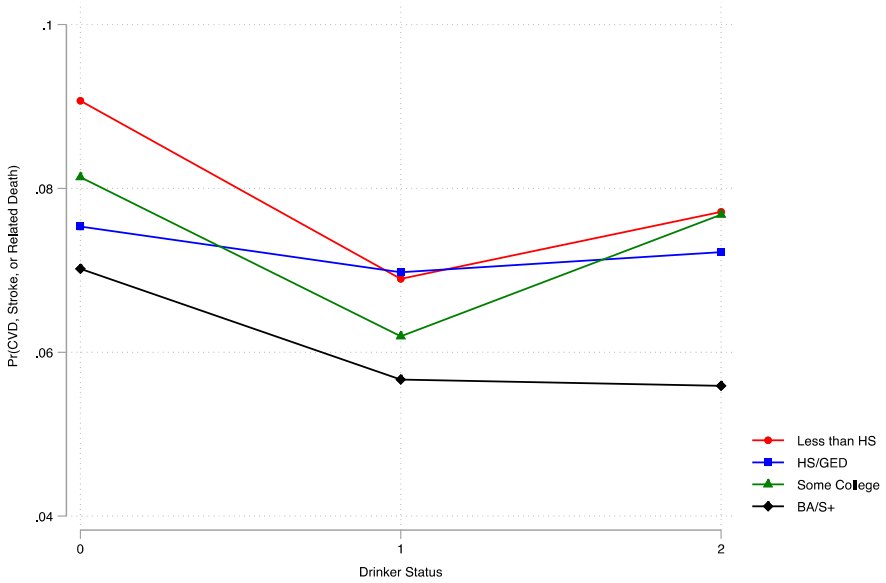

Figure 10. Predicted Margins of CVD, Stroke, or Related Death by Drinker Status across Education Groups

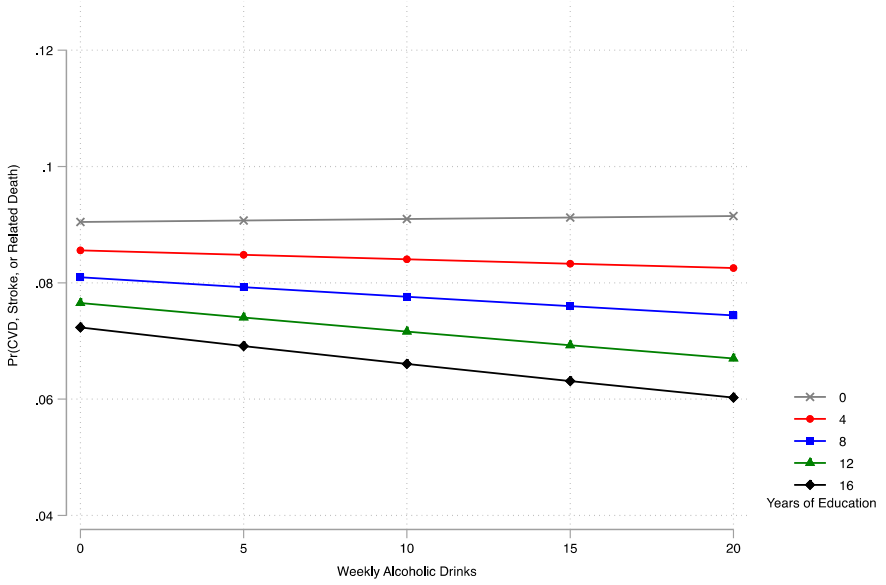

Figure 11. Predicted Margins of CVD, Stroke, or Related Death by Weekly Alcoholic Drinks and Years of Education

The final health behavior is BMI. As expected, the coefficient for an obese BMI is positive and significant in Models 1, 2, 3, and 4 (see Table 5); however, the coefficients for underweight and overweight are not significant for any education group in any model. While all the coefficients for an obese BMI are significant, the largest coefficient is for those with the most education and the smallest coefficients are for those with less than high school and those with high school or equivalent. In Model 5 (see Table 6) the coefficient for the continuous measure of BMI is statistically significant. This is different than the other two health behaviors when measured continuously; however, the interaction between BMI and years of education is not statistically significant. The predicted marginal effects for the interaction between BMI and years of education is statistically significant at every year of education. Furthermore, the risk of cardiovascular disease, stroke, or related death decreases with each year of education.

In Figure 12, I display the predicted margins of cardiovascular disease, stroke, or related death by BMI across education groups. As expected, the least educated are at the greatest risk of cardiovascular disease, stroke, or related death regardless of their BMI, while those with the most education have the least risk. Those with a high school degree or equivalent appear to see the most benefit in reducing their risk of cardiovascular disease, stroke, and related death when maintaining a healthy weight compared to being underweight; otherwise, the risks across education groups are relatively parallel. Figure 13 displays the predicted margins of cardiovascular disease, stroke, or related death by

BMI and years of education. As with the two other health behaviors, those with the least education maintain the highest risk of cardiovascular disease, stroke, or related death regardless of BMI. However, while the risk for all levels of education increases with BMI, those with the most education have the lowest risk of cardiovascular disease, stroke, or related death, and the disparities at the highest BMIs increase compared to the lowest BMIs.

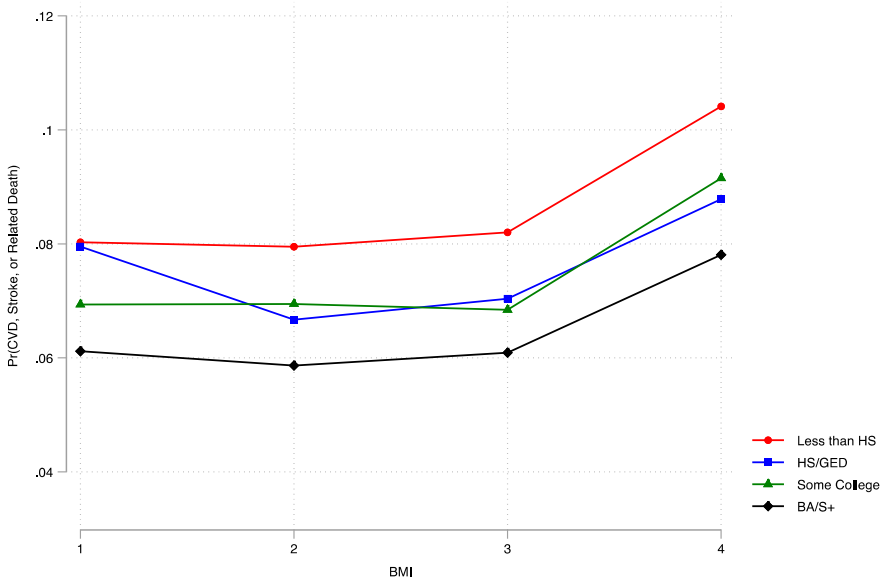

Figure 12. Predicted Margins of CVD, Stroke, or Related Death by BMI across Education Groups

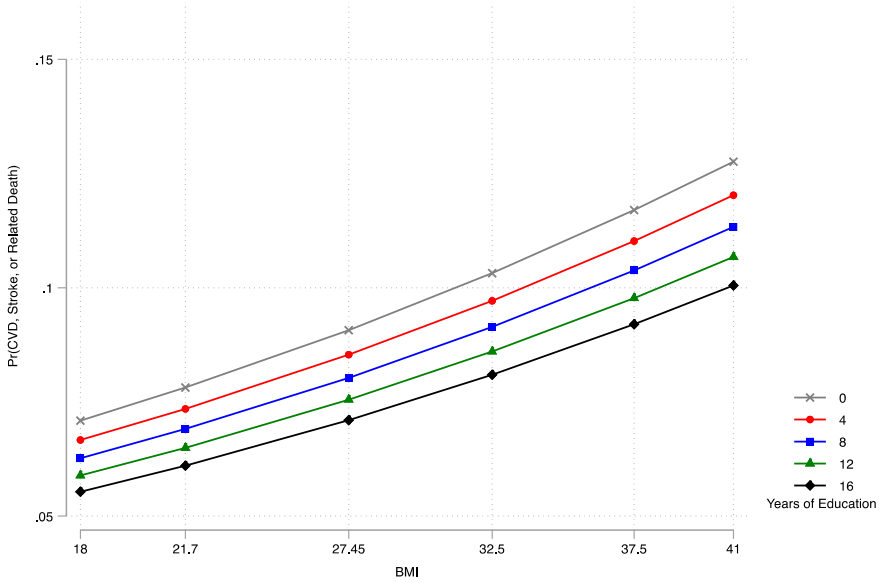

Figure 13. Predicted Margins of CVD, Stroke, or Related Death by BMI and Years of Education

3.4 Discussion

The link between health outcomes, health disparities, health behaviors, and education has been of great interest to scholars for decades. This study focused on the interaction between education, measured by educational attainment and years of education, with multiple health behaviors to better understand the relationship that education and health behaviors play in the risk of cardiovascular disease, stroke, and related death. Findings from this study suggest that while individuals with more education maintain a lower risk of cardiovascular disease, stroke, or related death, existing health disparities are not going to be erased by health behaviors. But the effects of certain health behaviors are different for individuals with less education than they are

for their more-educated counterparts. Specifically, smoking 1 to 10 cigarettes per day is associated with a higher risk for cardiovascular disease, stroke, or related death for those with more education than it is for those with less education. However, when measured on a continuous scale, the risks of smoking are relatively similar across all levels of education, with narrowing occurring at the highest levels of smoking. When measured categorically, not drinking moderately is associated with increased risk for people with less education than people with more education; however, when measured as a continuous variable, the risk for cardiovascular disease, stroke, or related death does not increase for people with less education as they drink more, but the risk does decrease for those with more education. Finally, regardless of how it is measured having an a high BMI increases the risk of cardiovascular disease, stroke, or related death for all levels of education.

Previous studies have yet to determine any clear support for a single explanation as to why some health behaviors might affect people of varying education levels differently (Cutler and Lleras-Muney 2010; Pampel et al. 2010; Shaw et al. 2014; Brunello et al. 2016). Some of these previous studies have isolated one aspect of SES (e.g., education, wealth; Shaw et al. 2014; Brunello et al. 2016) and only accounted for smoker status rather than number of cigarettes and have found that some indicators of SES, like education, play a more influential role in mediating and explaining the differences between health outcomes and health behaviors between groups. This study sought to

extend previous research by stratifying by SES (i.e., education) as well as including more nuanced measures of smoking and drinking behavior in order to better determine the relationship between health behaviors (smoking, drinking, and BMI), SES, and health disparities.

Findings from this study suggest that the health behaviors of interest do not affect people of different education levels in the same way. Like Brunello and colleagues' (2016) findings, results from this study show that education moderates the effects of health behaviors on health outcomes. This current study adds to their research by using a more detailed measure of smoking. Rather than simply identifying respondents as "current" or "non-current" smokers, this study measures the number of cigarettes respondents smoke each day. Findings in this study also build upon work by Shaw and colleagues (2014) by using the more nuanced measure of smoking. However, the more nuanced measure of smoking behavior included in this study indicates that the negative consequences of heavy cigarette smoking are greater for more-educated individuals than for individuals with less education. Since more-educated people are less likely to smoke (Pampel and Rogers 2004; Pampel 2009; Drope et al. 2018), one possible explanation for the finding in this study is that those who are highly educated and still smoke many cigarettes each day might be experiencing some other levels of psychological distress or social concerns that are exacerbating the negative consequences (Thomeer et al. 2019).

This study further builds upon research from Brunello et al. (2016) by using a more detailed measure of drinking behavior that categorizes drinkers as non-drinkers, moderate drinkers, or heavy drinkers based on respondents' sex and the average number of drinks they consume in a week. While Brunello et al. (2016) found that daily drinking was negatively correlated with self-rated health, that measure may be skewed by blending together moderate and heavy drinkers. Furthermore, though Shaw and colleagues (2014) do differentiate between moderate and heavy drinking, they do not distinguish these categories by sex, so males in their study are over-represented as heavy drinkers. Findings in this present study show that moderate drinking, for all levels of education, is beneficial to respondents and reduces the risk of heart disease, stroke, and related death. Furthermore, moderate drinking reduces the risks of cardiovascular disease, stroke, and related death more for the least educated than for the more highly educated. In general, non-drinking and heavy drinking increases the risks of heart disease, stroke, or related death, which is consistent with previous research (Di Castelnuovo et al. 2010; Ronksley et al. 2011).

This study is not without limitations. Even though the measure of smoking in this study is more detailed than those of previous studies, it still lacks some critical detail. The current smoking measure does not allow for the potential effects of social smoking or chain-smoking, nor does it identify those who might have smoked for long periods and then quit. Similarly, there are several possible drinking patterns that the

current measure does not capture, such as binge drinking or even the types of alcoholic beverages consumed. Finally, while BMI is widely used in this literature as a measure of weight management, it is a flawed measure that does not account for body fat percentage and various conditions that affect a person's total weight. Future research in this area should consider other measures of smoking and drinking behaviors as well as other measures related to weight management. Furthermore, with the rise in use of cigarette alternatives, such as e-cigarettes (which use nicotine derived from tobacco rather than tobaccos), research on health behaviors should strive to measure these cigarette alternatives.

In conclusion, this study examined whether people at various levels of education who participated in the same health behaviors would experience the same consequences of those behaviors. Using multiple indicators of education, findings from this study suggest that health behaviors do not affect people of different education levels in the same way. While people with the most education still see better health outcomes than their less-educated counterparts, they do not necessarily receive an extra benefit from the consequences of potentially harmful health behaviors. Middle- and higher-educated people see a stronger effect from moderate amounts of smoking and unhealthy BMIs, while the least educated receive the greatest benefit from moderately drinking. Overall, the findings from this study suggest that while there might not be symmetry in the effects of health behaviors between differing levels of education, those with more

education still maintain their health advantage compared to their less-educated counterparts.

4. Approval of Euthanasia: Differences Between Cohorts and Religion[1]

Attitudes toward end-of-life care have potential implications for how we handle our aging population as more people reach the oldest ages of life. Social issues and social changes ebb and flow over time. Specifically, the topic of euthanasia—ending a patient's life using medical methods (Emanuel et al. 2016)—seems to highlight conflicting norms in society: it is not appropriate to end a person's life; it is also not appropriate to allow people to suffer if it can be avoided. These conflicting norms can be seen in the increased approval of euthanasia and increased used of hospice care in the United States (Livne 2014), which conflict with the increasingly common opinion that life-saving attempts should be made in all circumstances (Pew 2013). Understanding what drives these opinions grows increasingly important with increasing costs of healthcare at the end of life, with approximately 77% of Medicare costs for decedents occurring during the final year of life and 40% being spent in the final month (Luce and Rubenfeld 2002). The rising cost of healthcare at the end of life is becoming increasingly important within our aging population as the oldest baby boomers are now in their early 70s. The baby boomer cohort could potentially pose an increasing cost burden on end-of-life care as they age. This study seeks to understand if the increasing trend in approval for

[1] This chapter is published in *SAGE Open*, January-March (2019): 1-11 and used here with permission under Sage Publishing's "Green Open Access: SAGE's Archiving and Sharing Policy."

euthanasia in the United States is driven by attitudinal changes in individuals or by cohort replacement.

Research has shown that social change is driven mostly by cohort replacement rather than by changes in individuals' attitudes over time (Elder & George 2016; Riley 1987). This occurs because younger cohorts will not only adopt attitudes and behaviors from their parents, they will also form their own attitudes based on the attitudes prevalent in society and of other members of their cohort. One such example is the gradual decline in religiosity and increase in secularization over time in the United States. These changes in religious attitudes are largely driven by cohort differences rather than individuals changing as they age (Schwadel 2010; Schwadel 2011). Religious variation by cohort directly relates to attitudes regarding euthanasia. Such religious variations over time are seen in both declines in religiosity—individual practices such as prayer or church attendance—and in institutional religious identity—such as belonging to a specific denomination (e.g., Ammerman 2007; Chaves 2011; Schwadel 2010; Schwadel 2011). Opinions regarding euthanasia also tend to vary by religion, sect, and denomination, with some liberal groups favoring euthanasia and others opposing it (Burdette, Hill, and Moulton 2005).

This paper seeks to add to the literature by investigating American approval toward euthanasia by considering whether the current attitudes are a result of cohort effects, including secularization. In this study, American approval of euthanasia is

compared across cohorts using nearly 20 years of data from the General Social Survey. Furthermore, religious variation in attitudes toward euthanasia is investigated by comparing various religious groups and levels of religiosity.

4.1 Background

4.1.1 Recent Trends

Advancements in medical technology over the past several decades have enabled medical professionals to diagnose more accurately, prescribe, and treat patients. This progress has also increased life expectancy as well as the ability to sustain life for those who are terminally ill (Burger, Baudisch, & Vaupel 2012; Caddell & Newton 1995). Euthanasia gives patients, families, and physicians an option to relieve pain and suffering either by ending life-sustaining care or hastening the end of life through medical methods.

Several studies have considered the changing opinion of the American public regarding euthanasia (e.g. Aghababaei 2013; Burdette et al. 2005; Caddell & Newton 1995; DeCesare 2000; Horsfall, Alcocer, Temple Duncan, & Polk 2001; Marini, Neuenschwander, & Stieffel 2006; Montero 2011). DeCesare (2000) investigated the public's attitudes regarding euthanasia and suicide when one is terminally ill using data from 1977 through 1996, and found that approval increased from just above 62% in 1977 to just over 70% in 1996. It is important to note that the data used in this study encompassed a period in which there were national news stories in the United States

regarding end of life and the right to terminate, and Oregon voters had passed their initial Death with Dignity Act in 1994, suggesting a period effect. DeCesare (2000) suggests that this may reflect two broader social trends: a decline in the public's confidence in medicine and an increase in the belief of autonomy, especially concerning end-of-life decisions. In a recent and comprehensive study of American attitudes towards euthanasia, Montero (2011) used multiple data sets to view trends dating back to 1947. This study found that since 1947, public approval of euthanasia has steadily increased from about 50% of Americans supporting a patient's right to end his or her life when suffering from a terminal illness up to 60% in 1977, peaking at approximately 75% in 2005 before leveling off to around 70% in 2007.

While there is a general positive trend in the approval of euthanasia over time, there have been no studies to date—that this author is aware of—that specifically investigate this trend between cohorts. This upward trend could either be a result of changes in attitudes by individuals as they get older, or it could be due to cohort replacement.

4.1.2 Social Change Between Cohorts

The idea that cohorts can affect social change or attitudes is not a new one. Ryder (1965), suggested that cohorts spark social change because of a cohort's characteristics and place in history. Ryder further suggested that large cohorts bring about more social change than small cohorts and that movements driven by younger members of a cohort

generate more change. This is applicable to a cohort like the baby boomers. Born between 1946 and 1964 and numbering 76 million people, American-born baby boomers were born and grew up as members of a large cohort wrought with changing ideologies and social movements (Hogan, Perez, and Bell 2008). Social issues such as abortion, same-sex marriage, women's rights, and end-of-life care have been debated for many years. Changes in the public's attitudes towards these and other social issues over time are a result of changes in cohorts and not in individuals changing their attitudes (Riley 1987). For example, baby boomers' attitudes toward these social issues tend to be more liberal than their parents' or grandparents' attitudes before them (Pew 2015). The Women's Movement—one of several different social movements that generated attention and change in the 1960s and 1970s when the baby boomers were in their youth and early adult years—is a prime example of social change due to cohort replacement. Age, period, and cohort analyses have demonstrated that the overall increase in gender egalitarian attitudes since the 1970s is a result of older cohorts being replaced by younger cohorts (Cotter, Hermsen, & Vanneman 2011; Pampel 2011a; Pampel 2011b). This understanding of change via cohort is important in understanding how social issues, policies, and laws evolve over time. It could be argued that people's attitudes change over time, which would suggest that there are some social factors that influence people as they age. However, much research suggests that these changes are a result of cohort replacement.

Cohort replacement is also associated with declining levels of religious participation and an increase in secularization (Elder & George 2016; Schwadel 2011). Secularization consists of declines in religious attendance as well as declines in confidence in religious authority or institutionalized religion (Schwadel 2010; Schwadel 2011; Sommerville 1998). This is an important consideration since religion has long been of interest to researchers when studying the trends of American attitudes of euthanasia (e.g. Aghababaei 2013; Burdette et al. 2005; Caddell & Newton 1995). These studies, and other studies (e.g.Hamil-Luker & Smith 1998) have shown that there is a correlation between religious belief, religiosity, and attitudes regarding euthanasia and physician-assisted suicide; individuals with a higher level of belief or religious practice and more conservative religious views are more opposed to euthanasia, due to the social and religious norm of "Thou shalt not kill," while those who are less religious or have less religious authority or control of their lives are more approving. It is important to note the context of religion in the United States. Compared to other nations, and especially Westernized nations, the United States is very religious (Chaves 2011). Americans are considered highly religious in both their individual expressions of religiosity (e.g., frequency of prayer, belief in God, attending religious meetings, etc.) and in their identification with institutionalized religious groups (e.g. Catholic, Protestant, etc.) (Ammerman 2007; Chaves 2011). This study will investigate the correlation between measures of religiosity and religious identification and approval of euthanasia.

Another correlation between religion and attitudes about euthanasia could be the increase in the number of people who claim no religious affiliation, or religious nones. There has been an increase in the religious nones over the past several decades with a steep rise beginning in 1990 (Lim, MacGregor, and Putnam 2010). During this era, favorable attitudes toward euthanasia have also increased (DeCesare 2000; Montero 2011). However, favorable attitudes of euthanasia have leveled off at around 70% since 1990, while the religious nones have continued to increase. If social change and secularization are linked to cohort replacement, then it is plausible that increased approval for euthanasia is a result of younger cohorts being more liberal and less religious than older cohorts. Baby boomers are less likely to be religious than generations before them and would therefore be less likely to have their attitudes on euthanasia influenced by religious beliefs or authority.

4.1.3 Research Questions

A summary of the literature suggests that approval for euthanasia saw a steady rise from the 1940s to the 1990s when it leveled off around 70%. This leveling off suggests that even though we have an aging population, these attitudes might be driven by cohorts or cohort replacement. Consistent with social change via cohort, secularization is increasing over time and this is not due to people becoming less religious as they age, but by younger cohorts being less likely to identify as religious. The literature leads to two research questions: first, is approval for euthanasia increasing

with each successive cohort; second, how does religious belief across cohorts affect attitudes toward euthanasia?

4.2 Methods

4.2.1 Sample

For this study, I use the General Social Survey (GSS) to assess changes in attitudes toward euthanasia over time. The GSS is a nationally representative survey that began in 1972. From 1972 to 1994, data were collected annually before switching to a biennial collection process beginning in 1994. For this analysis, I will be using 16 waves of data from 1985 to 2014, as not all the measures used in this present analysis are available in each collection year.

4.2.2 Measures

Dependent Variable. Approval for euthanasia is measured by respondents' answer to a question in the GSS: "When a person has a disease that cannot be cured, do you think doctors should be allowed by law to end the patient's life by some painless means if the patient and his family request it?" I then create a dummy variable for their responses with "no" (0) and "yes" (1) and I remove those who either did not answer or answered, "don't know" from my analysis.

Independent and Control Variables. The main independent variable is birth cohort, and I create this variable in two ways: first, I create three different birth cohorts based on the respondents' reported birth year. My emphasis in this study is the baby

boomers, who were born between 1946 and 1965. For consistency in my cohorts, I code pre-baby boomers as those who were born between 1936 and 1945, and post-baby boomers as those who were born between 1966 and 1985. Second, I restrict the data by age to reduce collinearity and to ensure that changes seen in cohorts were a result of cohort membership and not age. Only respondents ages 27 to 49 are included in this analysis. This age range was selected because there are no respondents in the data who were born before the baby boom that were younger than 27 and no respondents born after the baby boom that were older than 49. Other coding mechanisms for cohorts were attempted and analyzed, ranging from three birth cohorts to five birth cohorts. However, cohort sizes were so small that statistical power was lost. Other analyses using more cohorts demonstrated the same general patterns but with less power.

The GSS offers a wide array of religious groups that respondents can identify with. For simplicity, these groups have been clustered down to seven broader groups based on a modified version of Steensland and colleagues' religious coding (Steensland et al. 2000). In this analysis, the groups are nones, Catholics, Jewish, Conservative Protestants, Mainline Protestants, Black Protestants, and other. Other includes more eastern traditions such as Islam, Buddhism, and Hinduism.

To assess religiosity, I include three different variables available in the GSS. First is attendance at religious services, a commonly used measure of religiosity in the literature (Burdette et al. 2005; Montero 2011; Schwadel 2010); consistent with other

studies I truncate this to a dummy variable with attending religious services less than twice a month (0) and attending religious services twice a month or more (1). In addition to attendance at religious services, I include two other measures of religiosity that aim to capture more intrinsic levels of religiosity, which is often under-examined (Aghababaei 2013). The GSS asks respondents how often they pray, which I also truncate to a dummy variable with less than once a week (0) and once a week or more (1). My third measure of religiosity is Biblical literalism. Participants are asked their feelings about the Bible with the following response options; the literal word of God (1), an inspired word of God but not everything is literal (2), an ancient book of fables (3), and other (4). As with my other measures of religiosity, I create a dummy variable with those who do not feel the Bible is the literal word of God (0) and those who do feel that the Bible is the literal word of God (1).

Controls include age, ranging from 27 to 49; sex, coded 0 for male and 1 for female; race, the GSS only distinguishes white (0), black (1), and other (2). Other controls include years of education, family income, marital status dichotomized as not married (0) and married (1), and political ideology coded as liberal (0), moderate (1), or conservative (2). My total n for this study is 6,638.

4.2.3 Analyses

To estimate differences in approval for euthanasia between these three cohorts, I employ logistic regression. I estimate several models using logistic regression,

progressively adding more variables. In all my models, the baby boomer cohort is the reference group. Model 1 estimates the bivariate relationship between cohort and approval for euthanasia. Model 2 builds upon Model 1 by controlling for age. Model 3 includes the rest of my control variables; sex, race—with white as the reference group—marital status, years of education, and political ideology—with conservative as the reference category. In Model 4, I introduce the seven religious groups with the nones as my reference category. Model 5 adds my three measures of religiosity to this analysis. Models 6 and 7 include interactions in addition to the full list of variables; Model 6 includes an interaction of praying at least once a week with cohort, and Model 7 interacts cohort with religious group. Additional interactions were estimated and were not significant and are therefore not included in this paper, but they are available upon request. The Bayesian information criterion found that the best model that fit these data is Model 5.

4.3 Results

Descriptive statistics of my sample are presented in Table 7. I will briefly highlight some of the key descriptive statistics from this table and then discuss the results. First, roughly 55% of my sample belong to the baby boomer cohort with approximately 39% belonging to the post-baby boomer cohort and only about 6% being in the pre-baby boomer cohort. Second, nearly 78% of the sample report as being white, with approximately 14% of the sample reporting as black and only 8% reporting as

other. The pre-baby boomers have the highest percentage of white participants with the post-baby boomers having the lowest percentage of white respondents. Third, approximately 55% of the sample is female and this is relatively consistent among the three cohorts, with pre-baby boomers being the only group that is nearly 50% female and 50% male. Fourth, political ideology is relatively evenly distributed among the sample and among the cohorts. Those who identify as moderate make up about 37% of the sample, and within cohorts no group has a strong majority. The strongest majority observed is among moderate post-baby boomers who make up approximately 39% of their cohort's political ideology.

Table 7. Descriptive Statistics GSS, 1985 to 2014

	Pre-Baby Boomers	Baby Boomers	Post-Baby Boomers	Total
Mean Age	46.129	39.154	34.521	37.521
Male	205	1,690	1,126	3,021
Female	207	1,952	1,458	3,617
Race				
White	354	2,997	1,825	5,176
Black	43	449	433	925
Other	15	196	316	537
Married	256	2,075	1,282	3,613
Years of Education	13.311	13,802	13.955	13.832
Family Income	$10K to $14.9K	$15K to 19.9K	$15K to 19.9K	$15K to $19.9K
Political Ideology				
Conservative	153	1,355	831	2,239
Moderate	153	1,309	1,004	2,466
Liberal	106	1,078	749	1,933
Religious Group				
None	50	580	670	1,300
Catholic	110	953	597	1,660
Jewish	6	53	37	86
Conservative Protestant	137	986	600	1,822
Mainline Protestant	81	650	261	992
Black Protestant	21	290	224	535
Other	7	130	106	243
Religiosity				
Attend Religious Services 2+ Monthly	166	1,402	902	2,470
Pray 1+ Weekly	312	2,731	1,926	4,969
Bible is Word of God	114	1,021	790	1,925
n	412	3,642	2,584	6,638

Table 8. Odds Ratios from Logistic Estimates for Approval of Euthanasia (n=6,638)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Baby Boomers	REF	REF	REF	REF	REF	REF	REF
Pre-Baby Boomers	0.764*	0.852	0.845	0.871	0.813	1.300	1.086
Post-Baby Boomers	0.872*	0.810***	0.849*	0.813**	0.837*	0.614**	0.560**
Age		0.985***	0.984**	0.983***	0.987*	0.987*	0.987*
Female			0.698***	0.738***	0.877*	0.877*	0.879*
Race							
White			REF	REF	REF	REF	REF
Black			0.337***	0.361***	0.483***	0.475***	0.481***
Other			0.620***	0.632***	0.716**	0.711**	0.697***
Married			0.782***	0.827**	0.938	0.935	0.937
Years of Education			1.042***	1.024*	1.024*	1.024*	1.024*
Family Income			1.025	1.029	1.018	1.017	1.017
Political Ideology							
Conservative			REF	REF	REF	REF	REF
Moderate			2.288***	2.153***	1.932***	1.941***	1.940***
Liberal			2.751***	2.352***	1.992***	2.013***	2.008***
Religious Groups							
Nones				REF	REF	REF	REF
Catholic				0.382***	0.636***	0.624***	0.522***
Jewish				0.723	0.883	0.858	1.328
Conservative Protestant				0.296***	0.659***	0.641***	0.494***
Mainline Protestant				0.691**	1.122	1.099	0.960
Black Protestant				0.399***	0.757	0.745	0.606*
Other				0.554***	0.783	0.722	0.455**
Religiosity							
Attend Religious Services 2+ Monthly					0.484***	0.489***	0.480***
Pray 1+ Weekly					0.567***	0.507***	0.566***
Bible is Word of God					0.539***	0.538***	0.541***
Interactions							
Baby Boomers X Prayer						REF	
Pre-Baby Boomers X Prayer						0.580	
Post-Baby Boomers X Prayer						1.442*	
Pre-Baby Boomers X Faith							
Nones							REF
Catholic							0.688
Jewish							0.070*
Conservative Protestant							0.782
Mainline Protestant							0.597
Black Protestant							1.132
Other							--
Post-Baby Boomer X Faith							
Nones							REF
Catholic							1.467
Jewish							0.549
Conservative Protestant							1.786**
Mainline Protestant							1.320
Black Protestant							1.466
Other							2.952**

*$p < .05$; ** $p <. 01$; *** $p < .001$

Fifth are the different religious groups. The faith groups with the largest representation in the overall sample are Conservative Protestants (~27%), Catholics (~25%), and nones (~20%). While 80% of the sample identify with some religious group, when broken down, the nones are the third largest group in the sample. Some of the more notable differences between cohorts are seen with the nones only being about 12% of pre-baby boomers, just under 16% of baby boomers, and then reaching nearly 26% of post-baby boomers. This is consistent with the idea that secularization is growing and is more common among younger cohorts. Another notable change among the religious groups is the decline in Mainline Protestants, who represent nearly 20% of pre-baby boomers, almost 18% of baby boomers, and just 10% of post-baby boomers. Finally, the measures of religiosity. Roughly 37% of respondents in the sample attend religious services at least twice a month. Those most likely to do so are pre-baby boomers at about 40%, and the least likely are post-baby boomers at about 35%. One of the more notable descriptive statistics is for those who report praying at least once a week or more. In the overall sample, 75% of people report weekly prayer, and this figure remains constant between all three cohorts. Even though more people report being nones in younger cohorts, the amount of prayer has not decreased between cohorts. Crosstabs indicate that among the religious nones, nearly 43% of the overall sample report praying at least once a week and this figure was 42% among pre-baby boomer nones and up to just over

43% of post-baby boomer nones. This finding supports the idea that religious nones still might practice some level of spirituality or intrinsic religiosity.

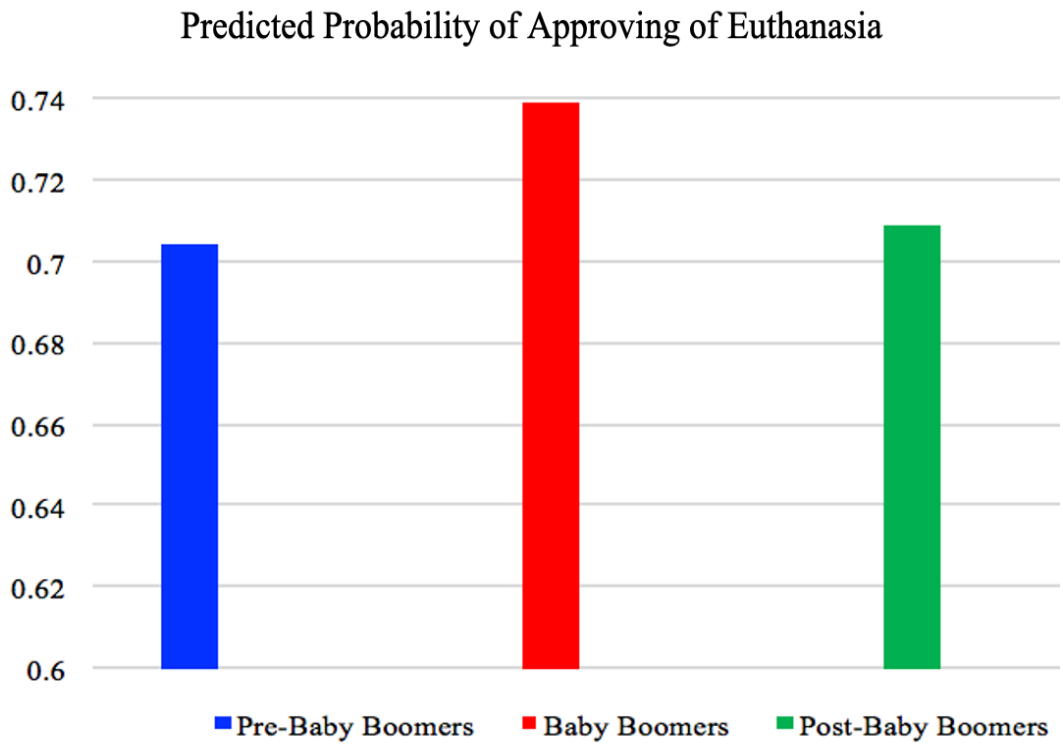

Figure 14. Predicted Probabilities for Approval of Euthanasia by Cohort

Table 8 shows the results for all seven of the estimated logistic regression models. Model 1 shows the bivariate relationship between cohorts and approval for euthanasia. Results show that both pre-baby boomers and post-baby boomers are significantly less likely to approve of euthanasia in comparison to baby boomers. Pre-baby boomers have an odds ratio of 0.764 while post-baby boomers have an odds ratio of 0.872. This suggests that baby boomers are significantly more likely to approve of euthanasia than either their predecessors or successors. This relationship is consistent in

all the models estimated. This provides only partial support for Hypothesis 1, while baby boomers were more likely than their predecessors to approve of euthanasia, levels of support do not increase from baby boomers to post-baby boomers. For simplicity in interpretation, I convert odds ratios into predicted probabilities. Figure 14 shows the predicted probability for each of the three cohorts approval of euthanasia based on estimates from Model 5. Displaying predicted probabilities for each model was considered, but since the pattern is consistent and similar in magnitude, only those from Model 5 are presented in the figures. Note that in Figure 14, the predicted probability of approval for euthanasia is highest among the baby boomers at 0.739, lowest among the pre-baby boomers at 0.704, and only at 0.709 for post-baby boomers.

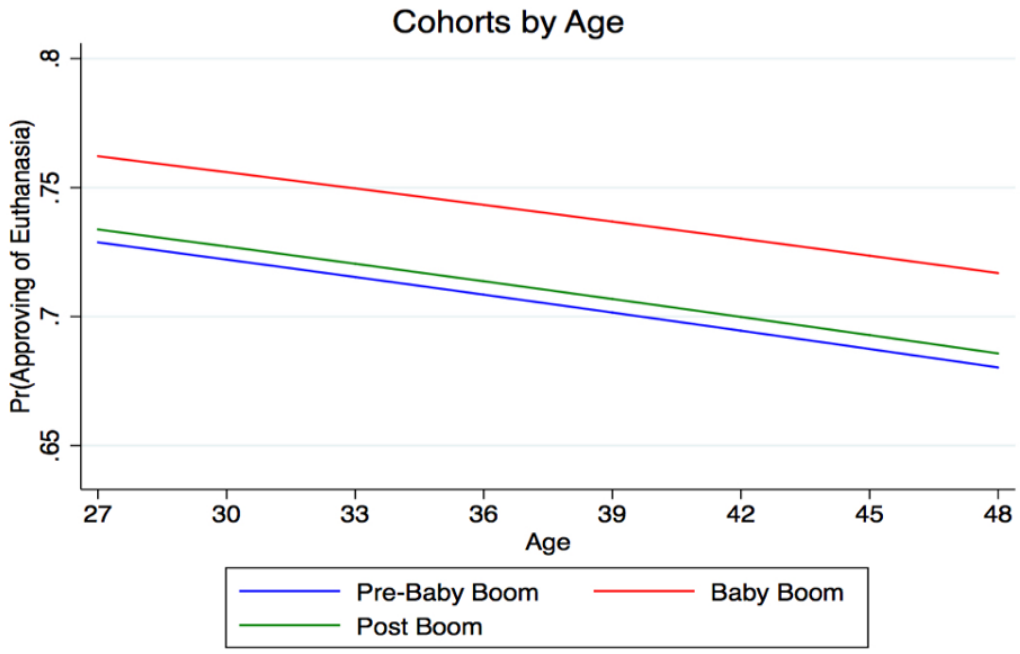

Figure 15. Predicted Probability for Approval of Euthanasia across Cohorts by Age

When age is added in Model 2, the significance for pre-baby boomers is explained away; but there is still a negative effect for pre-baby boomers compared to baby boomers. In Model 2, the odds ratio for age is 0.985, which demonstrates that odds of approval for euthanasia declines with age. This relationship shows (see Figure 15) that each cohort is less likely to approve of euthanasia as they age. It is important to know that I did estimate an interaction between cohort and age and found no significant effect. Because of this finding, it could be suggested that the oldest cohort would be the least likely to approve of euthanasia and the youngest cohort would be the most likely to approve. However, at every age baby boomers are still more likely to approve of euthanasia, which supports the idea that cohort does matter for attitudes and that baby boomers are unique as a cohort.

The results from Model 3, shown in Table 8, are worth noting even if there were no unexpected findings. Again, the pattern for pre- and post-baby boomers being less likely to approve of euthanasia than baby boomers holds when controlling for all the demographic and control variables. The effect is slightly smaller for post-boomers in this model but is still significant. Females are significantly less likely than men to approve of euthanasia with an odds ratio of 0.698, and this finding is consistent with previous research (Burdette et al. 2005; Montero 2011). Non-whites, or blacks and others in this sample, are both significantly less likely than whites to approve of euthanasia, which is also consistent with previous literature (Burdette et al. 2005; Montero 2011) that suggest

that some of the results could be explained by mistrust in the medical profession, especially among blacks. Also, consistent with previous research (Burdette et al. 2005; Montero 2011) higher education is significantly associated with higher odds for approval of euthanasia, as is higher income, although this is not significant. As expected, both moderates and liberals have significantly higher odds for approval of euthanasia than conservatives.

Model 4 in Table 8 shows the results when including religious groups in the regression. Unsurprisingly, belonging to a religious group is associated with lower odds for approval of euthanasia than being a part of the nones and all these groups, except for those who identify as Jewish, are statistically significant. The religious groups' odds ratios of approval are consistent with traditional levels of conservatism within each group. Those with the lowest odds ratio (0.296) are the Conservative Protestants, who are generally the most conservative religious group in the United States. Catholics (0.382) and Black Protestants (0.399) have similar odds ratio and are both seen as religiously conservative groups. Among the religious groups that are statistically significantly different than the nones, the largest odds ratio is for Mainline Protestants (0.691). Again, this is expected since belonging to a religious group is usually correlated with higher levels of conservatism on social issues compared to those who do not belong to a religious group. Furthermore, among major religious groups in the United States, Mainline Protestants are typically more progressive than their Christian peers.

In order to assess the extent to which attitudes are driven by belonging to one of these religions within a cohort, I also estimate an interaction between cohorts and religious groups (see Figure 16 and Model 7 in Table 8). While not every one of these interactions is significant, there are some patterns and results worth noting. In general, these interactions show that being a pre-baby boomer and belonging to these religious groups leads to lower odds of approval for euthanasia. The pattern is the opposite for post-baby boomers who belong to these religious groups. While only three of these interactions are significant at the $p<0.05$ level, the trends suggest that post-baby boomers who identify with these religious groups have higher odds for approving of euthanasia. This could suggest that secularization is having some effect among the religious post-baby boomers, meaning that even though these post-baby boomers do identify as religious, they might be less likely to adhere to religious leaders or religious authority.

In Figure 16, I report predicted probabilities from post-estimation techniques to highlight differences between groups and cohorts. Jewish baby boomers have a much higher probability of approval (0.913) than Jewish pre-baby boomers (0.513) and a noticeably higher probability than Jewish post-baby boomers (0.784). However, it should be noted that this could also be due to the small number of survey participants who identify as Jewish, with only 86 in the sample. This pattern is similar for Mainline Protestants, with baby-boomers having the highest probability of approval (0.838), pre-baby boomer Mainline Protestants having the lowest probability (0.777) and post-baby

boomers also having a lower probability (0.797) than baby boomers. While these two groups do standout, this is not entirely surprising as these groups are generally considered to be more progressive than their religious counterparts. However, another religious group worth noting in this interaction is the Catholic group. While this interaction is not significant, it is noteworthy because it follows the same pattern as Jewish and Mainline Protestant respondents even though Catholics are typically one of the more conservative religious groups, with Catholic leadership being publicly opposed to euthanasia. These could be respondents who identify as Catholic but might not have high levels of religiosity, suggesting support for secularization. They could also be practicing Catholics that do not adhere completely to Catholic leadership on this issue, again, supporting secularization.

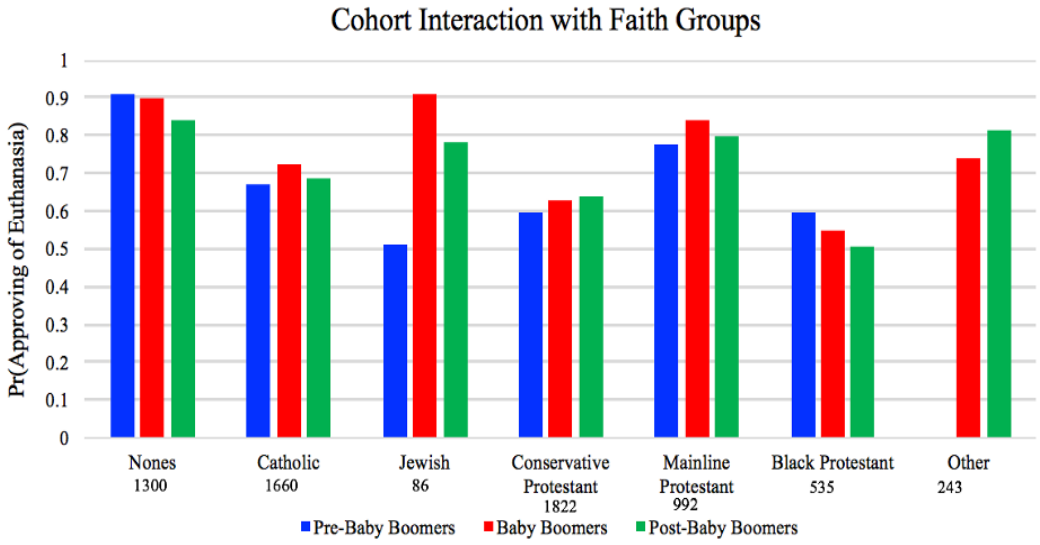

Figure 16. Cohort Interactions with Religious Groups. Predicted Probabilities for Approval of Euthanasia Shown

The final results are those from Models 5 and 6 found in Table 8. All three measures of religiosity have odds ratios below one, indicating a negative effect or that the odds for approval of euthanasia are less, and all three are significant at the $p<0.001$ level. Those who attend religious services at least twice a month have the lowest odds ratio (0.484) while those who pray at least once a week have the highest odds ratio (0.567), which still suggests that regular prayer diminishes approval for euthanasia. Finally, those who believe the Bible to be the literal word of God have an odds ratio of 0.539. When adding my three measures of religiosity in Model 5, the pattern and odds ratios for cohorts' approval of euthanasia do not appear to have any meaningful change. Furthermore, except for marital status, which loses statistical significance, none of the standard controls and demographic measures see any noteworthy changes with the addition of religiosity. However, there are some important changes that occur within religious groups when accounting for religiosity.

While five out of six religious groups for which coefficients are reported in Model 4 were statistically significant, when adding religiosity there are only two out of six that remain significant, Catholics and Conservative Protestants. Every single religious group sees an increased odds ratio when measures of religiosity are included in the model, with the statistical significance explained away by accounting for religiosity among Mainline Protestants, Black Protestants, and others. Perhaps the most interesting change from Model 4 to Model 5 is among Mainline Protestants. Not only do

Mainline Protestants lose statistical significance by accounting for religiosity, but they also go from an odds ratio below 1.000, a negative effect, to an odds ratio above 1.000, which suggests a positive effect. Even though this odds ratio is not significant in Model 5, it suggests that those who identify as Mainline Protestants and exhibit higher levels of religiosity are more likely to approve of euthanasia than those who do not. A possible explanation for this is that Mainline Protestants, who are generally considered more progressive, might be more likely to hear more progressive social views from religious leaders and from fellow worshipers in their communities when they are participating.

Finally, interactions with cohort and all three measures of religiosity were estimated, and only praying at least once a week has a significant effect only among post-baby boomers (see Model 6 in Table 8). For those post-baby boomers who do report praying at least once a week their odds ratio for approval of euthanasia is 1.442, which is a positive effect. Prayer is a more intrinsic measure of religiosity and therefore captures those who might be less inclined to attend services, take the Bible as the literal word of God, or even identify with an organized religion, but still seek some level of spirituality or prayer within themselves. In general, these findings support Hypothesis 2, that secularization partially explains cohort differences. If secularization did not play a role between the cohorts, differences would be explained by other factors such as political ideology or educational differences between cohorts, but there is no evidence of this in these results.

4.4 Discussion

Attitudes regarding euthanasia have been of interest among researchers for decades. Most studies in this line of research have focused on the social characteristics of those who do or do not approve of euthanasia or on general trends of approval over time. This study focused on differences between cohorts in an effort to further understand social change and how these attitudes might change going forward. Findings from this study provide evidence that there are cohort differences for approval of euthanasia and that younger cohorts are not necessarily more likely to approve.

While past research has shown a steady increase for approval of euthanasia from the 1940s until the 1990s when approving attitudes seemingly leveled off at around 70% (DeCesare 2000; Montero 2011), it is unclear whether or not this number will remain constant in the coming years. Findings from this study show two possible reasons why approval for euthanasia might dip down in the future. First, approval of euthanasia does decline as people get older. As pre-baby boomers die and become replaced by aging baby boomers, the baby boomers also might be less favorable in their approval of euthanasia. Second, this study found that the post-baby boomers, those born between 1966 and 1985 are less likely to approve of euthanasia than their predecessors. Even though post-baby boomers currently approve of euthanasia at a level similar to the overall trends we observe in the population, their support might diminish with age. Furthermore, if even younger cohorts—those born after 1985—follow this trend, overall

approval could decline in the future. However, this is highly dependent on several factors.

First, depending on how baby boomers deal with end-of-life care for their aging parents, the pre-baby boomers, their attitudes about euthanasia might shift. Second, and in conjunction with making decisions for their parents, baby boomers are currently between the ages of 52 and 71, meaning that they are not only in the process of making end-of-life care decisions for their parents, but are also in the position or very soon will be required to make decisions on their own behalf or on behalf of their significant others. A third factor that could influence future attitudes on euthanasia is how post-baby boomers and other younger generations react to helping the baby boomers make end-of-life care decisions. Post-baby boomers might see either an increase in the need for euthanasia to alleviate suffering, or they might want to prolong life to spend more time with loved ones.

This study found that nearly three quarters of baby boomers approve of euthanasia, which is significantly more than pre- or post-baby boomers' approval of euthanasia. Baby boomers represent roughly 25% of the entire United States population, meaning that at their current age and size they likely have the most influence on current opinions and policies. Overall approval for euthanasia reached 70% in 1991, when baby boomers were between ages 25 and 44 (DeCesare 2000; Montero 2011). As has been argued in the literature and in this paper, much social change is driven by cohorts and

not by aging individuals. If baby boomers developed these attitudes in early adulthood and early middle-age, findings from this study would suggest that their large size in the United States population could explain why approval reached 70% in the early 1990s and has leveled off since then.

In addition to identifying differences between cohorts, this study found, that consistent with prior research (Burdette et al. 2005; Caddell & Newton 1995; Hamil-Luker & Smith 1998; Montero 2011), approval for euthanasia is associated with religious belief and secularization. This study adds to previous research by investigating multiple measures of religiosity. Most previous studies have not considered intrinsic measures of religiosity and have focused more on external measures, such as frequency of attendance at religious services(e.g., Aghababaei 2013; Burdette et al. 2005). By including these additional measures of religiosity, I am able to account for more of the possible effects of secularization between cohorts. As noted in the literature, evidence of secularization is not only found through an increase in the religious nones, but there is also evidence that there is a decline in religious authority and privatization of religion and spiritualism (Schwadel 2010; Schwadel 2011; Schwadel 2013; Sommerville 1998). This current study finds that many people who do not identify as religious, or as belonging to an organized religion, still seek some level of spirituality and practice some form of prayer as a part of their lives. Post-baby boomers who pray at least once a week are more likely to approve of euthanasia than baby boomers who pray regularly, even though post-baby boomers

are significantly less likely to approve of euthanasia. This suggest that for post-baby boomers, who are less likely to be religious, those who pray regularly could still be seeking some form of intrinsic spirituality while not seeing a need for extrinsic religiosity that is displayed by frequent attendance at religious services.

There are qualitative differences between people who simply identify as a part of a religious group and those who display higher levels of religiosity. The most conservative religious groups, Catholics and Conservative Protestants seem to be the most resilient to these changes and maintain higher levels of religiosity (e.g. Aghababaei 2013; Burdette et al. 2005; Caddell & Newton 1995; Hamil-Luker & Smith 1998). It is possible that these more conservative groups might be less affected by secularization and still might be more likely than their counterparts to adhere to religious authority, or that their religious leaders are less likely to approve of euthanasia. It is possible that for the more progressive groups who lose their significance when accounting for religiosity that when participating in their religious communities they are more likely to encounter more progressive leaders and fellow members. Thus, it is possible that by participating in their religious communities and through intrinsic expressions of their faith, they become more likely to approve of euthanasia.

This study and these findings are not without limitations. First, while the religious groups were created based on Steensland et al. (2000), there are still some important qualitative differences between certain religious groups that are grouped

together. For example, the other group is comprised of mostly eastern traditions that are less common in the United States. Another limitation with the religious measures is that the measures for religiosity, while well-established in the literature, cannot fully capture the level of conviction or belief among those who identify as religious. Finally, the outcome measure is commonly used in this literature and does capture attitudes on euthanasia. However, this particular measure does not distinguish between voluntary active euthanasia—physician-assisted suicide—and voluntary passive euthanasia—ending or withholding treatment. These two types of euthanasia are qualitatively different and when asked directly about the two, people are less likely to approve of voluntary active euthanasia (Burdette et al. 2005; Emanuel et al. 2016).

Despite these limitations, this study has important implications for understanding attitudes toward euthanasia as well as potential policy. While there are cohort differences for attitudes of euthanasia, it is not clear whether these attitudes will continue to change as a result of cohort replacement. There is some evidence for this because baby boomers were more likely to approve than their predecessors; however, post-baby boomers were less likely to approve than baby boomers. Therefore, cohort replacement might not be able to completely explain the trending approval for euthanasia since the 1940s.

Policy makers should consider the differences in approving attitudes for euthanasia between cohorts as they continue to address healthcare reform and end-of-

life treatment options. At the time of this study, six states and Washington D.C. allow some form of voluntary active euthanasia; Oregon was alone in this practice from 1994 until 2008. While the increase in legalization of this practice as an end-of-life care option has been on the rise during the past decade, if post-baby boomers remain less likely to approve of these practices, legislators may have a more difficult time passing these types of laws in the future. However, there is still a sizeable number of baby boomers who are in favor of these laws.

Future research should consider qualitative research methods to better understand differences between religious groups and types of religiosity. If researchers can determine if and why some types of religiosity have a greater effect on attitudes of euthanasia, we might be able to better understand the impact of secularization on these attitudes and how this might affect social change. Future research should also investigate the impact of period effects on these attitudes. For example, even though approving attitudes have remained relatively level at 70% since 1990, there was a slight spike to approximately 75% in 2005, which was when Terri Schiavo died after a widely publicized 15-year legal battle between her husband and her parents to end and withhold her treatment after she was left in a vegetative state. This particular study was not concerned with period effects as the study window was from 1985 to 2014, during which overall approval remained fairly constant except for the aforementioned spike in

2005. However, this does not mean that other increases in the past are not partially a result of periods when medical technology and healthcare advanced.

In conclusion, the overall high approval for euthanasia in the United States seems to be a product of the large baby boomer cohort. Due to its large size and unique era in which baby boomers grew up, their attitudes are more favorable than their predecessors. Baby boomers are also more likely to approve of euthanasia than post-baby boomers, suggesting that there is something unique about the baby boomers which drives their social attitudes. While it is possible that attitudes could decline in the future, this seems unlikely. Even though post-baby boomers are less likely to approve of euthanasia than baby boomers, most of them still approve. As healthcare costs, especially in the final 12 months of life, continue to remain high, and as baby boomers age, it is possible that younger cohorts will seek for less expensive end-of-life care to deal with the coming needs. Finally, secularization does appear to be a contributing factor to attitudes about euthanasia. However, the effects of secularization appear to vary between cohorts and do not affect all religious groups to the same degree. Furthermore, it appears that among some religious groups, higher religiosity might increase odds for approval of euthanasia.

5. Conclusion

In this dissertation, I sought a better understanding of current social inequalities and health disparities. To do this, I conducted three quantitative studies using secondary data to study: (1) Socioeconomic inequality and disparities in cardiovascular disease, stroke, and related death during and after the Great Recession. (2) Socioeconomic inequality and whether the effects of certain health behaviors differ by social status. (3) Cohort and religious differences in beliefs about medical practices, in this case, euthanasia.

In chapter 2, I used 16 years of panel data from the Health and Retirement Study to assess the risks of cardiovascular disease, stroke, and related death among different socioeconomic status levels as measured by educational attainment. I find patterns that indicate a slight narrowing in the risks of cardiovascular disease, stroke, and related death between lower- and higher-socioeconomic groups; however, the findings are nonsignificant.

In chapter 3, I investigated whether there is symmetry in the effects of certain health behaviors—smoking, drinking, and BMI—and risks of cardiovascular disease, stroke, and related death among different socioeconomic statuses. In this study, I also use 16 years of panel data from the Health and Retirement Study. I add to the existing literature by using more nuanced measures of smoking and drinking while also stratifying my sample by educational status. I find that there are differing effects of

health behaviors among educational categories. For example, higher levels of daily cigarettes and higher BMIs correlate with a higher risk of cardiovascular disease, stroke, and related deaths for those with more education than those with the least education.

In chapter 4, I studied social change, cohort replacement, and religious affiliation in people's support of euthanasia. To do this, I used 16 waves of the General Social Survey. I find that there is likely a cohort effect regarding approval of euthanasia and that baby boomers are significantly more likely to approve of this medical practice than the birth cohorts before or after them. I also find that regardless of the cohort, those who belong to a more conservative religious group and display higher religiosity levels are less likely to approve of euthanasia. Together, these results suggest that as our population continues to age and become more secular, that approval rates for euthanasia could rise in the future.

Together, these studies contribute to medical sociology by increasing our understanding of economic inequality and health disparities during and after financial crises and broadening our understanding of health behaviors and socioeconomic statuses by showing that the effects of behaviors might differ by socioeconomic status. Finally, social factors outside of socioeconomic status, like birth cohort and religiosity, also correlate with health practices. Future research should expand on economic inequality and financial crisis by investigating broader age ranges and controlling for other variables such as employment, health insurance, and childhood background.

Future research on health behaviors and socioeconomic status should continue developing better and more nuanced measures to assess the effects of these behaviors better. Research into medical practices could focus on various practices, such as simple public health practices and willingness to participate based on various social factors. All of these lines of research will help advance the field of medical sociology.

Appendix A

Table 9. Discrete-Time Hazard Regression for CVD (n=10,345; 55,897 interval records)

	Model 1	Model 2	Model 3	Model 4
	Less than HS	HS/GED	Some College	BA/S+
Recession	2.002*	1.523*	0.175	-0.532
Age	0.022***	0.032***	0.035***	0.030***
Age*Recession	-0.026*	-0.018*	-0.002	0.009
Male	0.061	0.255***	0.247*	0.468***
Race/Ethnicity				
Non-Hispanic White	REF	REF	REF	REF
Non-Hispanic Black	-0.205*	-0.186†	-0.444**	-0.029
Non-Hispanic Other	0.179	-0.458	-0.136	-0.242
Hispanic	-0.411***	-0.415*	-0.376†	-0.284
Married	-0.035	-0.044	0.114	0.300*
South	-0.205*	0.171*	0.065	0.023
Income	0.016	-0.033	-0.015	-0.108**
Wealth	-0.229***	-0.147***	-0.225***	-0.010
Constant	-3.405***	-4.672***	-4.524***	-5.288***
n	13,582	19,880	11,142	11,293

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$

Table 10. Discrete-Time Hazard Regression for Stroke (n=10,345; 55,897 interval records)

	Model 1	Model 2	Model 3	Model 4
	Less than HS	HS/GED	Some College	BA/S+
Recession	2.061†	0.679	0.467	0.012
Age	0.039***	0.059***	0.056***	0.060***
Age*Recession	-0.030†	-0.011	-0.008	0.001
Male	0.141	0.012	0.287†	-0.176
Race/Ethnicity				
Non-Hispanic White	REF	REF	REF	REF
Non-Hispanic Black	-0.160	0.058	0.232	0.426†
Non-Hispanic Other	-0.524	-1.772†	0.047	-0.142
Hispanic	-0.487**	-0.455	0.167	0.357
Married	-0.235	-0.006	0.201	-0.204
South	0.295*	0.031	0.087	0.014
Income	-0.065†	-0.068	-0.151**	0.007
Wealth	-0.048	-0.072	-0.132	-0.039
Constant	-6.287***	-7.737***	-7.261***	-8.204***
n	13,582	19,880	11,142	11,293

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$

Table 11. Discrete-Time Hazard Regression for Death due to Circulatory Disease (n=10,345; 55,897 interval records)

	Model 1	Model 2	Model 3	Model 4
	Less than HS	HS/GED	Some College	BA/S+
Recession	0.035	0.014	1.631	-0.787
Age	0.096***	0.108***	0.113***	0.091***
Age*Recession	-0.001	-0.003	-0.025	0.004
Male	0.614***	0.723	0.649*	0.604*
Race/Ethnicity				
Non-Hispanic White	REF	REF	REF	REF
Non-Hispanic Black	0.067	0.383†	0.067	0.039
Non-Hispanic Other	0.900*	-1.191	0.278	Empty
Hispanic	-0.132	-0.596	0.110	-0.321
Married	-0.018	-0.137	-0.830**	-0.556*
South	0.061	0.043	-0.315	-0.073
Income	-0.038	-0.123*	0.151	-0.093
Wealth	-0.639***	-0.485***	-0.468**	-0.401***
Constant	-8.812***	-10.430***	-11.447***	-9.134***
n	13,582	19,880	11,142	10,963

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$

Table 12. OLS Regression for CVD, Stroke, or Related Death (n=10,345; 55,897 interval records)[1]

	Model 1	Model 2	Model 3	Model 4
	Less than HS	HS/GED	Some College	BA/S+
Recession	0.077	0.020	0.047	-0.076
Age	0.007***	0.006***	0.006***	0.005***
Age*Recession	-0.001	-0.001	-0.001	0.001
Male	0.035***	0.030***	0.030***	0.029***
Race/Ethnicity				
Non-Hispanic White	REF	REF	REF	REF
Non-Hispanic Black	-0.006	0.004	-0.012	0.005
Non-Hispanic Other	0.045†	-0.050*	0.013	-0.031
Hispanic	-0.030**	-0.035**	-0.009	-0.010
Married	-0.006	-0.007	-0.009	-0.007
South	-0.001	0.008	-0.003	-0.001
Income	-0.004	-0.006*	-0.002	-0.006†
Wealth	-0.036***	-0.018***	-0.018***	-0.011**
Constant	-0.215***	-0.204***	-0.232***	-0.171***
n	13,582	19,880	11,142	11,293

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$

[1] The Outcome variable in Table 10 is combined accumulated measure of cardiovascular disease, stroke, or related death. If respondents have no conditions (=0), if respondents have cardiovascular disease or stroke (=1), if respondents have cardiovascular disease and stroke (=2), if dead due to related cause (=3).

Table 13. Discrete-Time Hazard Regression for CVD, Stroke, or Related Death by Education Status with Various Controls (n=10,345; 55,897 interval records)

	w/ Income & w/o Wealth				w/o Income & w/Wealth				w/Income & Wealth			
	Less than HS	HS/GED	Some College	BA/S+	Less than HS	HS/GED	Some College	BA/S+	Less than HS	HS/GED	Some College	BA/S+
Recession	1.493*	1.397*	0.742	-0.483	1.353*	1.231*	0.657	-0.527	1.380*	1.279*	0.663*	-0.498
Age	0.045***	0.052***	0.052***	0.048***	0.044***	0.051***	0.051***	0.049***	0.044***	0.051***	0.062***	0.047***
Age*Recession	-0.022*	-0.018**	-0.011	0.006	-0.019*	-0.016*	-0.009	0.007	-0.019*	-0.016*	-0.010	0.007
Male	0.216**	0.291***	0.301***	0.340***	0.219**	0.282***	0.294***	0.325***	0.222**	0.290***	0.298***	0.341***
Race/Ethnicity												
NH-White	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
NH-Black	-0.111	-0.017	-0.141	0.132	-0.139†	-0.032	-0.182	0.141	-0.147†	-0.050	-0.186	0.110
NH-Other	0.186	-0.698*	0.025	-0.386	0.180	-0.695*	0.020	-0.379	0.170	-0.709*	-0.026	-0.394
Hispanic	-0.345***	-0.442**	-0.200	-0.191	-0.372***	-0.443**	-0.232	-0.161	-0.392***	-0.465**	-0.243	-0.211
Married	-0.081	-0.071	0.002	0.067	-0.075	-0.089	0.013	0.032	-0.054	-0.049	0.032	0.079
South	-0.011	0.141*	0.024	0.019	-0.028	0.136*	0.015	0.016	-0.032	0.133	0.015	0.014
Income	-0.030	-0.067**	-0.054	-0.096**	--	--	--	--	-0.026	-0.055*	-0.028	-0.085*
Wealth	--	--	--	--	-0.287***	-0.198***	-0.240***	-0.110*	-0.285***	-0.190***	-0.234***	-0.085
Constant	-5.582***	-6.230***	-6.227***	-5.979***	-4.305***	-5.481***	-5.273**	-5.901***	-4.232***	-5.333***	-5.185***	-5.598***
n	13,582	19,880	11,142	11,293	13,582	19,880	11,142	11,293	13,582	19,880	11,142	11,293

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$

Table 14. Discrete-Time Hazard Regression for CVD, Stroke, or Related Death by Wealth Quintiles (n=10,345; 55,897 interval records)

	WQ1	WQ2	WQ3	WQ4	WQ5
Recession	1.175†	0.959	0.712	1.285†	0.612
Age	0.044***	0.045***	0.051***	0.058***	0.062***
Age*Recession	-0.017*	-0.014	-0.009	-0.018†	-0.010
Male	0.160*	0.130	0.174*	0.473***	0.429***
Race/Ethnicity					
NH-White	REF	REF	REF	REF	REF
NH-Black	-0.153	-0.095	-0.217†	-0.093	-0.176
NH-Other	-0.332	0.128	-0.522	-0.131	-0.147
Hispanic	-0.438***	-0.361**	-0.463*	-0.419†	-0.350
Married	-0.043	0.138	0.100	-0.146	0.008
South	0.055	0.035	-0.049	0.153††	0.007
Income	-0.039	-0.015	-0.081*	0.075	-0.094*
Education	-0.016	0.010	-0.016	-0.013	0.001
Constant	-5.270***	-5.891***	-5.853***	-7.076***	-7.106***
n	11,313	11,081	11,006	11,281	11,215

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$

Table 15. Discrete-Time Hazard Regression for CVD, Stroke, or Related Death by Continuous Education & Income (n=10,345; 55,897 interval records)

	No Interaction	Interaction w/Educ		Interaction w/Income
Recession	1.002***	0.805*	Recession	0.816*
Education	-0.014*	-0.018**	Income	-0.069***
Educ*Recession		0.012	Inc*Recession	0.031
Age	0.050***	0.049***	Age	0.049***
Age*Recession	-0.014***	-0.014***	Age*Recession	-0.013
Male	0.269***	0.269***	Male	0.270***
Race/Ethnicity			Race/Ethnicity	
NH-White	REF	REF	NH-White	REF
NH-Black	-0.063	-0.062	NH-Black	-0.061
NH-Other	-0.162	-0.162	NH-Other	-0.164
Hispanic	-0.364	-0.362***	Hispanic	-0.362***
Married	-0.040	-0.039	Married	-0.039
South	0.052	0.052	South	0.052
Income	-0.058***	-0.058***	Education	-0.014*
Constant	-5.849***	-5.787***	Constant	-5.794***
n	55,897	55,897	n	55,897

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$

Appendix B

Table 16. Discrete-Time Hazard Models for CVD (n-12,642; 58,226 interval records)

	Less than HS	HS/GED	Some College	BA/S+
Age	0.019*	0.046***	0.039***	0.038***
Cohort	0.010	0.025***	0.019*	0.020*
Male	0.103	0.274***	0.169†	0.374***
Race/Ethnicity				
NH-White	REF	REF	REF	REF
NH-Black	-0.224*	-0.231*	-0.097	-0.130
NH-Other	0.214	-0.269	-0.149	0.174
Hispanic	-0.413***	-0.368*	-0.341†	-0.313
Married	-0.056	-0.090	0.119	0.214*
South	-0.213**	0.234***	0.070	-0.018
Had Cancer	-0.035	-0.021	0.009	0.046
Former Smoker	0.091	0.091	0.257**	0.247*
Daily Cigarettes				
0	REF	REF	REF	REF
1-10	0.342*	0.343**	0.497**	0.228
11-20	0.271	0.297	0.117	0.197
21+	0.482	0.262	0.282	-0.312
Drinker Status				
Moderate	REF	REF	REF	REF
Light	0.236†	0.038	0.200*	0.115
Heavy	-0.249	-0.060	0.297	-0.057
BMI				
Normal	REF	REF	REF	REF
Underweight	-0.057	0.040	-0.179	-0.343
Overweight	0.211*	0.193*	0.061	0.131
Obese	0.556***	0.446***	0.424***	0.386**
Wealth	-0.113**	-0.038	0.020	0.077
Income	-0.032	-0.037	-0.124***	-0.106***
Constant	-4.192***	-6.919***	-6.346***	-6.858***
n	14,259	20,148	11,992	11,827

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 17. Discrete-Time Hazard Regression for Stroke (n=12,642; 58,226 interval records)

	Less than HS	HS/GED	Some College	BA/S+
Age	0.014	0.042***	0.040**	0.066***
Cohort	-0.007	0.002	0.010	0.011
Male	0.255*	0.136	0.286†	-0.089
Race/Ethnicity				
NH-White	REF	REF	REF	REF
NH-Black	-0.068	0.255†	0.595***	0.471*
NH-Other	-0.496	-0.566	0.224	-0.168
Hispanic	-0.461**	-0.172	0.202	0.339
Married	-0.342*	-0.170	-0.054	-0.272†
South	0.148	0.075	-0.045	-0.084
Had Cancer	-0.267	-0.071	-0.003	0.006
Former Smoker	-0.003	0.087	0.038	7.701
Daily Cigarettes				
0	REF	REF	REF	REF
1-10	0.500**	0.050	0.371	1.034***
11-20	-0.093	0.172	0.678†	0.238
21+	-0.107	0.167	1.270**	0.847
Drinker Status				
Moderate	REF	REF	REF	REF
Light	0.217	-0.054	0.472**	0.179
Heavy	0.617*	0.076	0.106	-0.082
BMI				
Normal	REF	REF	REF	REF
Underweight	-0.143	-0.210	-0.025	-0.440
Overweight	0.073	-0.147	0.201	-0.131
Obese	0.038	0.073	-0.081	0.153
Wealth	0.004	-0.022	0.109	0.042
Income	-0.099***	-0.078***	-0.172***	-0.057
Constant	-4.431***	-6.448***	-7.384***	-8.810***
n	14,259	20,148	11,992	11,827

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 18. Discrete-Time Hazard Regression for Death due to Circulatory Disease (n=12,642; 58,226 interval records)

	Less than HS	HS/GED	Some College	BA/S+
Age	0.094***	0.083***	0.053**	0.076***
Cohort	-0.010	-0.025†	-0.034*	-0.035†
Male	0.671***	0.901***	0.952***	0.833**
Race/Ethnicity				
NH-White	REF	REF	REF	REF
NH-Black	0.156	0.406*	-0.129	-0.095
NH-Other	0.883**	-0.602	-0.083	Empty
Hispanic	-0.107	-0.345	-0.584	-1.127
Married	0.011	-0.175	-0.884***	-0.527†
South	0.032	0.217	-0.113	-0.130
Had Cancer	-0.242	0.331†	-0.237	0.085
Former Smoker	0.007	0.001	-0.116	-0.107
Daily Cigarettes				
0	REF	REF	REF	REF
1-10	0.333	0.812**	0.902*	0.481
11-20	0.576	0.659	0.818	1.742**
21+	0.447	1.004†	0.147	1.239
Drinker Status				
Moderate	REF	REF	REF	REF
Light	0.614*	0.352†	0.389	0.960**
Heavy	-0.237	0.438	0.080	0.908†
BMI				
Normal	REF	REF	REF	REF
Underweight	0.021	0.579†	0.515	1.040*
Overweight	-0.362*	-0.158	-0.034	-0.188
Obese	-0.074	-0.091	0.306	0.265
Wealth	-0.403***	-0.315***	-0.349***	-0.296***
Income	-0.043	-0.123*	0.133	-0.057
Constant	-9.213***	-8.549***	-6.403***	-8.260***
n	14,259	20,148	11,992	11,408

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 19. OLS Regression for CVD, Stroke, or Related Death (n=12,642; 58,226 interval records)[1]

	Less than HS	HS/GED	Some College	BA/S+
Age	0.006***	0.005***	0.004***	0.005***
Cohort	-0.001	0.001	0.001	0.001
Male	0.044***	0.039***	0.035***	0.030***
Race/Ethnicity				
NH-White	REF	REF	REF	REF
NH-Black	-0.001	0.008	0.007	0.002
NH-Other	0.052†	-0.025	-0.002	-0.013
Hispanic	-0.027**	-0.021*	-0.017	-0.013
Married	-0.009	-0.012†	-0.011	-0.009
South	-0.009	0.016**	0.001	-0.004
Had Cancer	-0.024†	0.007	-0.007	0.001
Former Smoker	0.002	0.005	0.009	0.007
Daily Cigarettes				
0	REF	REF	REF	REF
1-10	0.040**	0.037**	0.054***	0.037†
11-20	0.033	0.027	0.035	0.060
21+	0.039	0.038	0.050	0.027
Drinker Status				
Moderate	REF	REF	REF	REF
Light	0.035***	0.008	0.025**	0.022***
Heavy	0.005	0.006	0.016	0.005
BMI				
Normal	REF	REF	REF	REF
Underweight	0.010	0.050†	0.027	0.065
Overweight	-0.009	-0.001	-0.004	-0.003
Obese	0.021	0.017*	0.023*	0.019*
Wealth	-0.025***	-0.011***	-0.005	-0.003
Income	-0.007**	-0.007**	-0.011***	-0.007**
Constant	-0.115	-0.198***	-0.147***	-0.203***
n	14,259	20,148	11,992	11,827

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

[1] The Outcome variable in Table 10 is combined accumulated measure of cardiovascular disease, stroke, or related death. if respondents have no conditions (=0), if respondents have cardiovascular disease or stroke (=1), if respondents have cardiovascular disease and stroke (=2), if dead due to related cause (=3).

Table 20. Discrete-Time Hazard Regressions for CVD, Stroke, or Related Death by Education Status with Various Controls (n=12,642; 58,226 interval records)

	w/Income & w/o Wealth				w/Wealth & w/o Income				w/Wealth & Income			
	Less than HS	HS/GED	Some College	BA/S+	Less than HS	HS/GED	Some College	BA/S+	Less than HS	HS/GED	Some College	BA/S+
Age	0.027***	0.050***	0.042***	0.052***	0.031***	0.052***	0.043***	0.052***	0.032***	0.052***	0.043***	0.051***
Cohort	-0.006	0.010†	0.009	0.011	-0.002	0.013*	0.010	0.011	-0.001	0.013*	0.010	0.011
Male	0.263***	0.347***	0.307***	0.306***	0.265***	0.347***	0.306***	0.306***	0.269***	0.357***	0.306***	0.322***
Race/Ethnicity												
NH-White	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
NH-Black	-0.074	0.016	0.131	0.094	-0.089	0.007	0.127	0.094	-0.111	-0.014	0.093	0.053
NH-Other	0.286	-0.444†	-0.095	-0.034	0.278	-0.451†	-0.098	-0.034	0.251	-0.484†	-0.137	-0.058
Hispanic	-0.298***	-0.318*	-0.199	-0.193	-0.315***	-0.326*	-0.203	-0.193	-0.369***	-0.365**	-0.270†	-0.251
Married	-0.157*	-0.175*	-0.104	-0.039	-0.147*	-0.167**	-0.101	-0.039	-0.093	-0.118†	0..009	0.021
South	-0.081	0.220***	0.025	-0.028	-0.085	0.217***	0.025	-0.028	-0.093	0.213***	0.028	-0.029
Had Cancer	-0.173†	0.019	-0.094	0.045	-0.168†	0.018	-0.093	0.045	-0.172†	0.021	-0.079	0.050
Former Smoker	0.061	0.074	0.134†	0.148†	0.057	0.070	0.133†	0.148†	0.058	0.069	0.140†	0.151†
Daily Cigarettes												
0	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
1-10	0.427***	0.358***	0.491***	0.435*	0.420***	0.350**	0.490***	0.435*	0.415***	0.343**	0.476***	0.424*
11-20	0.275	0.339†	0.340	0.400	0.257	0.323†	0.337	0.400	0.260	0.319†	0.324	0.384
21+	0.399	0.333	0.423	0.299	0.379	0.319	0.418	0.299	0.362	0.307	0.426	0.289
Drinker Status												
Moderate	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Light	0.301**	0.084	0.296***	0.231**	0.290**	0.077	0.293***	0.231**	0.280**	0.068	0.264**	0.214*
Heavy	0.122	0.038	0.233	-0.014	0.130	0.039	0.232	-0.014	0.123	0.039	0.226	-0.014
BMI												
Normal	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Underweight	0.021	0.204	0.030	0.064	0.018	0.205	0.029	0.064	0.008	0.193	-0.002	0.048
Overweight	0.030	0.057	-0.027	0.040	0.028	0.056	-0.028	0.040	0.032	0.058	-0.017	0.042
Obese	0.294***	0.303***	0.299**	0.311**	0.293***	0.299***	0.298**	0.311	0.299***	0.299***	0.303***	0.313**
Wealth	--	--	--	--	-0.151***	-0.081*	-0.029	0.001	-0.148***	-0.076*	-0.014	0.023
Income	--	--	--	--	--	--	--	--	-0.060***	-0.062***	-0.126***	-0.099***
Constant	-4.329***	-6.528***	-6.053***	-6.891***	-4.017***	-6.338***	-5.964***	-6.891***	-3.920***	-6.193***	-5.640***	-6.609***
n	14,259	20,148	11,992	11,827	14,259	20,148	11,992	11,827	14,259	20,148	11,992	11,827

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 21. Discrete-Time Hazard Regression for CVD Stroke, or Related Death by Wealth Quintiles (n=12,642; 58,226 interval records)

	WQ1	WQ2	WQ3	WQ4	WQ5
Age	0.026***	0.043***	0.046***	0.048***	0.056***
Cohort	0.010†	0.007	0.002	-0.007	-0.005
Male	0.246**	0.183*	0.137†	0.404***	0.532***
Race/Ethnicity					
NH-White	REF	REF	REF	REF	REF
NH-Black	-0.019	-0.203*	-0.174	-0.023	0.055
NH-Other	-0.180	-0.054	-0.194	-0.188	0.327
Hispanic	-0.332**	-0.446***	-0.480**	-0.619**	-0.015
Married	-0.044	0.286	0.121	-0.118	0.001
South	0.034	0.108	-0.063	0.126	0.045
Had Cancer	0.076	-0.087	0.008	-0.055	-0.151
Former Smoker	-0.036	0.119	0.225**	0.067	0.020
Daily Cigarettes					
0	REF	REF	REF	REF	REF
1-10	0.375***	0.443***	-0.100	0.302†	0.530*
11-20	0.109	0.121	0.381	0.264	0.805**
21+	0.434	0.222	0.443	0.063	0.190
Drinker Status					
Moderate	REF	REF	REF	REF	REF
Light	0.257**	0.177†	0.248**	0.019	0.149†
Heavy	0.146	0.245	-0.159	0.232	0.006
BMI					
Normal	REF	REF	REF	REF	REF
Underweight	0.164	0.014	-0.113	-0.188	0.317
Overweight	0.020	0.106	-0.004	0.052	0.070
Obese	0.264**	0.208	0.257**	0.421***	0.447***
Education	0.003	-0.006	0.003	-0.009	0.014
Income	-0.064***	-0.040	-0.077**	0.005	-0.066†
Constant	-4.538***	-5.754***	-5.785***	-5.802***	-6.768
n	10,850	11,802	11,707	11,977	11,890

†$p < 0.1$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 22. Discrete-Time Hazard Regression for CVD Stroke, or Related Death by Continuous Education & Income (n=12,642; 58,226 interval records)

	Educ	Educ*HB		Income*HB
Education	-0.005	-0.013	Income	-0.077**
Age	0.043***	0.043***	Age	0.043***
Cohort	0.006*	0.006*	Cohort	0.006*
Male	0.305***	0.305***	Male	0.305***
Race/Ethnicity			Race/Ethnicity	
NH-White	REF	REF	NH-White	REF
NH-Black	-0.008	-0.010	NH-Black	-0.005
NH-Other	-0.061	-0.058	NH-Other	-0.063
Hispanic	-0.332***	-0.328***	Hispanic	-0.331***
Married	-0.070†	-0.069†	Married	-0.073*
South	0.046	0.047	South	0.045
Had Cancer	-0.042	-0.042	Had Cancer	-0.043
Former Smoker	0.097**	0.097**	Former Smoker	0.096**
Daily Cigarettes			Daily Cigarettes	
0	REF	REF	0	REF
1-10	0.420***	0.085	1-10	0.619***
11-20	0.333**	0.336	11-20	0.179
21+	0.371*	0.361	21+	0.921***
Drinker Status			Drinker Status	
Moderate	REF	REF	Moderate	REF
Light	0.192***	0.134	Light	0.142
Heavy	0.080	0.161	Heavy	-0.132
BMI			BMI	
Normal	REF	REF	Normal	REF
Underweight	0.072	0.009	Underweight	-0.102
Overweight	0.041	0.019	Overweight	0.031
Obese	0.317***	0.243	Obese	0.386***
Daily Cigs*Educ			Daily Cigs*Inc	
0		REF	0	REF
1-10		0.023	1-10	-0.070*
11-20		-0.001	11-20	0.050
21+		0.001	21+	-0.183**
Drink*Educ			Drink*Inc	
Moderate		REF	Moderate	REF
Light		0.004	Light	0.015
Heavy		-0.006	Heavy	0.060
BMI*Educ			BMI*Inc	
Normal		REF	Normal	REF
Underweight		0.005	Underweight	0.065
Overweight		0.002	Overweight	0.003
Obese		0.006	Obese	-0.002
Income	-0.080***	-0.080***	Education	-0.006
Constant	-5.634***	-5.533***	Constant	-5.628***
n	58,226	58,226	n	58,226

†p < 0.1. *p < 0.05. **p < 0.01. ***p < 0.001.

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Biography

Miles Marsala was born in 1987, in Salt Lake City, UT. He received a B.A. in French Studies from Brigham Young University in 2013, an M.S. in Sociology from Brigham Young University in 2015, and an M.A. in Sociology from Duke University in 2018. During his doctoral training at Duke University, he authored one peer-reviewed article, "Approval of Euthanasia: Differences Between Cohorts and Religion" (*SAGE Open*, January-March 2019: 1-11). He also completed the Certificate of College Teaching offered by the Graduate School at Duke University, was a fellow in the Preparing Future Faculty Fellowship (2019-2020), completed the Certificate for Teaching Writing in the Disciplines offered by the Thompson Writing Program, and was selected for the Bass Graduate School Fellowship (2020-2021), which he declined to accept a faculty position.

Miles will receive his Ph.D. from Duke University in September 2020. He will then begin his career as an Associate Professor in the Department of Social Science at Palm Beach State College.