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The Links Between a Postsecondary Education and Adult Health Behaviors

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Abstract

Postsecondary education is a fundamental social determinant of adult health behaviors. The knowledge and skills acquired through higher educational attainment can impact health behaviors indirectly through better occupations and incomes as well as directly by enhancing cognitive and non-cognitive abilities to enable healthier lifestyles. However, there has also been an increasing divide in health-related behaviors between adults with incomplete or lower-level postsecondary credentials (sub-BA) and those with at least a bachelor's degree (BA+). In fact, adults with sub-BA levels of postsecondary education have seen rising death rates from preventable behavioral causes of early mortality, such as alcoholic liver disease. These important distinctions in the associations between levels of postsecondary education and adult health behaviors necessitate further investigations. My dissertation is thus comprised of three empirical studies that address important knowledge gaps by providing a comprehensive exploration and decomposition of the relationship between a postsecondary education and adult health behaviors.

In Chapter 2, I document the prevalence of important health behaviors across detailed levels of postsecondary educational attainment. Estimates are provided both in aggregate and across gender and race/ethnicity population subgroups. In Chapter 3, I provide both an examination and decomposition of health behaviors among adults with incomplete or lower-level (sub-BA) postsecondary credentials and those with at least a bachelor's degree (BA+). Finally, in Chapter 4, I examine the relationship between completed levels of postsecondary education in adulthood and health behaviors measured at multiple time periods to determine how and when these associations evolve throughout the transition to adulthood.

Keywords

Postsecondary Education, Adult Health Behaviors, Health Lifestyles, Risk Behaviors, Social Determinants, Oaxaca-Blinder Decomposition

Summary for Lay Audience

Postsecondary education is among the strongest social determinants of health-related behaviors in adulthood. The positive education-health relationship is largely thought to be universal across populations, health outcomes, and the entire range of postsecondary educational attainment. However, a growing number of studies have found that higher levels of postsecondary educational attainment do not uniformly lead to better health behaviors in adulthood. My dissertation research is thus comprised of three empirical studies that address critical knowledge gaps by examining important distinctions in the relationships between a postsecondary education and adult health behaviors. My first study outlines behavioral disparities across detailed levels of postsecondary educational attainment. Estimates are provided both for the total population and across gender and race/ethnicity. My second study explores potential justifications for the observed disparities between the health behaviors of adults with either incomplete or lower-level postsecondary credentials and those with at least a bachelor's degree. My final study examines the relationship between an individual's highest level of postsecondary education in adulthood and health-related behaviors measured at multiple time periods to determine how and when those associations evolve throughout the transition to adulthood.

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Chapter 1

1 Introduction

1.1 Background

Postsecondary education is a fundamental social determinant of adult health behaviors (Duke and Macmillan 2016; Link and Phelan 1995; Walsemann, Hummer, and Hayward 2018). The knowledge and skills acquired through higher educational attainment can impact health behaviors indirectly through better occupations and incomes as well as directly by enhancing cognitive and non-cognitive abilities to enable healthier lifestyles (Brown 2016; Carroll et al. 2017; Duke and Macmillan 2016). In fact, higher educated adults generally exhibit healthier behaviors including lower rates of smoking and alcohol consumption, increased physical activity, greater use of preventative care measures, and better nutritional habits (Collin et al. 2021; Cutler and Lleras-Muney 2010; Ettman, Cohen, and Galea 2020; Pampel, Krueger, and Denney 2010). Higher educated adults are also more likely to get and stay married, develop strong social ties with greater civic engagement, and connect with other higher educated individuals, which in turn leads to healthier behaviors in adulthood (Hout 2012; Umberson, Crosnoe, and Reczek 2010).

The positive education-health gradient is largely thought to be universal across populations, health outcomes, and the entire range of educational attainment (Conti, Heckman, and Urzua 2010; Mirowsky and Ross 2017). However, a growing body of literature has shown that additional levels of postsecondary education do not uniformly equal better health. For example, adults with some college but no degree and those with technical/vocational associate degrees report a higher prevalence of a broad range of health and pain-related conditions compared to high school graduates who never attended college (see Rosenbaum 2012; Skalamera and Hummer 2016; Zajacova and Lawrence 2021). Adults with a bachelor's degree are also found to have better levels of physical functioning at mid-life, compared to high school graduates, while no returns were observed among those with lower-level postsecondary credentials (Carroll et al. 2017). With better health outcomes being concentrated at the highest rungs of the education

ladder, examining postsecondary education-related disparities in adult health behaviors may reveal critical insights that can help advance our understanding of population health.

1.2 Overview

Education-health studies typically group postsecondary credentials into a limited number of categories such as “some postsecondary” and “completed college or university” (Case and Deaton 2021; Jehn and Zajacova 2019; Lawrence 2017; Zheng 2017). This is an important omission as it obscures differentiations between the various types of postsecondary credentials, which range from vocational training to a doctorate or professional degree. These diversified credentials represent profoundly different levels of human capital accumulation, which lead to comparably varied life trajectories. Therefore, aggregating millions of adults with various levels of postsecondary educational attainment into a limited number of categories obscures the potential magnitude of disparities across the adult population.

Research has also shown that adults with at least a bachelor’s degree (BA+) exhibit healthier behaviors than those with incomplete or lower-level (sub-BA) postsecondary credentials (Jehn 2022). Yet, the source of these disparities has been understudied. As risk behaviors profoundly influence chronic illness and mortality, behavioral disparities represent a critical area of study for advancing our understanding of population health (Case and Deaton 2021; Hanson and Chen 2007; Lawrence et al. 2020). There is also an increasing divide between sub-BA and BA+ levels of postsecondary education (Case and Deaton 2021). Americans with lower-level postsecondary credentials have seen rising death rates from preventable behavioral causes of early mortality, such as alcoholic liver disease (Case and Deaton 2015, 2021; Sasson 2016). These important differences motivate the need to examine postsecondary education-related behavioral disparities across the sub-BA and BA+ population.

Despite the large and robust effects of a postsecondary education on adult health behaviors (Kirkpatrick Johnson et al. 2016; Link and Phelan 1995; Schüz et al. 2020), we know little about how and when these associations evolve in adulthood. The population health literature generally focuses on postsecondary education-related behavioral

disparities in adulthood, which is assessed after an individual has already completed their highest level of educational attainment (see Collin et al. 2021; Cutler and Lleras-Muney 2010; Ettman, Cohen, and Galea 2020; Jehn 2022; Pampel, Krueger, and Denney 2010). However, while a postsecondary education provides the knowledge and resources to enable healthier lifestyles, there is some evidence to suggest that behavioral disparities may appear earlier in the adult life course, long before the traditional ages at which a postsecondary education is completed (Maralani 2014).

My dissertation research thus draws on data from the National Longitudinal Study of Adolescent to Adult Health (Add Health) to assess the relationships between a postsecondary education and adult health behaviors. In Chapter 2, I identify differences in adult health behaviors across detailed levels of postsecondary educational attainment. In Chapter 3, I decompose the difference between adults with at least a bachelor's degree (BA+) and those with either incomplete or lower-level (sub-BA) postsecondary credentials. Lastly, in Chapter 4, I assess differences in the associations between a postsecondary education and health behaviors over time to determine how and when these disparities emerge. Across each of my integrated chapters, I examine a total of six adult health behaviors including binge drinking, smoking, marijuana use, lower physical activity, poor nutrition, and obesity. Each of the individual adult health behaviors are self-reported except for obesity, which is derived using a respondent's weight and height to calculate their body mass index. Table 1.1 includes a detailed description of how these behaviors are measured and assessed.

Table 1.1 Measures Used to Construct Health Lifestyles Index

Table 1.1: Health Behaviors Used to Construct Summation Index of Health Lifestyles

Variables	Description
Health Lifestyles Index	Summation index of six unhealthy behaviors using binary versions of the behavioral indicators listed below. Higher index scores indicate greater engagement in unhealthy behaviors.
Binge Drinking	Continuous measure of the number of alcoholic beverages respondents usually had each time they had drinks in the past 12 months (Wave III) or 30 days (Waves IV and V). Binge drinker is defined as an average that is ≥ 4 (women) or ≥ 5 (men) per instance.
Smoking	Measures the number of cigarettes respondents usually smoked each day in the last 30 days (range: 0-300). Smokers are defined as respondents that had at least one cigarette per day in the last 30 days.
Marijuana Use	Ordinal measure of the number of days respondents used marijuana in last 30 days: (0) never; (1) one day; (2) 2 or 3 days; (3) 1 day a week; (4) 2 days a week; (5) 3 to 5 days a week; (6) every day or almost every day. Marijuana users are defined as respondents that smoked at least once in the last 30 days.
Lower Physical Activity	Continuous measure of bouts of physical activity across broad categories of exercise in the last 7 days (range: 0-49). Lower physical activity is defined as an average that is ≤ 6 (Waves III and IV) or ≤ 7 (Wave V) bouts of activity per week.
Poor Nutrition	Continuous measure identifying the number of times respondents had fast food in the last 7 days (range: 0-50). Consuming an above average amount of fast food (≥ 2 times per week) indicates poor nutrition.
Obesity (BMI)	Continuous measure of respondent's body mass index (range: 15-98). Respondent considered obese if BMI ≥ 30.

Source: National Longitudinal Study of Adolescent to Adult Health

1.3 Theoretical Frameworks

My dissertation is grounded in three theoretical frameworks: (1) Fundamental cause theory outlines why a postsecondary education continues to be among the strongest social determinants of health inequalities, despite causes of adult morbidity and mortality changing over time. (2) Health lifestyles theory describes how the interplay between structure (social conditions) and agency (individual life chances) are associated with a broad spectrum of health-related behaviors. (3) Lastly, the life course approach allows us to examine how earlier exposures to physical, environmental, and socioeconomic factors influence later life stages. Combined, these three distinct but complementary theories provide a foundation for gaining a deeper understanding of the links between a postsecondary education and adult health behaviors.

1.3.1 Fundamental Cause Theory

Fundamental cause provides a theoretical foundation for understanding why a postsecondary education is among the strongest social determinants of health inequalities (Phelan, Link, and Tehranifar 2010). According to Link and Phelan (1995), individuals with higher levels of postsecondary educational attainment have greater access to flexible resources such as money, power, prestige, and beneficial social connections that can be used to minimize the risks of morbidity and mortality as well as the consequences of disease once they occur. Even if one of the pathways linking a postsecondary education to better health outcomes is blocked, there exists a myriad of other pathways by which the association is reproduced (Link and Phelan 1996; Noppert et al. 2021). Therefore, despite the mechanisms linking these resources to specific health outcomes potentially changing over time, it is the persistent association between a postsecondary education and health that makes it a fundamental social determinant of health inequalities.

Adults with higher levels of postsecondary education are indeed better able to utilize their resources to mitigate health risk behaviors and adopt protective strategies regardless of the prevailing circumstances. For example, a person with greater resources is better able to maintain a heart-healthy lifestyle and receive proper medical treatment to avoid the risks of heart disease (Phelan et al. 2010). Fundamental cause theory also implies that

health outcomes are the result of purposive action or various forms of health-directed human behavior. In fact, education-related disparities in the means to achieve health goals serves as the critical factor on which the fundamental relationship between a postsecondary education and health behaviors exists (Link and Phelan 2005). Moreover, this strong association informs empirical investigations of adult health behaviors as a postsecondary education is more strongly associated with preventable causes than from less preventable causes of early mortality (Mackenbach et al. 2015).

1.3.2 Health Lifestyles Theory

Cockerham and colleagues (1997) developed the health lifestyles theoretical framework which merges structure with agency to highlight how social conditions and individual life chances are associated with a broad spectrum of health-related behaviors. Health lifestyles essentially synthesizes Max Weber's (1978) Economy and Society and Pierre Bourdieu's (1986) Distinction. The theory can be divided into two mains components including: structural influences and habitus (Burdette et al. 2017).

The structural component of the theory suggests that health lifestyles are formed based on social positions. Individuals with similar status and class distinctions form aggregate status groups that share similar lifestyles (Burdette et al. 2017). For example, status groups influence our exposure to various health-related norms and customs through socialization and shared experiences. Status groups also influence our life chances by regulating our access to health-related resources. The most prominent factors contributing to the formation of status groups include level of education, occupation, marital status, gender, age, and race/ethnicity, which are all associated with unique sets of health behaviors that have variable impacts on overall health and well-being (Mollborn et al. 2014; Ross, Hill, and Mirowsky 2016). Thus, while individuals can make their own life choices (agency), those choices are often constrained by what is available to them given their life chances (structure) through a basic process of social stratification.

Bourdieu's (1986) contribution to the habitus component of health lifestyles theory begins with the assertion that repetition of exposure to behaviors through socialization and experiences leads to the development of an internalized disposition or habitus.

Cockerham (2005) extends this foundational theory and suggests habitus creates an overall disposition towards acceptable behaviors for individuals based on their social situations and settings. Once an individual develops a habitus, their health-related behaviors become an integrated component of their behavioral repertoires which may then occur naturally for them (Cockerham 2005). An individual may develop positive routine behaviors such as physical exercise and proper nutrition; however, they may also develop smoking or substance abuse habits (Burdette et al. 2017). By continuing to engage with a particular behavior, we reinforce or alter our dispositions and develop our own individual health lifestyles.

1.3.3 Life Course Theory

The life course theoretical framework allows us to better understand the relationship between a postsecondary education and adult health behaviors across various stages of development. For example, a life course approach demonstrates how current behavioral disparities are shaped by earlier exposures to physical, environmental, and socioeconomic factors. This theoretical approach is informed both by developmental and structural perspectives, which offer insights that can be leveraged to examine disparities in health behaviors throughout the life course (Jones et al. 2019; Lawrence et al. 2020; Willson and Shuey 2016).

Developmental perspectives emphasize how exposure to adverse health behaviors during sensitive developmental periods can significantly influence behavioral trajectories over the life course (Jones et al. 2019; Lawrence et al. 2020). In fact, health risk behaviors during critical periods can result in exposures that leave a lasting imprint on adult health, either concurrently or years later (Goosby, Cheadle, and McDade 2016; Lawrence, Mollborn, and Hummer 2017; Montez and Hayward 2011). Individual health risk behaviors may also become part of an overall health lifestyle that can impact trajectories of chronic disease and mortality (Burdette et al. 2017; Rogers, Hummer, and Nam 2000). Here, health behaviors established during earlier periods in the life course may follow into later adulthood; however, these behaviors may also be influenced by changes in exposures during subsequent developmental periods (Lawrence et al. 2020).

In contrast, structural perspectives emphasize how status and class distinctions within socially patterned environments disproportionately allocate behavioral risk factors that in turn influence behavioral trajectories (Jones et al. 2019). Structural models allow us to better understand how social constraints generate inequality in behavioral risk exposure as well as health resources based-on differences in economic factors, such as postsecondary education, and demographic characteristics, such as gender and race/ethnicity (Jones et al. 2019). This approach emphasizes that disadvantaged populations are more likely to experience structural constraints that define their exposure to health-related norms and customs and subsequently influence health behaviors.

The life course theoretical framework thus allows us to understand how health behaviors display both continuity and change throughout the transition to adulthood (Mollborn, Lawrence, and saint Onge 2021). That while developmental periods, exposure to risk-related behaviors, and structural constraints can make many health behaviors more difficult to adopt or change at various stages of the life course, these influential factors can also be flexible (Cockerham 2018; Mollborn et al. 2021). For example, through postsecondary educational attainment, upwardly mobile young adults may attempt to distance themselves from the health behavior-related norms and customs of their status and class distinction origins (Curl, Lareau, and Wu 2018; Mollborn et al. 2021).

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Chapter 2

2 The Relationship Between Postsecondary Education and Adult Health Behaviors

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2.1 Introduction

A postsecondary education is a fundamental social determinant of adult health behaviors (Johnson et al. 2016; Link and Phelan 1995; Schüz et al. 2020). However, education-health studies often group postsecondary credentials into a limited number of categories such as "some postsecondary" and "completed college or university" (Case and Deaton 2021; Jehn and Zajacova 2019; Lawrence 2017; Zheng 2017). This is an important omission as it obscures differentiations between the various types of postsecondary credentials, which range from vocational training to a doctorate or professional degree. The expansion of higher education has also led to an increase in educational attainment with nearly 80% of adults between the ages of 33-44 having at least some postsecondary education. These diversified credentials represent profoundly different levels of human capital accumulation, which lead to comparably varied life trajectories. Therefore, aggregating millions of adults with various levels of educational attainment into a limited number of categories obscures the potential magnitude of disparities across the adult population. The present study thus examines adult health related behavioral disparities across the full range of postsecondary educational attainment.

To better understand associations between postsecondary educational attainment and adult health behaviors, this study adopts the health lifestyles theoretical framework. Developed by Cockerham et al. (1997), health lifestyles are defined as a combined pattern of health behaviors based on available options according to social conditions and individual life chances. Individuals with similar status and class distinctions form aggregate status groups and share similar lifestyles (Burdette et al. 2017). For example,

status groups influence our exposure to various health related norms and customs through socialization and shared experiences. Level of education, gender, and race/ethnicity are important factors for the formation of status groups, each of which are associated with unique sets of health behaviors that have variable impacts on overall health and well-being (Mollborn et al. 2014; Ross, Hill, and Mirowsky 2016). To assess adult health lifestyles, this study combines some of the leading behavioral causes of early mortality to identify a broad spectrum of behaviors associated with postsecondary educational attainment.

Due to the differential returns to a postsecondary education, I also examine disparities across the most influential demographic characteristics including gender and race/ethnicity. The theories of resource substitution and multiplication present two competing hypotheses for assessing disparities in health-related returns to higher education across population subgroups (Ross and Mirowsky 2006). Resource substitution suggests individuals who are marginalized within society will experience steeper education-health gradients as they have fewer alternative health-promoting socioeconomic resources (Ross and Mirowsky 2010; Vable et al. 2018). For example, through a process of resource substitution, changing patterns of depression were found to depend more strongly on additional years of education for women than for men (Ross and Mirowsky 2006). In contrast, resource multiplication theory suggests education-health returns are greater among socially advantaged population subgroups (Ross and Mirowsky 2006). Advantaged groups gain more from education as their social and economic resources multiply to perpetuate and enhance their advantage (Montez and Barnes 2016). As such, examining the potential differences by gender and race/ethnicity may help us to better understand the relationship between postsecondary education and adult health behaviors.

2.1.1 Differences in Education Returns

The knowledge and skills acquired through a postsecondary education can impact health behaviors indirectly through better occupations and incomes as well as directly by enhancing cognitive and non-cognitive abilities to enable healthier lifestyles (Carroll et al. 2017). Adults with higher levels of education generally demonstrate healthier

behaviors including lower rates of smoking and alcohol consumption, increased physical activity, and better nutrition (Collin et al. 2021; Ettman, Cohen, and Galea 2020; Jamal et al. 2018). Higher education is also associated with a greater use of safety and preventative health measures (Cutler and Lleras-Muney 2010; Pampel, Krueger, and Denney 2010). The positive education-health gradient is largely thought to be universal across populations, health outcomes, and the entire range of educational attainment (Conti, Heckman, and Urzua 2010; Mirowsky and Ross 2017).

Although educational attainment remains one of the strongest social determinants of adult health behaviors, a growing body of literature has shown that additional levels of education do not uniformly equal better health. For example, several recent studies have found that adults with some college but no degree and those with technical/vocational associate degrees report more pain and a higher prevalence of a broad range of health conditions than high school graduates who never attended college (see Zajacova and Johnson-Lawrence 2016; Zajacova and Lawrence 2021; Zajacova, Rogers, and Johnson-Lawrence 2012). Adults with a bachelor's degree were also found to have better physical functioning at mid-life, compared to high school graduates, while no returns were observed among those with lower-level postsecondary credentials (Carroll et al. 2017). These critical differences in education-related outcomes motivate the need to examine adult health behaviors across the entire postsecondary education gradient.

2.1.2 Gender and Race

Gender influences labor market outcomes and economic returns to a postsecondary education. As a result, men and women may also exhibit significant differences in their health behaviors. For example, regardless of their level of education, men generally exhibit higher instances of substance abuse and other adverse health-related behaviors than women (Hill et al. 2006; Olson, Hummer, and Harris 2017; Ross et al. 2016). Conversely, women more effectively adopt positive health behaviors, including proper nutrition and preventative care. There is also some evidence to suggest women experience steeper education-health gradients, which supports a process of resource substitution; however, resource multiplication theory would predict that men gain more from education than women due to their social and economic advantages (Ross and

Mirowsky 2010; Vable et al. 2018). Therefore, the complexity of gender differences in health behaviors deserves attention, particularly as adults in their thirties and forties continue to exhibit troubling health and mortality trends and whose most productive years of work and family life are ahead of them.

The association between a postsecondary education and adult health behaviors may also differ by race/ethnicity. Black Americans earning at least a bachelor's degree continue to be exposed to higher levels of stress and disadvantages in a society where they suffer social, economic, and political exclusion (Simons et al. 2020). For example, among college graduates, Black American unemployment rates are approximately two-thirds higher and their salaries are substantially lower than their non-Hispanic White counterparts (Brown 2019). Hispanic/Latino adults also experience economic disadvantages, compared to non-Hispanic White Americans (Goldman et al. 2006; Turra and Goldman 2007; Vable et al. 2018). Lower economic returns to a postsecondary education among Black and Hispanic/Latino Americans causes socioeconomic disadvantages such as residing in impoverished neighborhoods and poor access to health care (Cutler and Lleras-Muney 2006; Warren et al. 2020). As a result, it is reasonable to expect that lower income, incidents of personal discrimination, and living in disadvantaged neighborhoods determine exposure to health-related norms and customs which negatively influence adult health behaviors. On the other hand, one would expect to finder steeper education-health gradients among Black and Hispanic/Latino Americans as they have fewer alternative health-promoting socioeconomic resources. These conflicting possible outcomes motivate the need to examine racial differences in the association between a postsecondary education and adult health behaviors.

2.2 Contributions of This Study

The potential differences in the association between a postsecondary education and adult health behaviors necessitate the need for a comprehensive analysis of disparities across the entire postsecondary education gradient. My aim is to contribute to this literature by not only providing the first systematic analysis but to also identify important differences both in aggregate and across gender and race/ethnicity population subgroups. Using a covariance-weighting technique, I assess adult health lifestyles using a weighted

behavioral index that combines some of the leading behavioral causes of early mortality to identify a broad spectrum of behaviors associated with postsecondary educational attainment. My analysis reveals substantial disparities in adult health behaviors even after taking into account a range of potential confounders and mechanisms relevant to the education-health behavior association, including additional demographics as well as measures of socioeconomic status and parental background characteristics..

2.3 Methods

2.3.1 Data

Data comes from Wave V of the 2018 National Longitudinal Study of Adolescent to Adult Health (Add Health), administered by the University of North Carolina Population Center (Harris et al. 2009). The purpose of the survey was to collect information about respondents' social behaviors, economic resources, as well as their physical and mental wellbeing. Wave 5 of Add Health represents a longitudinal sample of respondents that have been followed from adolescence (grades 7-12) into adulthood (age 33-44). Data were collected between 2016 and 2018 with a total sample size of 12,300 respondents.

Due to the large number of health behavior-related questions, Add Health data is uniquely positioned to offer insights about the associations between a postsecondary education and adult health behaviors. These data also cover the ideal age range, as it reflects the period immediately following the transition to adulthood where health behaviors are better established (Lawrence 2017). The analytic sample is defined as adults 33 to 44 years of age. Respondents are excluded if they do not have valid responses for the health behaviors assessed in this study (N – 740). The final analytic sample thus includes 11,560 respondents.

2.3.2 Measures

Outcome Variables

I examine a total of six adult health behaviors including binge drinking, smoking, marijuana use, lower physical activity, poor nutrition, and obesity. Binge drinking measures the number of alcoholic beverages respondents usually have each time they had

drinks in the past 30 days. Those having more than four (women) or five (men) are considered binge drinkers (Centers for Disease Control and Prevention 2022). Smoking and marijuana use are operationalized as dichotomous measures identifying respondents who have smoked tobacco or marijuana, respectively, at least once in the past 30 days. Lower physical activity measures bouts of exercise across several broad categories of activities, coded with a range of 0 to 49. Poor nutrition measures how many times respondents ate fast food in the last 7 days, with a range of 0 to 50. Both variables are dichotomized at their midpoint to identify respondents with below average levels of physical activity or respondents that consume an above average level of fast food, respectively. Obesity is a dichotomous measure of the proportion of respondents experiencing a body mass index ≥ 30.

Each of the individual adult health behaviors are self-reported except for obesity, which is derived using a respondent's weight and height to calculate their body mass index. While obesity is not a direct health behavior, it is an important biomarker proxy of nutritional habits (see Knol et al. 2017; Lawrence 2017; Price et al. 2017; Rigdon et al. 2017; Shinde 2019).

Once all outcome variables are properly specified, I constructed a health behavior summary index using a covariance-weighted average of indicators as proposed by Anderson (2008). The primary advantage of this procedure is that it increases efficiency by ensuring highly correlated indicators receive less weight than uncorrelated indicators (Schwab et al. 2020). Higher index scores indicate increased engagement in unhealthy behaviors. A further description of these variables is provided in Table 1.1.

Explanatory Variables

The focal explanatory variables include level of educational attainment, gender, and race. Level of education uses the maximum detail available with a total of eight categories (less than high school diploma or GED, high school diploma as reference, some postsecondary, vocational training, associate degree, bachelor's degree, master's degree, and doctorate or professional degree). Gender (male as reference versus female) and race/ethnicity (non-Hispanic White as reference, Black, Hispanic/Latino, and 'other racial

identities) are assessed using interaction models to identify differences between these key population subgroups. In addition, this study also accounts for factors known to influence returns to postsecondary educational attainment including demographics, measures of socioeconomic status, and parental background characteristics.

Demographics include age (continuous variable ranging from 33 to 44), marital status (married as reference, previously married, and never married), presence of children (no children as reference versus has children), region of residence (South as reference, West, Midwest, and Northeast), and immigrant status (US born as reference versus non-US born).

Measures of socioeconomic status include postsecondary enrolment status (not enrolled as reference versus currently enrolled) and household income. The income variable was originally coded in categories from 1=less than $5000 to 13=$200,000 or more. I recoded each category to its midpoint value and divided it by 10,000 in order to use the income variable as a continuous covariate.

Parental background characteristics include family household structure (one-parent household as reference versus two-parent household), parental education (no college completion as reference versus at least one parent having completed college), family household income, and parental expectations for study respondents to complete college (not disappointed as reference, somewhat disappointed, and very disappointed). Family household income represents gross total income and is treated as a continues covariate.

2.3.3 Statistical Analysis

Study sample characteristics are provided for each variable included in the analyses (Table 2.1). Descriptive statistics are assessed for both the full sample as well as stratified by gender and race/ethnicity. As the weighted index scores are normally distributed, a series of linear regression models are estimated to assess differences in health behavior index scores (Table 2.2). Model 1 only includes the focal education variable to establish baseline differences in health behaviors by level of education. Model 2 adds the remaining focal explanatory variables, including gender and race. The third model

includes the demographic control variables found to influence adult health behaviors. Model 4 incorporates measures of socioeconomic status. Lastly, Model 5 additionally includes parental background characteristics. The estimates from Model 5 are converted into predicted average health behavior index scores (Figure 2.1), while holding the independent control variables constant at typical values, their average proportions or means (Fox and Andersen 2006).

In order to assess differences across gender and race/ethnicity, Table 2.3 includes a series of linear regression interaction models. The first model for each group includes level of education, gender, race/ethnicity, and age as well as the corresponding interactions. The second models include the remaining demographic characteristics, measures of socioeconomic status, and parental background characteristics. The results from the second model for each group are again used to determine predicted average index scores which are presented as a graphical display (Figure 2.2).

Missing data ranges from <0.5% for level of education, age, marital status, presence of children, and postsecondary enrolment status to approximately 2.9% for immigrant status, 6.2% for region of residence, 13.3% for parental college expectations, 17.4% for household income, and 20.2% for family household income. Missing observations are imputed using multiple imputation by chained equations (MICE) with ten replicates (Royston and White 2011). All analyses also use the Wave V cross-sectional survey weights in order to account for attrition across survey waves as well as to obtain unbiased population estimates.

2.3.4 Sensitivity Analysis

In addition to the main findings, I also conduct various sensitivity analyses. Appendix Table 2.2 includes estimates from linear regression models using an unweighted summary index of adult health behaviors (Mullan Harris, Lee, and DeLeone 2010). Appendix Table 2.3 assesses gender and race differences using fully adjusted stratified linear regression models. Lastly, Appendix Table 2.4 includes fully adjusted logistic regression estimates for each individual health behavior. To better interpret the results

from these models, average adjusted probabilities are calculated from the estimated odds ratios and the findings are presented graphically (Appendix Figure 2.1).

2.4 Results

Table 2.1 presents the prevalence of each individual health behavior and describes the characteristics of the target population across all variables in this study, for the full sample as well as stratified by gender and race/ethnicity population subgroups. The complex patterns observed indicate that there is substantial behavioral heterogeneity among adults 33-44 years of age. In the interest of space, I only discuss the results related to the response variables. While relatively low rates of binge drinking (20%), smoking (27%), and marijuana use are observed (20%), adults in their thirties and forties are substantially more likely to exhibit physical inactivity (56%), consume an above average amount of fast food (48%), or experience obesity (41%). The estimated gender differences in these health behaviors indicate that men are more likely to engage in unhealthy behaviors than women. Although the descriptive results show seemingly inconsistent behavior patterns across race/ethnicity, Black Americans generally exhibit worse health behaviors than their Hispanic/Latino or non-Hispanic White counterparts.

Table 2.1 Sample Characteristics

Table 2.1: Characteristics of the Target Population						
	Total	Male	Female	White	Black	Hispanic
Health Behaviors						
Binge Drinking (%)	19.5	26.3	12.6	20.0	15.7	22.9
Smoking (%)	27.0	29.8	24.3	29.2	25.5	18.3
Marijuana Use (%)	20.3	24.5	16.1	20.1	24.4	18.0
Lower Physical Activity (%)	55.8	52.9	58.7	55.2	58.7	55.8
Poor Nutrition (%)	47.8	51.5	44.2	43.9	62.9	52.5
Obesity (%)	40.5	39.2	41.9	38.1	53.0	44.1
Health Behavior Index (mean)	0.1	0.2	0.0	0.0	0.3	0.1
Level of Education (%)						
<High School or GED	9.0	11.4	6.4	8.4	11.3	11.4
High School Diploma	12.4	14.9	9.8	11.2	14.2	16.5
Some Postsecondary	25.2	26.9	23.5	23.9	30.1	28.4
Vocational Training	5.9	05.6	6.2	6.0	5.8	6.5
Associates Degree	10.3	08.7	11.9	10.8	8.9	9.2
Bachelor's Degree	23.4	22.1	24.8	25.0	17.1	19.0
Master's Degree	10.5	7.5	13.4	10.8	10.8	7.7
Doctorate/Prof Degree	3.4	2.8	3.9	3.9	1.8	1.2
Demographic Characteristics						
Female (%)	49.7			49.6	51.4	48.6
Race/Ethnicity (%)						
Non-Hispanic White	68.5	68.7	68.3			
Black	15.2	14.7	15.7			
Hispanic/Latino	10.9	11.1	10.6			
Other	5.3	5.4	5.3			
Age (mean)	37.9	38.0	37.8	37.8	38.1	37.9
Marital Status (%)						
Married	56.4	55.6	57.2	62.0	34.2	54.2
Previously Married	16.5	15.3	17.7	16.0	18.8	18.1
Never Married	27.1	29.1	25.1	22.0	47.0	27.7
Presence of Children (%)	66.6	61.3	72.1	67.7	64.0	67.3
Region of Residence (%)						
South	41.5	41.6	41.3	37.9	64.0	43.5
West	18.3	17.7	19.0	15.5	7.8	33.6
Midwest	27.8	27.4	28.1	33.2	21.2	9.8
Northeast	12.4	13.3	11.5	13.4	7.0	13.1
Foreign Born (%)	5.9	5.8	5.9	1.2	2.3	25.1
Socioeconomic Status						
Enrolled in PS (%)	7.6	6.0	9.1	6.6	10.5	9.7
Household Income (mean)	8.8	9.1	8.5	9.0	5.8	8.0
Parental Background						
Two-Parent Household (%)	50.6	48.9	52.3	54.9	36.3	41.5
Parent Graduated College (%)	27.8	28.6	27.1	31.8	18.4	14.2
Family Household Income (mean)	7.0	7.0	7.0	7.9	4.6	5.1
Expectation to Complete College (%)						
Not Disappointed	15.8	16.9	4.6	17.6	12.7	11.0
Somewhat Disappointed	43.2	43.0	43.3	46.7	36.2	37.1
Very Disappointed	41.0	40.0	42.0	35.6	51.1	51.9
N	11,560	5,000	6,560	6,759	2,252	1,600

Source: Wave 5 of the 2018 National Longitudinal Study of Adolescent to Adult Health.
All descriptive statistics include sampling weights to account for unequal probability of selection into the sample.
Behavior index scores represent standardized weighted values, with the mean being close to the midpoint of zero.
Both household and parental household income are measured in the tens of thousands.

Table 2.2 includes a series of linear regression models estimating differences in covariance-weighted behavior index scores. The unadjusted estimates from Model 1 indicate adults with less than a high school diploma or GED have significantly higher index scores ($p<0.001$), compared to high school graduates (the reference category). Adults with at least some postsecondary education reported slightly lower index scores ($p<0.05$), while no significant difference is observed among adults with a vocational certificate. The remaining levels of education have increasingly lower health behavior index scores ($p<0.001$). These estimates remain largely the same after controlling for gender and race/ethnicity. While the education coefficients are slightly attenuated in the fully adjusted regression model, these estimates also indicate that the variables assessed in this study explain approximately 16% of the difference in health behavior index scores.

Table 2.2 Regression Estimates (Weighted Behavioral Index)

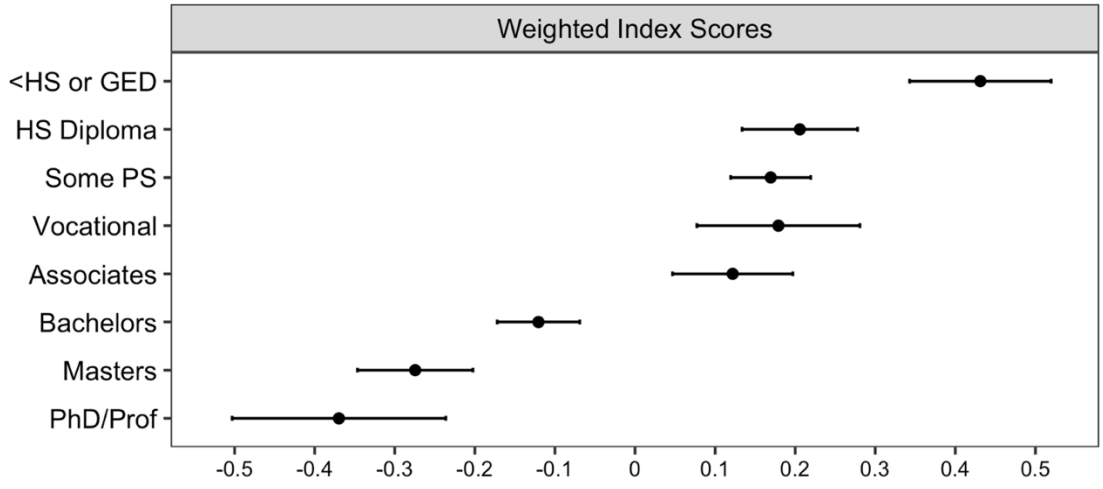
Table 2.2: Linear Regression of Weighted Health Behavior Index

	Model 1	Model 2	Model 3	Model 4	Model 5
Level of Education (ref = HS Diploma)					
<High School or GED	0.30***	0.28***	0.25***	0.23***	0.23***
	[0.19,0.41]	[0.17,0.39]	[0.14,0.36]	[0.12,0.34]	[0.12,0.34]
Some Postsecondary	-0.09	-0.08	-0.07	-0.03	-0.04
	[-0.17,0.00]	[-0.17,0.01]	[-0.16,0.02]	[-0.12,0.05]	[-0.13,0.05]
Vocational Training	-0.07	-0.05	-0.05	-0.02	-0.03
	[-0.19,0.06]	[-0.17,0.08]	[-0.17,0.08]	[-0.15,0.10]	[-0.15,0.09]
Associates Degree	-0.20***	-0.17**	-0.15**	-0.08	-0.09
	[-0.31,-0.10]	[-0.28,-0.07]	[-0.26,-0.05]	[-0.19,0.02]	[-0.19,0.02]
Bachelor's Degree	-0.55***	-0.52***	-0.46***	-0.33***	-0.33***
	[-0.63,-0.46]	[-0.61,-0.43]	[-0.55,-0.37]	[-0.42,-0.24]	[-0.42,-0.24]
Master's Degree	-0.75***	-0.71***	-0.65***	-0.49***	-0.49***
	[-0.85,-0.65]	[-0.82,-0.61]	[-0.75,-0.55]	[-0.60,-0.39]	[-0.60,-0.38]
Doctorate/Prof Degree	-0.92***	-0.88***	-0.81***	-0.59***	-0.58***
	[-1.07,-0.77]	[-1.03,-0.73]	[-0.96,-0.66]	[-0.74,-0.43]	[-0.74,-0.43]
Female (ref = Male)		-0.14***	-0.15***	-0.18***	-0.18***
		[-0.19,-0.09]	[-0.20,-0.10]	[-0.23,-0.13]	[-0.23,-0.13]
Race/Ethnicity (ref = non-Hispanic White)					
Black		0.19***	0.10**	0.05	0.05
		[0.13,0.26]	[0.03,0.17]	[-0.02,0.12]	[-0.03,0.12]
Hispanic/Latino		-0.04	0.03	0.01	-0.00
		[-0.12,0.04]	[-0.06,0.11]	[-0.08,0.09]	[-0.09,0.08]
Other		-0.13*	-0.01	-0.04	-0.05
		[-0.23,-0.03]	[-0.12,0.09]	[-0.14,0.07]	[-0.15,0.06]
Age		-0.01	-0.01	-0.01	-0.00
		[-0.02,0.00]	[-0.02,0.01]	[-0.02,0.01]	[-0.02,0.01]
R^2	0.10	0.11	0.14	0.16	0.16

Source: Wave 5 of the 2018 National Longitudinal Study of Adolescent to Adult Health (N=11,560).
Estimates include sampling weights to account for unequal probability of selection into the sample.
Model 1 regresses level of education on weighted index.
Models 2-5 additionally include: demographic characteristics; sociodemographic controls; measures of socioeconomic status; and parental background characteristics, respectively.
*p < 0.05; **p < 0.01; ***p < 0.001.

Figure 2.1 includes fully adjusted predicted health behavior index scores. While adults with less than a high school diploma or GED continue to have the highest predicted index scores (which indicates increased engagement in unhealthy behaviors), those with either a high school diploma, some postsecondary, vocational certificate, or associates degree are not found to significantly differ. The results indicate a decrease in unhealthy behaviors among those with a bachelor's degree and again among those with either a graduate or professional degree, when compared to adults with any other level of education.

Figure 2.1 Predicted Health Behavior Index Scores



Estimates from Table 2.2 Model 5 are converted into predicted behavioral index scores, while holding the independent control variables constant at typical values, their average proportions or means (Fox and Andersen 2006)

Table 2.3 includes a series of interaction models for both gender and race/ethnicity population subgroups. Compared to those with a high school diploma, men with less than a high school diploma or GED exhibit significantly higher health behavior index scores, while their female counterparts do not. Moreover, the benefit of higher education is only observed among men with at least a bachelor's degree, whereas women begin to exhibit better health behaviors at the vocational certificate level. These differences, as well as the steeper overall slope across levels of education, suggest women benefit more from higher levels of postsecondary education and supports a resource substitution hypothesis.

Table 2.3 Regression Estimates (Gender and Race/Ethnicity Interactions)

Table 2.3: Linear Regression of Weighted Health Behavior Index (Gender and Race/Ethnicity Interactions)

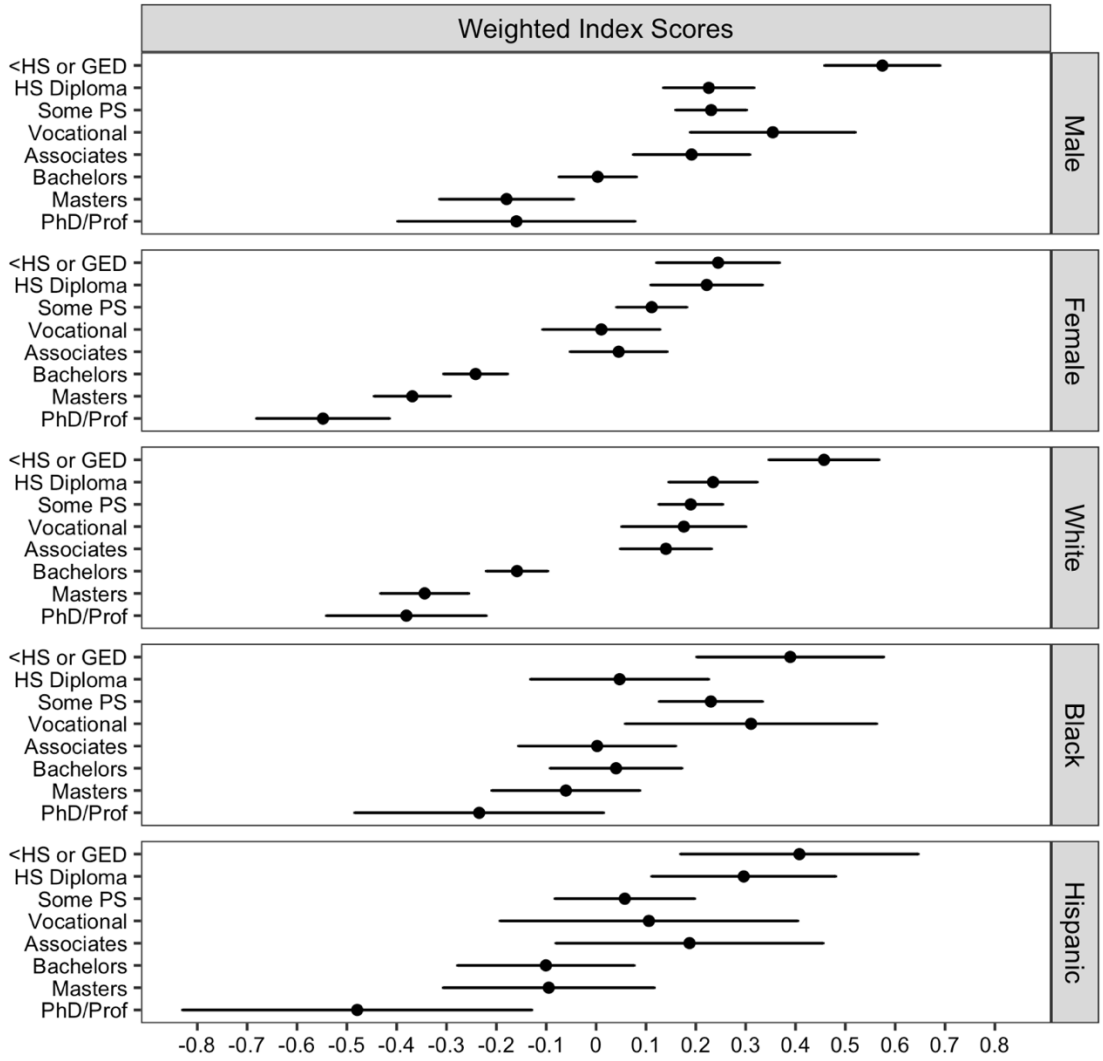
	Gender		Race/Ethnicity	
	Model 1	Model 2	Model 1	Model 2
Level of Education (ref = HS Diploma)				
<High School or GED	0.39***	0.35***	0.30***	0.22**
	[0.25,0.54]	[0.20,0.49]	[0.16,0.44]	[0.08,0.36]
Some Postsecondary	-0.05	0.01	-0.08	-0.05
	[-0.17,0.06]	[-0.11,0.12]	[-0.19,0.03]	[-0.15,0.06]
Vocational Training	0.10	0.13	-0.07	-0.06
	[-0.09,0.29]	[-0.06,0.32]	[-0.23,0.08]	[-0.21,0.09]
Associates Degree	-0.15	-0.03	-0.17**	-0.10
	[-0.30,0.00]	[-0.18,0.11]	[-0.30,-0.05]	[-0.22,0.03]
Bachelor's Degree	-0.41***	-0.22***	-0.58***	-0.39***
	[-0.53,-0.30]	[-0.34,-0.10]	[-0.69,-0.47]	[-0.50,-0.28]
Master's Degree	-0.65***	-0.41***	-0.81***	-0.58***
	[-0.82,-0.49]	[-0.57,-0.24]	[-0.93,-0.68]	[-0.71,-0.45]
Doctorate/Prof Degree	-0.68***	-0.39**	-0.92***	-0.62***
	[-0.94,-0.42]	[-0.64,-0.13]	[-1.10,-0.74]	[-0.80,-0.43]
Female (ref = Male)	0.02	-0.00	-0.14***	-0.19***
	[-0.12,0.16]	[-0.15,0.14]	[-0.19,-0.092]	[-0.24,-0.14]
Race/Ethnicity (ref = non-Hispanic White)				
Black	0.19***	0.04	-0.03	-0.19
	[0.12,0.26]	[-0.03,0.11]	[-0.22,0.16]	[-0.39,0.01]
Hispanic/Latino	-0.04	-0.00	0.01	0.06
	[-0.12,0.04]	[-0.09,0.09]	[-0.18,0.20]	[-0.14,0.27]
Age	-0.01	-0.00	-0.01	-0.00
	[-0.02,0.00]	[-0.02,0.01]	[-0.02,0.00]	[-0.02,0.01]
<HS or GED*Female	-0.29**	-0.33**		
	[-0.51,-0.07]	[-0.54,-0.11]		
Some Postsecondary*Female	-0.08	-0.12		
	[-0.26,0.09]	[-0.29,0.06]		
Vocational*Female	-0.32*	-0.34**		
	[-0.57,-0.07]	[-0.59,-0.09]		
Associates*Female	-0.10	-0.14		
	[-0.31,0.11]	[-0.35,0.07]		
Bachelors*Female	-0.24**	-0.24**		
	[-0.41,-0.07]	[-0.41,-0.07]		
Masters*Female	-0.16	-0.18		
	[-0.37,0.05]	[-0.39,0.02]		
Doctorate /Prof Degree*Female	-0.40*	-0.38*		
	[-0.71,-0.09]	[-0.68,-0.08]		
<HS or GED*Black			0.08	0.12
			[-0.21,0.37]	[-0.17,0.41]
<HS or GED*Hispanic			-0.17	-0.11
			[-0.49,0.15]	[-0.44,0.21]
Some Postsecondary*Black			0.21	0.23
			[-0.02,0.43]	[-0.00,0.46]
Some Postsecondary*Hispanic			-0.20	-0.19
			[-0.45,0.05]	[-0.45,0.06]
Vocational*Black			0.35*	0.32
			[0.01,0.69]	[-0.02,0.66]
Vocational*Hispanic			-0.15	-0.13
			[-0.54,0.23]	[-0.51,0.25]
Associates*Black			0.01	0.05
			[-0.26,0.27]	[-0.22,0.32]
Associates*Hispanic			-0.02	-0.01
			[-0.36,0.33]	[-0.36,0.33]
Bachelors*Black			0.37**	0.39**

			[0.14,0.61]	[0.14,0.63]
Bachelors*Hispanic			0.06	-0.00
			[-0.21,0.33]	[-0.28,0.27]
Masters*Black			0.48***	0.47***
			[0.22,0.74]	[0.21,0.73]
Masters*Hispanic			0.20	0.19
			[-0.10,0.50]	[-0.11,0.49]
Doctorate /Prof Degree*Black			0.40*	0.33
			[0.06,0.75]	[-0.02,0.7]
Doctorate /Prof Degree*Hispanic			-0.08	-0.16
			[-0.51,0.34]	[-0.59,0.27]
R^2	0.12	0.16	0.12	0.16

Source: Wave 5 of the 2018 National Longitudinal Study of Adolescent to Adult Health (N=11,560).
Estimates include sampling weights to account for unequal probability of selection into the sample.
Model 1 includes level of education, gender, race, and age, as well as the corresponding interaction.
Model 2 additionally include the remaining control variables assessed in this study.
*p < 0.05; **p < 0.01; ***p < 0.001.

Interesting differences are also observed by race/ethnicity. The pattern among non-Hispanic White adults is comparable to that of the Hispanic population, whereby lower index scores are only observed among those with at least a bachelor's degree, compared to those with a high school diploma. However, Black Americans only exhibit lower health behavior index scores at the doctoral or professional degree level. For an alternative means of interpretation, the fully adjusted interaction models are converted into predicted health behavior index scores, while holding the independent control variables constant at typical values, their average proportions or means (Fox & Andersen, 2006).

Figure 2.2 Predicted Health Behavior Index Scores by Gender and Race/Ethnicity



Estimates from Table 2.3 Model 2 for each group are converted into predicted behavioral index scores, while holding the independent control variables constant at typical values, their average proportions or means (Fox and Andersen 2006).

2.5 Discussion

Despite the strong link between a bachelor's degree and adult health behaviors, we know little about the behavioral patterns among those with lower-level postsecondary credentials. These credentials represent profoundly different levels of human capital accumulation, which lead to comparably varied life trajectories. As a result, this study examines differences in adult health behaviors across detailed levels of postsecondary education using covariance-weighted behavioral index scores. The analyses also substantially extend prior work by providing health behavior estimates both in aggregate and across gender and race/ethnicity population subgroups. The main findings indicate that higher levels of postsecondary education lead to healthier behaviors in adulthood; however, generally only at the bachelor's degree level and beyond, with no improvements in adult health behaviors among those with sub-BA levels of education, which includes incomplete or lower-level postsecondary credentials. These estimates also fill an important gap in the literature as existing education-health studies generally group postsecondary credential into a limited number of categories (Case and Deaton 2021; Lawrence 2017; Zheng 2017).

The observed behavioral index scores indicate substantial heterogeneity in adult health behaviors. While adults with either less than a high school diploma or GED have the worst health behaviors, those with either a high school diploma, some postsecondary, a vocational certificate, or an associate degree do not significantly differ. However, significantly better health behaviors are observed among those with a bachelor's degree and again among those with either a graduate or professional degree, when compared to adults with any other level of education. The lack of behavioral improvements among the sub-BA levels of education suggests these lower-level credentials do not provide enough human capital, economic resources, and psychosocial abilities necessary to enable healthier lifestyles in adulthood. This has important implications as the vast majority of young adults are pursuing at least some form of postsecondary education, but improved health behaviors seem to be concentrated at the highest rungs of the education ladder perpetuating social disadvantages.

The findings also show that women experience steeper education-health gradients, compared to men. For example, women that have completed any type of postsecondary education have significantly lower predicted behavioral index scores, compared to those with a high school diploma. In comparison, men only experience returns to a postsecondary education at the bachelor's degree level and beyond. These estimates support a process of resource substitution, as women generally have fewer alternative health-promoting socioeconomic resources (Ross and Mirowsky 2010; Vable et al. 2018).

The predicted index scores also reveal interesting behavioral patterns across race/ethnicity as White and Hispanic/Latino Americans have comparable health lifestyles across levels of postsecondary education; however, Black Americans were found to experience no returns except at the doctoral or professional degree level. This is consistent with other recent studies which have found flatter education-health gradients among Black adults (Bell et al. 2018; Kroeger and Frank 2018; Vable et al. 2018). These estimates may reflect the higher levels of stress and economic disadvantages experienced by Black Americans (Goldman et al. 2006; Simons et al. 2020; Turra and Goldman 2007). It is also indicative of a resource multiplication process whereby socially advantaged groups gain more from education as their social and economic resources multiply to perpetuate and enhance their advantage (Ross and Mirowsky 2006).

2.5.1 Limitations

As one of the first studies to identify disparities in health behaviors across the entire postsecondary education gradient, this work has limitations that future research could address. While I control for differences in demographics, there may be other confounders that were missed. Future research could further examine social and contextual determinants of health behaviors in adulthood. As potential selection effects were not specifically addressed, future studies may want to account for health differences in adolescence when estimating the association between education and adult health behaviors. Further research on these important relationships will continue to help us understand inequalities in adult health behaviors.

2.5.2 Conclusion

In this article, I describe large behavioral disparities among lower-level postsecondary credentials which persist even after controlling for various demographics, measures of socioeconomic status, and parental background characteristics. The findings highlight the complex and profound association between a postsecondary education and adult health behaviors. As such, I strongly encourage scholars and policymakers to continue to examine how differentiation in postsecondary education may impact various health outcomes. These findings are also informative for policy initiatives and any potential targeted public health interventions.

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Appendix Table 2.1 Correlation Matrix

Appendix Table 2.1: Tetrachoric Correlations Between Binary Health Behaviors

	Drinking	Smoking	Marijuana	Lower Activity	Poor Nutrition	Obesity
Drinking	1.00					
Smoking	0.37	1.00				
Marijuana	0.29	0.46	1.00			
Lower Activity	0.01	0.07	-0.05	1.00		
Poor Nutrition	0.08	0.07	0.02	0.16	1.00	
Obesity	0.06	-0.02	-0.09	0.19	0.27	1.00

Source: Wave 5 of the 2018 National Longitudinal Study of Adolescent to Adult Health (N=11,560).

Appendix Table 2.2 Regression Estimates of Behavioral Index

Appendix Table 2.2: Linear Regression of Summary Health Behavior Index					
	Model 1	Model 2	Model 3	Model 4	Model 5
Level of Education (ref = HS Diploma)					
<High School or GED	0.39***	0.37***	0.33***	0.29***	0.29***
Some Postsecondary	-0.13*	-0.12*	-0.11	-0.06	-0.06
Vocational Training	-0.11	-0.09	-0.08	-0.05	-0.06
Associates Degree	-0.27***	-0.24***	-0.22**	-0.12	-0.12
Bachelor's Degree	-0.74***	-0.70***	-0.63***	-0.46***	-0.45***
Master's Degree	-0.99***	-0.95***	-0.87***	-0.65***	-0.64***
Doctorate/Prof Degree	-1.22***	-1.17***	-1.08***	-0.78***	-0.77***
Female (ref = Male)		-0.16***	-0.17***	-0.22***	-0.22***
Race/Ethnicity (ref = Non-Hispanic White)					
Black		0.25***	0.13**	0.07	0.06
Hispanic/Latino		-0.06	0.02	0.01	-0.01
Other		-0.16*	0.00	-0.03	-0.04
Age			-0.01	-0.00	-0.00
Marital Status (ref = Married)					
Previously Married			0.32***	0.22***	0.22***
Never Married			0.35***	0.25***	0.25***
Presence of Children (ref = No Children)			0.07	0.07	0.07
Region of Residence (ref = South)					
West			-0.29***	-0.24***	-0.22***
Midwest			0.01	0.01	0.01
Northeast			-0.33***	-0.28***	-0.28***
Non-US Born (ref = US Born)			-0.23***	-0.20**	-0.21**
Enrolled in PS (ref = Not Enrolled)				-0.21***	-0.21***
Household Income				-0.03***	-0.03***
Two-Parent Household					0.03
Parent Graduated College					-0.10**
Family Household Income					-0.00
Expectation to Complete College (ref = Not Disappointed)					
Somewhat Disappointed					0.08
Very Disappointed					0.09
R^2	0.11	0.12	0.15	0.16	0.17

Source: Wave 5 of the 2018 National Longitudinal Study of Adolescent to Adult Health (N=11,560).
Estimates include sampling weights to account for unequal probability of selection into the sample.
*p < 0.05; **p < 0.01; ***p < 0.001.

Appendix Table 2.3 Regression Estimates (Stratified by Gender and Race/Ethnicity)

Appendix Table 2.3: Linear Regression of Health Behavior Index (Stratified by Gender and Race/Ethnicity)					
	Male	Female	White	Black	Hispanic
Level of Education (ref = HS Diploma)					
<High School or GED	0.35***	0.02	0.22**	0.36**	0.10
Some Postsecondary	-0.01	-0.11	-0.04	0.16	-0.26*
Vocational Training	0.12	-0.20*	-0.06	0.27	-0.23
Associates Degree	-0.04	-0.17*	-0.08	-0.10	-0.12
Bachelor's Degree	-0.27***	-0.43***	-0.37***	-0.08	-0.47***
Master's Degree	-0.45***	-0.55***	-0.56***	-0.18	-0.46**
Doctorate/Prof Degree	-0.46***	-0.71***	-0.59***	-0.33*	-0.92***
Female (ref = Male)			-0.18***	-0.14*	-0.25**
Race/Ethnicity (ref = Non-Hispanic White)					
Black	0.03	0.05			
Hispanic/Latino	0.03	-0.04			
Other	-0.06	-0.05			
Age	-0.02	0.01	0.00	-0.02	-0.03
Marital Status (ref = Married)					
Previously Married	0.21***	0.15***	0.22***	-0.02	0.17
Never Married	0.18***	0.22***	0.23***	0.00	0.27**
Presence of Children (ref = No Children)	0.06	0.01	-0.00	0.05	0.23**
Region of Residence (ref = South)					
West	-0.11*	-0.16***	-0.18***	-0.19	-0.03
Midwest	0.01	0.04	-0.01	0.09	0.28
Northeast	-0.19***	-0.18***	-0.20***	-0.12	-0.06
Non-US Born (ref = US Born)	-0.17	-0.17**	-0.10	-0.41**	-0.03
Enrolled in PS (ref = Not Enrolled)	-0.25**	-0.12*	-0.21***	-0.04	-0.14
Household Income	-0.02***	-0.03***	-0.03***	-0.021***	-0.02*
Two-Parent Household	-0.01	0.04	0.05	-0.01	-0.09
Parent Graduated College	-0.01	-0.12***	-0.07*	-0.06	0.01
Family Household Income	-0.00	0.00	0.00	-0.00	0.01
Expectation to Complete College (ref = Not Disappointed)					
Somewhat Disappointed	0.09	0.04	0.07	0.12	0.09
Very Disappointed	0.11*	0.04	0.09	0.15	0.03
R^2	0.13	0.18	0.17	0.09	0.12
N	5000	6560	6759	2252	1600

Source: Wave 5 of the 2018 National Longitudinal Study of Adolescent to Adult Health.
Estimates include sampling weights to account for unequal probability of selection into the sample.
*p < 0.05; **p < 0.01; ***p < 0.001.

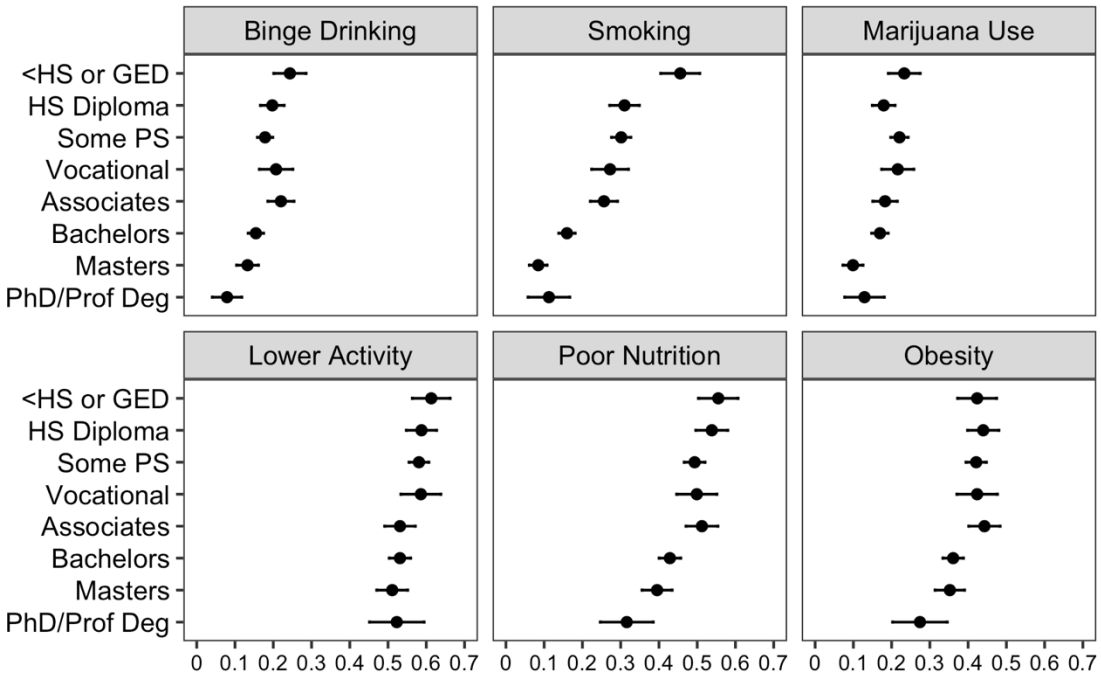
Appendix Table 2.4 Regression Estimates (Individual Health Behaviors)

Appendix Table 2.4: Logistic Regression of Individual Health Behaviors

	Binge Drinking	Smoking	Marijuana Use	Lower Activity	Poor Nutrition	Obesity
Level of Education (ref = HS Diploma)	1.31	1.86***	1.39*	1.11	1.07	0.94
<High School or GED	0.88	0.96	1.29*	0.97	0.84	
Some Postsecondary	1.06	0.83	1.26	0.99	0.85	0.93
Vocational Training	1.15	0.77*	1.02	0.80	0.90	0.94
Associates Degree	0.74*	0.42***	0.93	0.80*	0.64***	1.01
Bachelor's Degree	0.62**	0.21***	0.50***	0.73*	0.56***	0.72**
Master's Degree	0.35***	0.28***	0.68	0.77	0.40***	0.69**
Doctorate/Prof Degree	0.88	0.96	1.29*	0.97	0.84	0.48***
Female (ref = Male)	0.42***	0.82**	0.60***	1.30***	0.73***	0.93
Race/Ethnicity (ref = Non-Hispanic White)						
Black	0.67***	0.50***	1.15	0.98	1.69***	1.46***
Hispanic/Latino	1.31*	0.47***	0.85	0.93	1.29**	1.28*
Other	1.03	0.82	0.69*	1.02	1.28*	0.85
Age	0.94**	1.00	0.96*	1.02	1.00	1.03*
Marital Status (ref = Married)						
Previously Married	1.63***	1.97***	1.70***	0.86	0.98	0.91
Never Married	1.67***	1.92***	1.76***	0.92	1.00	0.92
Presence of Children (ref = No Children)	1.09	1.17*	0.89	1.03	1.18*	1.01
Region of Residence (ref = South)						
West	0.73**	0.75**	1.96***	0.78**	0.60***	0.77**
Midwest	1.21*	1.15	1.33**	0.92	0.82**	0.92
Northeast	0.89	0.85	1.27*	0.89	0.38***	0.89
Non-US Born (ref = US Born)	0.79	0.67*	0.53**	1.17	1.04	0.64**
Enrolled in PS (ref = Not Enrolled)	0.68**	0.70**	0.79	0.80*	0.91	1.00
Household Income	1.01	0.95***	0.96***	0.97***	0.98***	0.96***
Two-Parent Household	1.03	0.91	0.84*	1.05	1.19**	1.10
Parent Graduated College	0.85	0.91	1.20*	0.94	0.87*	0.86*
Family Household Income	1.01	1.00	1.02***	1.00	0.98***	0.99
Expectation to Complete College (ref = Not Disappointed)						
Somewhat Disappointed	0.98	1.14	1.26*	1.14	1.05	0.93
Very Disappointed	1.03	1.03	1.16	1.13	1.11	1.00

Source: Wave 5 of the 2018 National Longitudinal Study of Adolescent to Adult Health (N=11,560).
Estimates include sampling weights to account for unequal probability of selection into the sample.
*p < 0.05; **p < 0.01; ***p < 0.001.

Appendix Figure 2.1 Predicted Probabilities of Individual Health Behaviors



Estimates from Appendix Table 2.4 are converted into predicted probabilities for each behavior, while holding the independent control variables constant at typical values, their average proportions or means (Fox and Andersen 2006).

Chapter 3

3 Postsecondary Education and Adult Health Lifestyles: Examining Sources of Disparities

3.1 Introduction

This study analyzes postsecondary education-related disparities in adult health lifestyles. Adults with at least a bachelor's degree (BA+) exhibit healthier lifestyles than those with incomplete or lower-level (sub-BA) postsecondary credentials (Jehn 2022). Yet, the source of these disparities has been understudied. This is an important omission as risk behaviors profoundly influence chronic illness and mortality (Hanson and Chen 2007). Behavioral disparities thus represent a critical area of study for advancing our understanding of population health, particularly as nearly 68% of American adults in their thirties and forties (approximately 56.5 million people) have at least some postsecondary and yet risk behaviors continue to be concentrated among lower-educated adults (Case and Deaton 2021; Lawrence et al. 2020; NCES 2021). In fact, there is an increasing divide between sub-BA and BA+ levels of postsecondary education (Case and Deaton 2021). Americans with lower-level postsecondary credentials have seen rising death rates from preventable behavioral causes of early mortality, such as alcoholic liver disease (Case and Deaton 2015, 2021; Sasson 2016). These important differences motivate the need to examine adult health behaviors across the sub-BA and BA+ population. I therefore provide a comprehensive exploration and decomposition of adult health behaviors using theoretical and empirically selected explanatory factors including demographics, parental background, social contexts, economic well-being, and employment characteristics.

To better understand the association between a postsecondary education and adult health behaviors, I adopt the health lifestyles theoretical framework. Health lifestyles merges structure with agency to highlight how social conditions and individual life chances are associated with a broad spectrum of potential health-related behaviors (Cockerham, Rütten, and Abel 1997). For example, through socialization and shared experiences,

individuals with similar status and class distinctions form aggregate status groups that exhibit similar health lifestyles (Burdette et al. 2017). Health lifestyles research also sheds light on why health behaviors persist or change as well as how health disparities are linked to social inequalities (Mollborn, Lawrence, and Saint Onge 2021). As health behavior practices do not act in isolation, we also gain deeper insights about the constellation of behaviors that make up an overall lifestyle by assessing multiple behaviors simultaneously (Cockerham 2005). Therefore, rather than focusing on individual health behaviors, I combine some of the leading behavioral causes of early mortality to identify a broad spectrum of behaviors influenced by postsecondary educational attainment.

3.2 Explanatory Factors

3.2.1 Demographics

Based on the health lifestyles theoretical framework, gender and race/ethnicity are among the most prominent factors contributing to the formation of status groups and subsequently associated with unique sets of health behaviors (Mollborn et al. 2014; Olson, Hummer, and Harris 2017). In fact, both gender and race/ethnicity differences in the association between a postsecondary education and adult health behaviors are well documented (Jehn 2022; Olson et al. 2017; Ross and Mirowsky 2010; Simons et al. 2020; Zajacova 2006). For example, there are compositional differences in adult health behaviors as higher educated women more effectively adopt positive behaviors, including proper nutrition and preventative care, while exhibiting lower instances of substance abuse and risk-seeking or adverse health-related behaviors than their male counterparts (Hill et al. 2006; Olson et al. 2017; Ross and Mirowsky 2006). There are also differences in the effect of a postsecondary education as women experience steeper education-health gradients than men (Ross and Mirowsky 2010; Vable et al. 2018). Moreover, regardless of level of education, Black and Hispanic/Latino Americans experience higher rates of social and economic disadvantages than non-Hispanic White Americans (Goldman et al. 2006; Simons et al. 2020; Turra and Goldman 2007; Vable et al. 2018). Lower economic returns to postsecondary education among Black and Hispanic/Latino Americans perpetuates inequalities in health behaviors and restricts access to proper medical care

(Cutler and Lleras-Muney 2006; Warren et al. 2020). Accounting for differences in demographics thus serves as a critical component for understanding how postsecondary education influences adult health lifestyles.

3.2.2 Parental Background

As adult health lifestyles are formed based on an interplay between structure and agency, measures of parental socioeconomic status (SES) also represent powerful predictors of various adult health outcomes, whereby increases in family SES is associated with an increase in health benefits (Cohen et al. 2010; Hanson and Chen 2007; Pollitt et al. 2007). For example, individuals with college educated parents are more likely to have access to higher education as well as higher income and SES through better occupations, which in turn influences adult health (Cohen et al. 2010). In fact, lower parental socioeconomic status is associated with an elevated risk of premature mortality, regardless of SES achieved in adulthood (Galobardes, Lynch, and Smith 2008; Hanson and Chen 2007). Lower parental SES environments are also hypothesized to influence health developmental trajectories and the acquisition of health-related behaviors (Cohen et al. 2010). Although there is some evidence to suggest that parental SES does not directly impact adult health, but rather serves as a marker of future adult SES (Cohen et al. 2010), differences in parental SES remain an influential component of the link between a postsecondary education and adult health behaviors.

3.2.3 Social Contexts

While higher educated adults share similar social status and class distinctions, they also exhibit similar lifestyles. For instance, college graduates are more likely to get and stay married, develop strong social ties with greater civic engagement, and connect with other higher educated individuals, which in turn leads to healthier behaviors in adulthood (Hout 2012; Umberson, Crosnoe, and Reczek 2010). Married men and women also exhibit healthier habits and lifestyles than those who are never married, divorced/separated, or widowed (Waite and Gallagher 2001). Having strong social ties reduces stress, improves mental health, and increases a sense of personal control which better enables an individual to develop healthier behaviors in adulthood (Umberson et al. 2010). Higher

education also influences exposure to health-related norms and customs through socialization and shared experiences within a social network of individuals with similar social positions. Having a healthy social network has a positive effect on adult health behaviors while unhealthy networks result in negative effects (Christakis and Fowler 2008; Lawrence 2017; Walsemann, Hummer, and Hayward 2018). Therefore, the relationships an individual forms in adulthood may help explain how postsecondary educational attainment can influence health-related behaviors in adulthood.

3.2.4 Economic Well-being

According to human capital theory, the abilities, knowledge, and resources acquired through a postsecondary education result in higher income and socioeconomic status in adulthood (Becker 1964). Higher levels of postsecondary education also serve as a signal of an individual's cumulative stock of cognitive and noncognitive abilities that subsequently yield better economic returns (Spence 1978). Thus, whether from a human capital or signaling perspective, higher education is associated with higher income. Better economic returns may in turn allow higher income adults to adopt healthier lifestyles with more physical activity, better nutritional habits, and lower rates of smoking and alcohol consumption compared to those with lower income (Andrews, Hill, and Cockerham 2017; Snead and Cockerham 2002). In fact, unhealthy behaviors are found to be most concentrated among lower income adults. As health behaviors substantially impact health, income disparities in adult health behaviors contribute to income disparities in mortality (Brunello et al. 2016; Ho and Fenelon 2015; Mehta, House, and Elliott 2015). Higher personal and family income also allows people to afford access to better health behaviors. For example, smoking cessation aids, weight loss programs, and gym memberships can be purchased to improve health behaviors (Lawrence 2017). In addition to income, I also assess other potential explanatory measures of economic well-being including postsecondary enrolment status (which accounts for tangential labor market participation), home ownership, and whether respondents have any household student loans.

3.2.5 Employment Characteristics

A postsecondary education also influences employment characteristics not captured by measures of economic well-being, such as the types of occupations within which people are employed (Hout 2012; Manley et al. 2003). Higher educated adults are more likely to have stable and rewarding employment as well as employer provided health insurance benefits which can promote healthier behaviors (Manley et al. 2003). Differences in employment can also substantially impact adult health behaviors as occupations provide material, social, and psychological resources which influences our exposure to various health-related norms and customs (Burdette et al. 2017; Montez et al. 2018). For instance, an academic may display better nutritional habits and lower rates of smoking, but they may also have a higher alcohol intake, limited sleep, and frequent sedentary time (Mollborn et al. 2021). While this combination of health behaviors may seem discordant in terms of healthfulness, it may be consistent with the norms and customs associated with academic occupations. Therefore, adults with similar occupations may also experience similar occupational risks and health lifestyles.

3.3 Methods

3.3.1 Data

Data comes from Wave V of the National Longitudinal Study of Adolescent to Adult Health (Add Health), administered by the University of North Carolina Population Center. Add Health is a longitudinal sample of respondents that have been followed from adolescence into adulthood through a total of five waves (Harris et al. 2009). Schools included in the original Add Health sampling frame were selected by region, urbanicity, school size and type, and racial composition based on a stratified sampling design. In-school data collection began when respondents were in grades 7–12 with a sample of 20,745 adolescents being selected for the Wave I in-home interviews in 1994-1995. Additional in-home interviews were conducted in 1996 (Wave II), 2001–2002 (Wave III), 2008–2009 (Wave IV), and 2016-2018 (Wave V). With a large number of education and health behavior-related questions, Add Health is uniquely positioned to offer insights about the associations between a postsecondary education and adult health lifestyles.

The initial Wave V sample includes adult 33-44 years of age with a total of 12,300 respondents. To assess postsecondary education-related disparities in adult health behaviors, I exclude respondents without at least some postsecondary education (N – 2,092). I also exclude respondents that failed to have valid responses for any of the individual health behaviors assessed in this study (N – 742). Lastly, as is common in the econometrics literature (Abbott 2005; Adams 2015), as well as to allow for consistent application of all explanatory factors, I exclude those without active labor market participation (N – 1,263), which results in a final analytic sample of 8,203 respondents.

3.3.2 Measures

Outcome Variables

I examine a total of six adult health behaviors including binge drinking, smoking, marijuana use, lower physical activity, poor nutrition, and obesity. Binge drinking measures the number of alcoholic beverages respondents usually have each time they had drinks in the past 30 days. Using the Centers for Disease Control and Prevention's definition, those having more than four (women) or five (men) are considered binge drinkers (CDC 2022). Smoking and marijuana use are operationalized as dichotomous measures identifying respondents who have smoked tobacco or marijuana, respectively, at least once in the past 30 days. Lower physical activity measures bouts of exercise across several broad categories of physical activity, coded with a range of 0 to 49. Poor nutrition measures how many times respondents ate fast food in the last 7 days, with a range of 0 to 50. Both variables are dichotomized at their mean to identify respondents with below average levels of activity or respondents that consume an above average level of fast food, respectively. Obesity is a dichotomous measure of the proportion of respondents experiencing a body mass index ≥ 30.

Each of the individual adult health behaviors are self-reported except for obesity, which is derived using a respondent's weight and height to calculate their body mass index. While obesity is not a direct health behavior, it is an important biomarker proxy of nutritional habits (see Knol et al. 2017; Lawrence 2017; Price et al. 2017; Shinde 2019).

After dichotomizing each of these health behaviors, I constructed a summation index of adult health lifestyles (Mullan Harris, Lee, and DeLeone 2010). Creating a behavioral index allows me to identify a broad spectrum of health behaviors influenced by postsecondary educational attainment. Each unit increase on the lifestyles index represents regular engagement in one additional unhealthy behavior, whereby lower scores indicate better health lifestyles. Table 1.1 includes a detailed description of how these variables are coded.

Explanatory Variables

The focal explanatory variable is level of postsecondary education. This variable distinguishes between respondents with sub-BA, including incomplete and lower-level postsecondary credentials, and those with at least a bachelor's degree (BA+), which also includes respondents with masters, doctoral, or professional degrees. I also assess potential explanatory factors known to influence returns to a postsecondary education including demographics, parental background, social contexts, economic well-being, and occupation characteristics (Mollborn et al. 2021).

Demographics include gender (male as reference versus female), race (non-Hispanic white as reference, Black, Hispanic/Latino, and 'other' racial identities), age (continuous variable ranging from 33 to 44), immigration status (U.S. born as reference versus foreign born), and region of residence (South as reference, West, Midwest, and Northeast).

Parental background characteristics include household composition, postsecondary education, household income, and expectation to complete college. Household composition identifies the number of parents in the home (one-parent household as reference versus two-parent household). Postsecondary education is a dichotomous measure of whether respondents have at least one parent with a college degree (no college as reference versus parent graduated college). Parental household income is a continuous measure of real dollars earned per year divided by 10,000. Lastly, expectation to complete college measures the potential level of parental disappointed if the respondent were to not complete college (not disappointed as reference, somewhat disappointed, and very disappointed).

Social contexts include marital status (married as reference, previously married, and never married) and presence of children (no children as reference versus respondent has at least one child). To assess emotional support, respondents were asked: “For each of the following individuals or groups of people (spouse, family, and friends) indicate whether or not you can open up to them if you need to talk about your worries.” I therefore include three measures assessing emotional support (no support as reference versus has support). Additional measures include number of close friends (five or less as reference versus six or more), frequency of social gatherings (never to 1-2x a year as reference, several times a year, and at least once a month), and frequency of religious attendance (never as reference, sometimes, and often).

Measures of economic well-being include personal and household income, mortgage payments, and household student loans. Both personal and household income were originally coded in categories from 1=less than $5000 to 13 =$200,000 or more. I recoded each category to its midpoint value (1=$2500 to 13 = ($22500) and divided it by 10,000 to use both income variables as continuous covariates. Despite a strong correlation between personal and household income (r=0.73), the models assessed in this study reveal no multicollinearity based on a variance inflation factor (VIF) of 2.58 and 2.70, respectively. Mortgage payments serves as proxy for home ownership (no mortgage as reference versus paying a mortgage). Lastly, having household student loans is a binary indicator (no loans as reference versus household has student loans).

Employment characteristics include type of occupation (managerial, business, and science as reference, service occupations, sales and office, natural resources and construction, and production and transportation), employment hours (part-time as reference versus full-time), sedentary working conditions (physical work as reference versus sedentary work), and two measures assessing whether respondents receive either health or sickness benefits from their employer (no benefits as reference versus receiving benefits).

3.3.3 Statistical Analysis

To address missingness for independent variables as well as to retain cases across estimates and models, I use multiple imputation by chained equations (MICE) with ten replicates (Royston and White 2011). Missing data ranges from <0.5% for level of education, marital status, presence of children, number of close friends, social gatherings, religious attendance, emotional support from either spouse, family, or friends, postsecondary enrolment status, employment hours, sedentary working conditions, and health or sickness benefits to approximately 0.8% for personal income, 0.9% for mortgage payments, 1.0% for household student loans, 2.0% for immigrant status, 2.3% for type of occupation, 5.9% for region of residence, 13.2% for parental expectation to complete college, 15.5% for household income, and 23.3% for parental income. All analyses also use the Wave V cross-sectional survey weights in order to account for attrition across survey waves as well as to obtain unbiased population estimates.

I estimate sample characteristics for each variable included in the analyses for both the full sample and by sub-BA and BA+ levels of postsecondary education (Table 3.1). This also includes details on the distribution of the behavioral index. I then use a series of linear regression models to assess differences in adult health lifestyle index scores (Table 3.2). Model 1 only includes the focal education variable to establish baseline differences in health lifestyles by level of postsecondary education. Model 2 includes controls for demographics. Model 3 controls for parental background characteristics. Model 4 includes respondents' measures of social contexts. Model 5 assesses economic well-being. Model 6 includes employment characteristics. Lastly, Model 7 includes controls for all variables assessed in this study. The estimates from Table 3.2 Model 7 are subsequently converted into predicted average behavioral index scores (Figure 3.1), while holding the independent control variables constant at typical values, their average proportions or means (Fox and Andersen 2006).

Using an Oaxaca-Blinder decomposition model (Blinder 1973; Oaxaca 1973), I also provide estimates that describe a proportion of the observed inequalities in health lifestyles between sub-BA and BA+ levels of postsecondary education (Table 3.3). Essentially, a decomposition model can indicate to what extent differences in the mean

predicted outcomes between groups is due to differences in the observable explanatory factors assessed in this study (Blinder 1973; Jann 2008; Oaxaca 1973). The remaining inequality, or unexplained proportion, is then due to differential effects of the unobserved factors that are not included in the model, such as other health promoting domains. The percentage explained by each explanatory factor is subsequently presented in a graphical display (Figure 3.2).

3.3.4 Sensitivity Analysis

I also conducted several additional sensitivity analyses. First, I examined fully adjusted logistic regression estimates for each individual health behavior (Appendix Table 3.1). To better interpret the results from these models, average predicted probabilities are calculated from the associated odds ratios. These estimates are then presented in Appendix Figure 3.1 for both sub-BA and BA+ levels of postsecondary education.

Appendix Table 3.2 includes a series of linear regression models estimating differences in health lifestyle index scores using a covariance-weighted average of the individual indicators, as proposed by Anderson (2008). The primary advantage of this procedure is that it normalizes the distribution and increases the efficiency of a behavioral index by ensuring highly correlated indicators receive less weight than uncorrelated indicators (Schwab et al. 2020). Essentially, this procedure produces a standardized weighted index with a sample mean that is close to zero. Higher index scores indicate increased engagement in unhealthy behaviors, whereby lower scores indicate better health lifestyles.

3.4 Results

Table 3.1 presents the prevalence of each health behavior and I describe the characteristics of the target population across all variables in this study, for the full sample as well as stratified by level of postsecondary education (sub-BA and BA+). The complex patterns observed indicate that there is substantial behavioral heterogeneity among adults 33-44 years of age. While relatively low rates of binge drinking (18%), smoking (21%), and marijuana use are observed (18%), adults in their thirties and forties are substantially more likely to exhibit lower physical inactivity (54%), consume an

above average amount of fast food (46%), or experience obesity (38%). The estimated education differences in these health behaviors indicate that adults with sub-BA levels of postsecondary education are more likely to engage in unhealthy behaviors than their BA+ counterparts.

Table 3.1 Sample Characteristics

Table 3.1: Characteristics of the Target Population

	Total Sample	sub-BA	BA+	Difference
Health Lifestyles Index				
Average Index Score (mean)	1.9	2.3	1.6	***
Composition of Index (%)				***
0 Risk Behaviors	13.4	7.5	19.4	
1-2 Risk Behaviors	53.8	50.0	57.6	
3-4 Risk Behaviors	20.2	38.7	21.7	
5-6 Risk Behaviors	2.6	3.8	1.4	
Individual Health Behaviors				
Binge Drinking (%)	18.1	21.9	14.3	***
Smoking (%)	20.5	29.3	11.7	***
Marijuana Use (%)	18.0	21.7	14.2	***
Lower Physical Activity (%)	53.8	57.1	50.4	***
Poor Nutrition (%)	46.0	53.7	38.4	***
Obesity (%)	38.1	45.0	31.3	***
Level of Education				
sub-BA (%)	47.3			
BA+ (%)	52.7			
Demographics				
Female (%)	50.3	46.6	54.0	***
Age (mean)	37.8	37.9	37.7	**
Race (%)				***
Non-Hispanic White	70.5	67.4	73.5	
Black	13.8	15.8	11.8	
Hispanic/Latino	10.2	12.1	8.2	
Other	5.6	4.7	6.5	
Foreign Born (%)	5.7	5.5	5.9	n.s.
Region of Residence (%)				***
South	41.7	43.5	39.8	
West	18.4	17.4	19.4	
Midwest	26.8	28.0	25.6	
Northeast	13.2	11.2	15.2	
Parental Background				
Two-Parent Household (%)	54.7	50.6	58.8	***
Parent Graduated College (%)	33.8	20.3	47.2	***
Parental Income (mean)	7.7	6.2	9.2	***
Expectation to Complete College				***
Not Disappointed	11.9	16.1	7.6	
Somewhat Disappointed	43.6	45.5	41.8	
Very Disappointed	44.5	38.4	50.6	
Social Contexts				
Marital Status (%)				***
Married	60.5	53.8	67.1	
Previously Married	15.2	19.5	11.0	
Never Married	24.3	26.7	21.9	
Presence of Children (%)	66.9	68.5	65.2	*
Number of Close Friends (%)				***
5 or less	83.6	88.3	78.9	

6 or more	16.4	11.7	21.2	
Social Gatherings (%)				***
Never to 1-2x A Year	7.8	10.9	4.8	
Several Times A Year	19.1	21.7	16.5	
At Least Once A Month	73.1	67.4	78.7	
Religious Attendance (%)				***
Never	38.8	43.0	34.6	
Sometimes	36.2	35.0	37.3	
Often	25.1	22.0	28.1	
Emotional Support – Spouse (%)	78.3	75.7	80.9	***
Emotional Support – Family (%)	82.0	79.4	84.6	***
Emotional Support – Friends (%)	87.8	84.2	91.4	***
Economic Well-being				
Postsecondary Enrolment (%)	8.5	9.8	7.3	**
Personal Income (mean)	6.7	5.2	8.1	***
Household Income (mean)	10.2	8.0	12.4	***
Paying a Mortgage (%)	54.7	47.9	61.5	***
Household Student Loans (%)	8.5	9.8	7.3	***
Employment Characteristics				
Occupation (%)				***
Managerial, Business, and Science	53.7	34.1	73.2	
Service Occupations	12.5	17.9	7.1	
Sales and Office	21.3	26.7	15.9	
Natural Resources and Construction	5.4	9.7	1.2	
Production and Transportation	7.1	11.7	2.6	
Hours Worked (%)				***
Part-Time	16.7	19.1	14.3	
Full-Time	83.3	80.9	85.7	
Sedentary Work (%)	51.5	41.6	61.3	***
Health Benefits (%)	81.4	76.4	86.4	***
Sickness Benefits (%)	83.5	79.2	87.8	***
N	8203	3879	4324	

Source: Wave 5 of the National Longitudinal Study of Adolescent to Adult Health.
All descriptive statistics include sampling weights to account for unequal probability of selection into the sample.
Parental as well as personal and household income is measured in the tens of thousands.
*p < 0.05; **p < 0.01; ***p < 0.001.

Demographic differences indicate that the majority of adults with incomplete and lower-level postsecondary credentials are men, while the opposite is found among those with at least a bachelor's degree. There are also a larger percentage of Black and Hispanic/Latino adults among those with sub-BA levels of postsecondary education. Compared to those with incomplete or lower-level postsecondary credentials, adults with at least a bachelor's degree are significantly more likely to come from a two-parent household, have at least one parent that graduated college, have higher parental household income, and greater expectations to complete college. They are also more likely to be married with children, have at least 6 or more close friends, attend social gatherings at least once a month, regularly participate in religious activities, and receive emotional support from either their spouse, family, or friends. Adults with at least a bachelor's degree also have higher personal and household incomes as well as greater likelihood of home ownership; however, they are more likely to be paying student loans. Lastly, adults with at least a bachelor's degree are more likely to work in managerial, business, or science related occupations, work full-time hours, experience sedentary working conditions, and have health and sickness benefits provided by their employer, compared to those with incomplete or lower-level postsecondary credentials.

Table 3.2 Regression Estimates (Health Lifestyles Index)

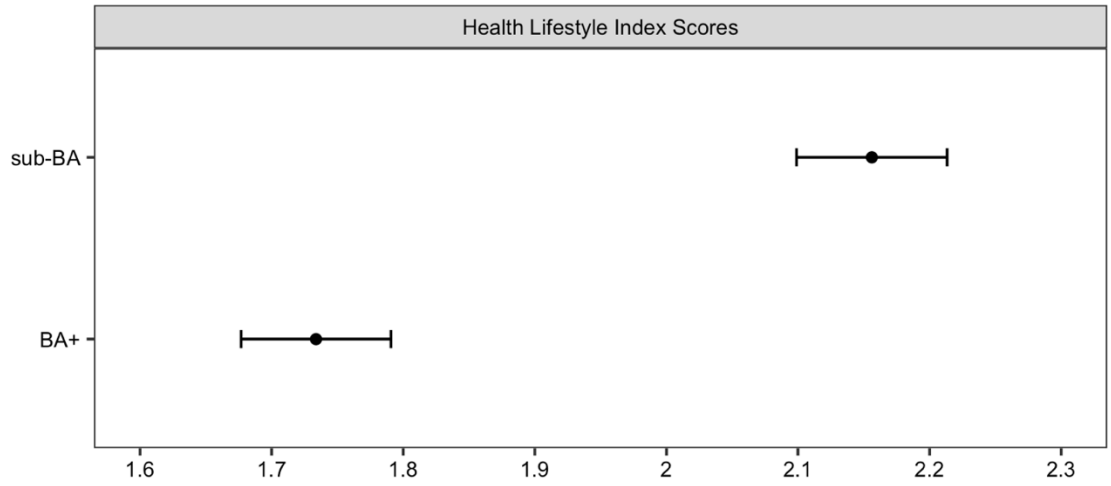
Table 3.2: Linear Regression of Health Lifestyles Index							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Level of Education (ref = sub-BA)							
BA+	-0.68***	-0.64***	-0.62***	-0.61***	-0.53***	-0.60***	-0.42***
Demographics							
Female (ref = Male)		-0.19***					-0.23***
Age		-0.02					-0.01
Race (ref = Non-Hispanic White)							
Black		0.32***					0.15**
Hispanic/Latino		0.03					-0.03
Other		0.05					0.01
Foreign Born (ref = U.S. Born)		-0.29***					-0.25***
Region of Residence (ref = South)							
West		-0.22***					-0.23***
Midwest		0.01					-0.05
Northeast		-0.30***					-0.34***
Parental Background							
Two-Parent Household (ref = One-Parent Household)			-0.07				-0.02
Parent Graduated College (ref = No College)			-0.12**				-0.08*
Parental Household Income			-0.01**				-0.00
Expectation to Complete College (ref = Not Disappointed)							
Somewhat Disappointed			0.02				0.02
Very Disappointed			-0.04				-0.02
Social Contexts							
Marital Status (ref = Married)							
Previously Married				0.24***			0.12*
Never Married				0.33***			0.18**
Presence of Children (ref = No Children)				0.06			0.05
6 or More Close Friends (ref = 5 or less)				-0.09			-0.02
Social Gatherings (ref = Never to 1-2x A Year)							
Several Times A Year				-0.10			-0.07
At Least Once A Month				-0.07			0.00
Religious Attendance (ref = Never)							
Sometimes				-0.03			-0.07
Often				-0.24***			-0.33***
Emotional Support – Spouse (ref = No Support)				-0.02			0.02
Emotional Support – Family (ref = No Support)				-0.03			-0.01
Emotional Support – Friends (ref = No Support)				0.00			0.06
Economic Well-being							
Personal Income					0.00		-0.01
Household Income					-0.04***		-0.03***
Paying a Mortgage (ref = No Mortgage)					-0.16***		-0.13**
Household Student Loans (ref = No Loans)					0.18***		0.14***

Employment Characteristics							
Occupation (ref = Managerial, Business, and Science)							
Service Occupations						0.01	-0.07
Sales and Office						0.14**	0.05
Natural Resources and Construction						0.26*	0.17
Production and Transportation						0.28***	0.04
Full-Time Hours (ref = Part-Time)						0.16**	0.10
Sedentary Work (ref = Non-Sedentary Occupation)						-0.07	0.02
Health Benefits (ref = No Benefits)						-0.02	-0.02
Sickness Benefits (ref = No Benefits)						-0.11	-0.04
R2	0.07	0.10	0.08	0.09	0.11	0.08	0.15

Source: Wave 5 of the National Longitudinal Study of Adolescent to Adult Health (N=8203).
Estimates include sampling weights to account for unequal probability of selection into the sample.
*p < 0.05; **p < 0.01; ***p < 0.001.

Table 3.2 includes a series of linear regression models estimating differences in adult health lifestyle index scores. The unadjusted estimates from Model 1 indicate that adults with at least a bachelor's degree have significantly better behavioral index scores ($p<0.001$), compared to those with sub-BA levels of postsecondary education (the reference category). This estimate remains largely the same when controlling for each group of explanatory factors included in this study; however, the estimated difference is slightly attenuated in the fully adjusted regression model.

Figure 3.1 Predicted Health Lifestyle Index Scores



Estimates from Table 3.2 Model 7 are converted into predicted health lifestyle index scores, while holding the independent control variables constant at typical values, their average proportions or means (Fox and Andersen 2006).

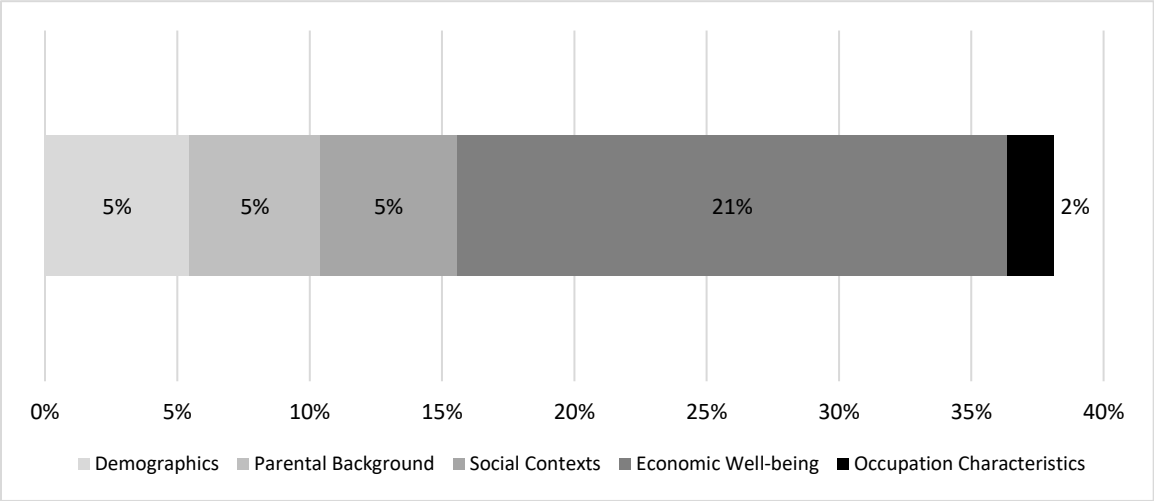
To provide an easy-to-interpret output, I also convert the estimates from Model 7 into fully adjusted predicted health lifestyle index scores, while holding the independent control variables constant at typical values, their average proportions or means (see Fox & Andersen 2006). The predicted index scores are plotted in Figure 3.1, along with their corresponding 95 percent confidence intervals. After controlling for differences in demographics, parental background, social contexts, economic well-being, and employment characteristics, the estimates support previous findings as adults with incomplete or lower-level postsecondary credentials have significantly higher predicted index scores (which indicates increased engagement in unhealthy behaviors), compared to adults with at least a bachelor's degree.

Table 3.3: Blinder-Oaxaca Decomposition of Health Lifestyles Index			
Health Lifestyles Index	Differences Due to Explanatory Factors	Confidence Interval	Percentage of Total Difference
Total Difference (ref = sub-BA)	-0.68***	[-0.76,-0.61]	100.00
Explained	-0.26***	[-0.32,-0.20]	38.12
Unexplained	-0.42***	[-0.51,-0.33]	61.88
Composition of Explained			
Demographics	-0.04***	[-0.05,-0.02]	5.36
Parental Background	-0.03***	[-0.06,-0.01]	4.95
Social Contexts	-0.04***	[-0.06,-0.01]	5.15
Economic Well-being	-0.14***	[-0.18,-0.10]	20.82
Employment Characteristics	-0.01	[-0.05,0.02]	1.74

Source: Wave 5 of the National Longitudinal Study of Adolescent to Adult Health (N=8203).
Estimates include sampling weights to account for unequal probability of selection into the sample.
Demographics include gender, age, race, immigrant status, and region of residence.
Parental Background includes two-parent household, parent completed college, parental household income, and expectation to complete college.
Social Contexts include marital status, presence of children, number of close friends, social gatherings, religious attendance, support from spouse, support from family, and support from friends.
Economic Well-being includes postsecondary enrolment, personal income, household income, household income per person, paying a mortgage, and household student loans.
Occupation Characteristics include occupation, hours worked, sedentary occupation, health benefits, and sickness benefits.
*p < 0.05; **p < 0.01; ***p < 0.001.

Table 3.3 includes estimates from a fully adjusted Oaxaca-Blinder decomposition model assessing differences in average health lifestyle index scores across sub-BA and BA+ levels of postsecondary education. The estimates indicate that approximately 36% of the postsecondary education-related disparities in adult health lifestyles is explained by differences in the explanatory factors assessed in this study, with measures of economic well-being explaining the greatest percentage (21%). Differences in demographics (5%), parental background (5%), and social contexts (5%) also explain a significant percentage; however, after controlling for personal and household income, differences in employment characteristics do not explain a significant percentage of the disparities across the two groups. Figure 3.2 includes a stacked bar graph of the estimated explained percentages from the decomposition model.

Figure 3.2 Decomposition of Disparities in Adult Health Lifestyles



3.5 Discussion

Research has previously established that adults with at least a bachelor's degree (BA+) exhibit healthier lifestyles than those with incomplete or lower-level (sub-BA) postsecondary credentials (Jehn 2022). Yet, we have known little about the source of these disparities. I address this gap and extend prior work by identifying and decomposing differences in the associations between a postsecondary education (sub-BA versus BA+) and adult health lifestyles using theoretical and empirically selected explanatory factors.

First, my initial findings indicate that there are significant postsecondary education-related disparities in health lifestyles between adults with incomplete or lower-level (sub-BA) postsecondary credentials and those with at least a bachelor's degree (BA+). Using a summation index of six unhealthy behaviors (which reflects a combined six-point scale), I find that sub-BA adults engage in a predicted average of 2.2 unhealthy behaviors, whereas the predicted average among BA+ adults is approximately 1.7 unhealthy behaviors.

The estimated difference in average behavioral index scores indicate substantial heterogeneity in adult health lifestyles, whereby adults with sub-BA levels of postsecondary education are found to engage in significantly more unhealthy behaviors

compared to those with at least a bachelor's degree. These estimates support the health lifestyles theoretical framework as they reflect a combined pattern of health behaviors based on available options according to social conditions and individual life chances (Cockerham et al. 1997).

My initial findings also support numerous existing studies that have linked BA+ levels of postsecondary education to better health behaviors and outcomes in adulthood (Carroll et al. 2017; Case and Deaton 2021; Cowell 2006; Jehn 2022; Kirkpatrick Johnson et al. 2016; Lawrence 2017; Walsemann et al. 2018; Zheng 2017). There has also been a growing number of recent studies that have shown that adults with sub-BA levels of postsecondary education report a higher prevalence of a broad range of health and pain-related conditions compared to high school graduates who never attended college (see Rosenbaum 2012; Skalamera and Hummer 2016; Zajacova and Lawrence 2021).

Next, estimates from my decomposition model reveals additional insights about the disparities in adult health lifestyles between adults with sub-BA and BA+ levels of postsecondary education. Economic well-being is found to explain the greatest percentage of the observed difference in average health lifestyle index scores (21%). Demographics, parental background, and social contexts each explain an additional five percent of that difference. Lastly, after controlling for personal and household income, employment characteristics are not found to explain a significant percentage of the difference between sub-BA and BA+ levels of postsecondary education.

Given the importance of economic well-being as an explanatory factor, my findings extend prior work that has found socioeconomic status to be a fundamental social determinant of adult health behaviors (Kirkpatrick Johnson et al. 2016; Link and Phelan 1995; Schüz et al. 2020). The increased engagement in unhealthy behaviors among adults with incomplete or lower-level credentials suggest that sub-BA levels of postsecondary education may not provide enough human capital, economic resources, and cognitive and noncognitive abilities to enable healthier lifestyles in adulthood (Carroll et al. 2017; Hout 2012; Mirowsky and Ross 2017). Lower economic returns to sub-BA levels of

postsecondary education may also be limiting their access to both health knowledge and health care which perpetuates social disadvantages.

Higher socioeconomic groups may also be using the adoption of healthier lifestyles as a means of setting themselves apart from their lower socioeconomic counterparts (Cockerham 2005). Such arguments stem from classical and modern theorists who emphasized that lifestyles are a source of social differentiation that reinforces group differences (Bourdieu 1984; Veblen and Mills 2017). For example, more physical activity, better nutritional habits, and lower rates of smoking and alcohol consumption represent forms of socioeconomic-based social distinctions that subsequently promote longevity (Andrews et al. 2017; Pampel, Krueger, and Denney 2010; Snead and Cockerham 2002). The remaining difference explained by demographics, parental background, and social contexts are also in line with previous findings. For example, researchers have found higher rates of unhealthy behaviors (e.g., substance use, poor diets, and low physical activity) among men, whereas women are less likely to engage in risk taking behaviors (Olson et al. 2017; Ross and Mirowsky 2010; Zajacova 2006). Black and Hispanic/Latino Americans continue to experience higher rates of social economic disadvantages than non-Hispanic White Americans, which in turn negatively influences adult health lifestyles (Simons et al. 2020; Vable et al. 2018).

Parental socioeconomic status experienced in childhood also serves as a powerful predictor of health and mortality in adulthood (Cohen et al. 2010). For example, those with college educated and higher socioeconomic parents are more likely to have better access to educational opportunities and subsequently higher status occupations that yield better economic returns. Conversely, socioeconomic disadvantages during childhood may place individuals at risk of poor adult health lifestyles as a result of having less access to health care and knowledge about the negative consequences of health-compromising behaviors (Cohen et al. 2010; Hanson and Chen 2007).

Higher education also increases the likelihood of marriage and the development of strong social connections which lead to healthier behaviors in adulthood (Hout 2012; Lawrence 2017; Umberson et al. 2010). The various social roles experienced through family and

social networks have in turn been found to influence adult health behaviors and lifestyles (Daw, Margolis, and Verdery 2015; Mollborn and Lawrence 2018). In particular, social roles influence health lifestyles as they define our exposure to health-related norms and customs that provide behavioral guidance over the life course (Mollborn et al. 2021).

3.5.1 Limitations

Although I was able to explain 36% of the group difference in adult health lifestyles, this work has limitations that future research could address. While I control for differences in a rich set of theoretical and empirically selected explanatory factors, there may be other factors that were missed. For example, future research could further examine social contexts and occupation related determinants of adult health lifestyles. Future research should seek to explore ways to incorporate those not in the labor market for a broader analysis of occupation-related characteristics. Moreover, broader operationalizations beyond individual behaviors are needed. Large-scale surveys should measure local or cultural definitions of health behaviors by incorporating multiple group-based identities and norms. Researchers could then identify how particular behaviors are perceived across local communities and uncover other critical explanatory factors that have yet to be explored.

3.5.2 Conclusion

In this article, I describe significant behavioral disparities in adult health lifestyles between adults with sub-BA and BA+ levels of postsecondary education. These differences persist even after controlling for a rich set of explanatory factors including demographics, parental background, social contexts, economic well-being, and employment characteristics. The estimates support the health lifestyles theoretical framework and highlight the complex interplay between structure and agency as adults with similar levels of postsecondary education are found to exhibit similar health lifestyles. These findings are also informative for potential targeted public health interventions, particularly among lower-socioeconomic groups. I also address limitations to my study and provide potential directions for future research. Lastly, I strongly encourage scholars to continue to pay close attention to how differences across these key

explanatory factors influence both returns to postsecondary education and subsequently adult health lifestyles.

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Appendix Table 3.1 Regression Estimates (Individual Health Behaviors)

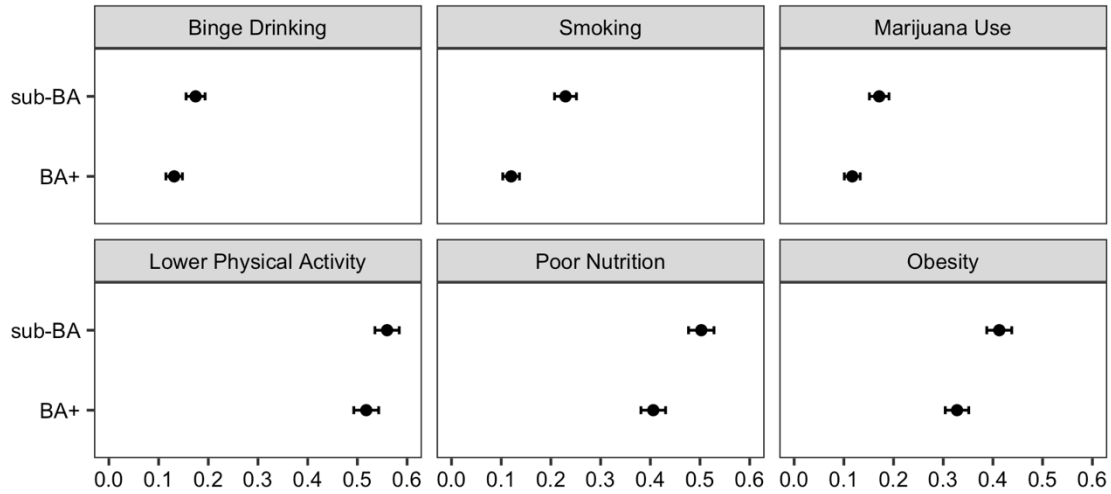
Appendix Table 3.1: Fully Adjusted Logistic Regression of Individual Health Behaviors

	Binge Drinking	Smoking	Marijuana Use	Lower Physical Activity	Poor Nutrition	Obesity (BMI)
Level of Education (ref = sub-BA)	0.72**	0.46***	0.64***	0.84*	0.68***	0.69***
BA+						
Demographic Characteristics						
Female (ref = Male)	0.41***	0.87	0.54***	1.35***	0.68***	1.05
Age	0.94*	0.98	0.96	0.99	1.01	1.04
Race (ref = Non-Hispanic White)						
Black	0.88	0.62***	1.52**	0.99	1.61***	1.26*
Hispanic/Latino	1.52**	0.56***	1.06	0.77*	1.12	1.12
Other	1.05	0.84	0.73	1.14	1.41*	0.76
Foreign Born (ref = U.S. Born)	0.69	0.79	0.61*	1.02	0.85	0.54***
Region of Residence (ref = South)						
West	0.63***	0.79	1.82***	0.82*	0.59***	0.79*
Midwest	1.22	1.17	1.26	0.87	0.76**	0.82*
Northeast	0.74*	0.95	1.05	0.91	0.34***	0.83
Parental Background						
Two-Parent Household (ref = One-Parent Household)	0.94	0.88	0.80*	1.02	1.13	0.97
Parent Graduated College (ref = No College)	0.89	1.00	1.21	0.92	0.81**	0.90
Parental Household Income	1.01	1.00	1.02***	1.00	0.99*	0.98**
Expectation to Complete College (ref = Not Disappointed)						
Somewhat Disappointed	0.92	0.95	1.15	1.08	1.06	0.99
Very Disappointed	0.79	0.83	1.02	1.12	1.08	0.97
Social Contexts						
Marital Status (ref = Married)						
Previously Married	1.54**	2.11***	1.69***	0.73**	0.99	0.77*
Never Married	1.63***	1.83***	1.32*	0.87	1.07	0.89
Presence of Children (ref = No Children)	1.06	1.06	0.71**	1.13	1.22*	1.00
6 or More Close Friends (ref = 5 or less)	1.40**	1.27*	1.37*	0.80*	0.88	0.75**
Social Gatherings (ref = Never to 1-2x A Year)						
Several Times A Year	0.98	0.57***	1.16	0.89	1.14	1.01
At Least Once A Month	1.64*	0.72*	1.63**	0.76*	1.05	0.95
Religious Attendance (ref = Never)						
Sometimes	0.84	0.91	0.82*	0.91	1.21*	0.95
Often	0.39***	0.39***	0.24***	0.84*	1.34***	1.10
Emotional Support – Spouse (ref = No Support)	1.16	1.30*	1.23	0.94	0.89	0.85
Emotional Support – Family (ref = No Support)	1.06	1.14	1.01	0.92	1.05	0.89
Emotional Support – Friends (ref = No Support)	1.00	1.17	0.93	1.00	1.11	1.13
Economic Well-being						
Postsecondary Enrolment (ref = Not Enrolled)	0.74	0.85	0.79	0.78*	0.86	1.01
Personal Income	0.99	1.01	0.96*	1.00	0.97*	1.01
Household Income	1.00	0.97*	1.00	0.97***	0.98*	0.94***
Paying a Mortgage (ref = No Mortgage)	1.04	0.83	0.73**	0.82**	1.02	0.95
Household Student Loans (ref = No Loans)	1.31**	1.13	1.14	0.97	1.05	1.34***

Labor Market Conditions						
Occupation (ref = Managerial, Business, and Science)						
Service Occupations	1.45*	1.00	1.02	0.73**	0.87	0.96
Sales and Office	1.35*	1.31*	1.08	0.86	1.01	0.96
Natural Resources and Construction	1.74**	1.29	0.72	1.33	1.03	0.94
Production and Transportation	1.07	1.38	0.64*	1.06	0.95	1.17
Full-Time Hours (ref = Part-Time)	0.90	1.01	0.90	1.12	1.25*	1.30*
Sedentary Work (ref = Non-Sedentary Occupation)	1.01	0.76**	0.93	1.25**	1.03	1.06
Health Benefits (ref = No Benefits)	1.15	0.76	0.77	1.01	0.95	1.25
Sickness Benefits (ref = No Benefits)	1.04	0.72*	0.77	1.06	1.19	1.03

Source: Wave 5 of the National Longitudinal Study of Adolescent to Adult Health (N=8203).
Estimates include sampling weights to account for unequal probability of selection into the sample.
*p < 0.05; **p < 0.01; ***p < 0.001.

Appendix Figure 3.1 Predicted Probabilities of Individual Health Behaviors



Estimates from Appendix Table 3.1 are converted into predicted probabilities of engaging in each of the individual health behaviors, while holding the independent control variables constant at typical values, their average proportions or means (Fox and Andersen 2006).

Appendix Table 3.2 Regression Estimates (Weighted Behavioral Index)

Appendix Table 3.2: Linear Regression of Weighted Health Lifestyles Index							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Level of Education (ref = sub-BA)							
BA+	-0.52***	-0.48***	-0.47***	-0.47***	-0.41***	-0.46***	-0.32***
Demographic Characteristics							
Female (ref = Male)		-0.17***					-0.19***
Age		-0.01*					-0.01
Race (ref = Non-Hispanic White)							
Black		0.24***					0.12**
Hispanic/Latino		0.03					-0.01
Other		0.02					-0.00
Foreign Born (ref = U.S. Born)		-0.24***					-0.20***
Region of Residence (ref = South)							
West		-0.14**					-0.16***
Midwest		0.02					-0.03
Northeast		-0.20***					-0.24***
Parental Background							
Two-Parent Household (ref = One-Parent Household)			-0.06*				-0.02
Parent Graduated College (ref = No College)			-0.08*				-0.06
Parental Household Income			-0.00*				-0.00
Expectation to Complete College (ref = Not Disappointed)							
Somewhat Disappointed			0.01				0.02
Very Disappointed			-0.03				-0.01
Social Contexts							
Marital Status (ref = Married)							
Previously Married				0.19***			0.10*
Never Married				0.26***			0.14**
Presence of Children (ref = No Children)				0.03			0.02
6 or More Close Friends (ref = 5 or less)				-0.05			-0.00
Social Gatherings (ref = Never to 1-2x A Year)							
Several Times A Year				-0.06			-0.04
At Least Once A Month				-0.03			0.03
Religious Attendance (ref = Never)							
Sometimes				-0.04			-0.07
Often				-0.23***			-0.29***
Emotional Support – Spouse (ref = No Support)				-0.01			0.02
Emotional Support – Family (ref = No Support)				-0.03			-0.01
Emotional Support – Friends (ref = No Support)				-0.00			0.04
Economic Well-being							
Postsecondary Enrolment (ref = Not Enrolled)					-0.18***		-0.14**
Personal Income					0.00		-0.01
Household Income					-0.03***		-0.02***
Paying a Mortgage (ref = No Mortgage)					-0.14***		-0.10**
Household Student Loans (ref =					0.14***		0.11***

No Loans)							
Labor Market Conditions							
Occupation (ref = Managerial, Business, and Science)							
Service Occupations						0.01	-0.05
Sales and Office						0.11**	0.03
Natural Resources and Construction						0.20*	0.13
Production and Transportation						0.20**	0.02
Full-Time Hours (ref = Part-Time)						0.12**	0.07
Sedentary Work (ref = Non-Sedentary Occupation)						-0.05	0.02
Health Benefits (ref = No Benefits)						-0.01	-0.01
Sickness Benefits (ref = No Benefits)						-0.09	-0.04
R2	0.07	0.09	0.07	0.09	0.11	0.08	0.15

Source: Wave 5 of the National Longitudinal Study of Adolescent to Adult Health (N=8203).
Estimates include sampling weights to account for unequal probability of selection into the sample.
*p < 0.05; **p < 0.01; ***p < 0.001.

Chapter 4

4 Transitions to Adulthood: Postsecondary Education-Related Disparities in Health Lifestyles

4.1 Introduction

Despite the large and robust effects of a postsecondary education on adult health lifestyles (Kirkpatrick Johnson et al. 2016; Link and Phelan 1995; Schüz et al. 2020), we know little about how and when these associations evolve throughout adulthood. The population health literature generally focuses on postsecondary education-related behavioral disparities in adulthood, which is assessed after an individual has already completed their highest level of educational attainment (see Collin et al. 2021; Cutler and Lleras-Muney 2010; Ettman, Cohen, and Galea 2020; Jehn 2022; Pampel, Krueger, and Denney 2010). However, while a postsecondary education provides the knowledge and resources to enable healthier lifestyles, there is some evidence to suggest that behavioral disparities may appear earlier in the adult life course, long before the education is acquired (Maralani 2014). I therefore examine the relationship between completed levels of postsecondary education measured in adulthood (after the traditional ages at which education is completed) and health lifestyles measured at multiple time periods to determine how and when these associations develop during the transition to adulthood.

Drawing on life course theory, researchers have found that health lifestyles are influenced by a sequence of socially defined events and exposures from earlier stages of the adult life course (Crosnoe, Kendig, and Benner 2017; Jones et al. 2019; Umberson, Crosnoe, and Reczek 2010). For example, the transition to adulthood is a critical developmental stage as health behavior practices are adopted or discarded and can subsequently extend into middle and later adulthood (Daw, Margolis, and Wright 2017; Harris et al. 2006; Harris and McDade 2018; Noppert et al. 2021; Rogers, Hummer, and Nam 2000). In fact, many young adults experiment with risk behaviors, such as smoking and alcohol consumption, and often change their physical activity practices, which can lead to significant weight gain (Daw et al. 2017; Kwan et al. 2012; Maggs and Schulenberg

2004; Nelson et al. 2008; Tucker, Ellickson, and Klein 2003). Engaging in health risk behaviors during critical periods can result in exposures that leave a lasting imprint on adult health, either concurrently or years later (Goosby, Cheadle, and McDade 2016; Lawrence, Mollborn, and Hummer 2017; Montez and Hayward 2011). Therefore, to better understand the postsecondary education gradient in health lifestyles we must consider how these associations emerge across the adult life course.

Higher levels of postsecondary education in adulthood may already be influencing behavioral practices long before the traditional ages at which education is completed. The positive links between a postsecondary education and adult health lifestyles have been well documented (Duke and Macmillan 2016; Link and Phelan 1995; Walsemann, Hummer, and Hayward 2018). The knowledge and skills acquired through postsecondary educational attainment can directly impact health behaviors by enhancing cognitive and non-cognitive abilities to enable healthier lifestyles (Brown 2016; Carroll et al. 2017; Duke and Macmillan 2016). Higher educated adults generally exhibit healthier behaviors including lower rates of smoking and alcohol consumption, increased physical activity, greater use of preventative care measures, and better nutritional habits (Collin et al. 2021; Cutler and Lleras-Muney 2010; Ettman et al. 2020; Pampel et al. 2010). However, if adults with higher levels of postsecondary education exhibit healthier behavior practices because they have better analytical or self-efficacy skills, then they must have acquired these skills and resources earlier in the transition to adulthood (Maralani 2014).

Postsecondary education-health studies also typically only examine one risk behavior at a time (see Boardman and Alexander 2011; Crosnoe et al. 2017; Maralani 2014; Pollard et al. 2010). This is an important limitation as we know that health behaviors do not act in isolation and often cluster together to form an overall health lifestyle (Cockerham 2005). The health lifestyles theoretical framework merges structure with agency to highlight how social conditions and individual life chances are associated with a broad spectrum of potential health-related behaviors. Health lifestyles research also sheds light on why health behaviors persist or change as well as how health disparities are linked to social inequalities (Mollborn, Lawrence, and Saint Onge 2021). By assessing multiple behaviors simultaneously, we also gain deeper insights about the constellation of

behaviors that make up an overall adult health lifestyle (Cockerham 2005). Therefore, rather than only focusing on an individual health behavior, I combine some of the leading behavioral causes of early mortality to identify a broad spectrum of behaviors influenced by postsecondary educational attainment.

4.2 Contributions of This Study

The present study draws on data from the National Longitudinal Study of Adolescent to Adult Health (Add Health) to assess the relationships between postsecondary education and health lifestyles. To gain a better understanding about how and when these associations evolve throughout adulthood, completed levels of postsecondary education measured in adulthood is used to assess health lifestyles measured at multiple time periods. Based on the life course and health lifestyles theoretical frameworks, I hypothesize that higher levels of completed postsecondary education in adulthood will positively influence behavioral practices at earlier stages of the adult life course and that education-related disparities in health lifestyles will increase over time. My aim is to extend prior work by providing estimates for both multiple time periods and health behaviors as well as to inform empirical investigations of risk-related behaviors during the transition to adulthood.

4.3 Methodology

4.3.1 Data

Data comes from the National Longitudinal Study of Adolescent to Adult Health (Add Health), administered by the University of North Carolina Population Center. Add Health is a longitudinal sample of respondents that have been followed from adolescence into adulthood through a total of five waves (Harris et al. 2009). Schools included in the Add Health sampling frame were selected by region, urbanicity, school size and type, and racial composition based on a stratified sampling design. In-school data collection began when respondents were in grades 7–12 with a sample of 20,745 adolescents being selected for the Wave I in-home interviews in 1994-1995. Additional in-home interviews were conducted in 1996 (Wave II), 2001–2002 (Wave III), 2008–2009 (Wave IV), and 2016-2018 (Wave V).

My initial sample is defined as respondents that participated in Waves III to V (N = 8,876), which effectively captures information as respondents were pursuing a postsecondary education in young adulthood (Wave III) as well as their transitions to adulthood (Waves IV and V). These waves also include measures of important health behaviors that were not recorded during earlier periods of data collection. With a large number of education and health behavior-related questions, these longitudinal data are uniquely positioned to offer insights about how and when the associations between a postsecondary education and health lifestyles emerge during the transition to adulthood.

Respondents are excluded if they failed to have valid responses for any of the individual health behaviors assessed in this study (N – 1,003). I also exclude respondents without at least a high school education (N – 482). As a result, my final analytic sample includes 7,391 respondents.

4.3.2 Measures

Outcome Variables

I examine a total of six adult health behaviors including binge drinking, smoking, marijuana use, lower physical activity, poor nutrition, and obesity. Each of the individual adult health behaviors are self-reported except for obesity, which is derived using a respondent's weight and height to calculate their body mass index. They are also each measured at three time periods, including Wave III (age 18-26), Wave IV (age 24-32), and Wave V (age 33-43). Table 1.1 includes a detailed description of how these variables are coded.

Binge drinking measures the number of alcoholic beverages respondents usually have each time they had drinks in the past 12 months (Wave III) or 30 days (Waves IV and V). Using the Centre for Disease Control and Prevention's (CDC) definition, those having more than four (women) or five (men) are considered binge drinkers (CDC 2022). Both smoking and marijuana use are operationalized as dichotomous measures identifying respondents who have smoked tobacco or marijuana, respectively, at least once in the past 30 days.

Lower physical activity measures bouts of exercise across several broad categories of physical activity, coded with a range of 0 to 49. Poor nutrition measures how many times respondents ate fast food in the last 7 days, with a range of 0 to 50. Both variables are dichotomized at their mean to identify respondents with below average levels of physical activity or an above average level of fast-food consumption, respectively. Obesity is a dichotomous measure of the proportion of respondents with a body mass index ≥ 30. While body mass index is not a direct health behavior, it is an important biomarker proxy of nutritional habits (see Knol et al. 2017; Lawrence 2017; Price et al. 2017; Shinde 2019).

After dichotomizing each of the individual health behaviors, I constructed a summation index of adult health lifestyles (Mullan Harris, Lee, and DeLeone 2010). Creating a behavioral index allows me to identify postsecondary education-related disparities across a broad spectrum of health behaviors. Each unit increase on the lifestyles index represents regular engagement in one additional unhealthy behavior, whereby lower scores indicate better health lifestyles.

Explanatory Variables

The focal explanatory variable is the respondent's level of educational attainment in adulthood (measured after the traditional age at which education is completed - Wave V). This variable distinguishes between respondents with a high school diploma (which serves as reference and the minimum entry requirement for postsecondary educational attainment), sub-BA (including incomplete and lower-level postsecondary credentials), and those with at least a bachelor's degree (BA+, which also includes masters, doctoral, and professional degrees).

I also account for basic demographics including gender (male as reference versus female), year of birth (continuous measure ranging from 1974 to 1983), and race/ethnicity (non-Hispanic white as reference, Black, Hispanic/Latino, and 'other' racial identities). Differences across these demographic characteristics are known to influence returns to a postsecondary education and are associated with unique sets of

health behaviors that have variable impacts on overall health and well-being (Mollborn et al. 2014; Ross, Hill, and Mirowsky 2016).

4.3.3 Statistical Analysis

To address missingness for independent variables as well as to retain cases across estimates and models, I use multiple imputation by chained equations (MICE) with ten replicates (Royston and White 2011). However, missing data was relatively low across measures (<0.5% for both level of education and birth year). All analyses also use cross-sectional survey weights in order to account for attrition across survey waves as well as to obtain unbiased population estimates

For my analyses, I first estimate mean health lifestyle index scores as well as the distribution of the individual health behaviors by level of education for each wave of responses (Table 4.1). I then provide sample characteristics for each of the explanatory variables included in the analyses for both the full sample and by level of education (high school diploma, sub-BA, and BA+; Table 4.2). Lastly, I include a series of fully adjusted ordinary least squares (health lifestyle index) and logistic (individual health behaviors) regression estimates across each wave of responses (Table 4.3). The estimates from the health lifestyle index models are subsequently converted into predicted behavioral index scores (Figure 4.1), while holding the independent control variables constant at typical values, their average proportions or means (Fox and Andersen 2006).

4.3.4 Sensitivity Analysis

Using additional data from Wave I (collected in 1995), I also include a sensitivity analysis to examine a potential reverse association whereby adolescent measures of academic performance, health and health behaviors, and parental background characteristics influence postsecondary educational attainment and subsequently adult health lifestyles (see Appendix Table 4.1 for a detailed list of these variables). To test for potential reverse associations, I first calculate a fully adjusted logistic regression model to estimate propensity scores related to BA+ completion (Wave V), with a high school diploma or sub-BA levels of postsecondary education serving as reference. I then use the likelihood of BA+ completion as an explanatory variable to provide a series of ordinary

least squares (health lifestyle index) and logistic (individual health behaviors) regression estimates across each wave of responses (Waves III to V; see Appendix Table 4.2).

4.4 Results

Table 4.1 presents mean health lifestyle index scores as well as the distribution of the individual health behaviors by level of education across each wave of responses. The observed patterns represent unadjusted education-related differences in adult behavioral practices. Estimates of the behavioral index suggests that respondents with at least a bachelor's degree are found to have lower average index scores throughout the transition to adulthood (indicating healthier lifestyles) compared to those with either a high school diploma or sub-BA levels of postsecondary education. A similar pattern is also observed for the distribution of the individual health behaviors. In contrast, those with lower levels of education (high school or sub-BA) are found to have comparable estimates for both the behavioral index and the individual health behaviors in young adulthood (Wave III) with disparities subsequently emerging later in the transition to adulthood (Waves IV and V).

Table 4.1 Unadjusted Estimates of Health Lifestyles

Table 4.1: Health Lifestyles by Level of Education						
			Health Lifestyle Index (Mean)			
Level of Education	Wave III		Wave IV		Wave V	
HS Diploma	2.4	[2.3, 2.6]	2.3	[2.2, 2.4]	2.4	[2.3, 2.5]
sub-BA	2.4	[2.3, 2.4]	2.1	[2.1, 2.2]	2.1	[2.1, 2.2]
BA+	1.9	[1.8, 2.0]	1.5	[1.4, 1.5]	1.6	[1.5, 1.6]
			Individual Health Behaviors (Percent %)			
			Binge Drinking			
Level of Education	Wave III		Wave IV		Wave V	
HS Diploma	41.4	[36.7, 46.1]	30.2	[25.7, 34.6]	25.2	[21.2, 29.2]
sub-BA	40.9	[38.5, 43.2]	25.8	[23.6, 27.9]	20.7	[18.7, 22.7]
BA+	39.9	[37.6, 42.3]	21.0	[18.9, 23.0]	14.8	[13.1, 16.6]
			Smoking			
Level of Education	Wave III		Wave IV		Wave V	
HS Diploma	45.6	[40.8, 50.3]	50.5	[45.8, 55.2]	39.5	[34.8, 44.1]
sub-BA	40.1	[37.8, 42.5]	41.6	[39.2, 43.9]	31.0	[28.8, 33.3]
BA+	23.7	[21.6, 25.8]	23.8	[21.7, 25.9]	13.0	[11.3, 14.7]
			Marijuana Use			
Level of Education	Wave III		Wave IV		Wave V	
HS Diploma	23.4	[19.4, 27.5]	18.1	[14.3, 21.9]	22.6	[18.5, 26.6]
sub-BA	24.9	[22.8, 27.0]	20.0	[18.0, 22.0]	23.0	[20.9, 25.0]
BA+	21.6	[19.5, 23.7]	12.3	[10.6, 13.9]	15.5	[13.7, 17.3]
			Lower Physical Activity			
Level of Education	Wave III		Wave IV		Wave V	
HS Diploma	63.7	[59.2, 68.2]	65.3	[60.8, 69.8]	67.3	[62.8, 71.7]
sub-BA	65.5	[63.2, 67.7]	62.1	[59.7, 64.3]	64.1	[61.8, 66.4]
BA+	59.1	[56.7, 61.4]	55.1	[52.7, 57.4]	58.8	[56.5, 61.2]
			Poor Nutrition			
Level of Education	Wave III		Wave IV		Wave V	
HS Diploma	46.1	[41.4, 50.9]	29.3	[24.8, 33.7]	37.2	[32.6, 41.7]
sub-BA	43.3	[40.9, 45.7]	26.1	[24.0, 28.3]	30.4	[28.2, 32.6]
BA+	33.1	[30.9, 35.3]	14.3	[12.7, 15.8]	22.0	[20.1, 24.0]
			Obesity (BMI)			
Level of Education	Wave III		Wave IV		Wave V	
HS Diploma	24.2	[20.2, 28.2]	40.2	[35.6, 44.8]	50.6	[45.9, 55.4]
sub-BA	23.0	[21.1, 25.0]	37.2	[34.9, 39.4]	45.0	[42.6, 47.3]
BA+	13.3	[11.7, 14.9]	23.7	[21.8, 25.7]	31.4	[29.2, 33.5]
N	7,391		7,391		7,391	

Source: National Longitudinal Study of Adolescent to Adult Health.
All descriptive statistics include sampling weights to account for unequal probability of selection into the sample
Health lifestyles index ranges from 0-6 with higher scores indicating an increased number of unhealthy behaviors

Table 4.2 describes the characteristics of the target population across the explanatory variables used in this study, for the full sample as well as stratified by level of education (high school, sub-BA, and BA+). Demographic differences indicate that the majority of adults with a high school diploma are men, while the opposite is found among those with sub-BA and BA+ levels of postsecondary education. Respondents are found to have similar average birth years, regardless of level of education, which reflects the relatively homogenous age range of the Add Health sample. Lastly, there is also a larger percentage of Black and Hispanic/Latino adults with either a high school diploma or sub-BA levels of postsecondary education. Given these patterns, each of my regression models control for differences in demographic characteristics.

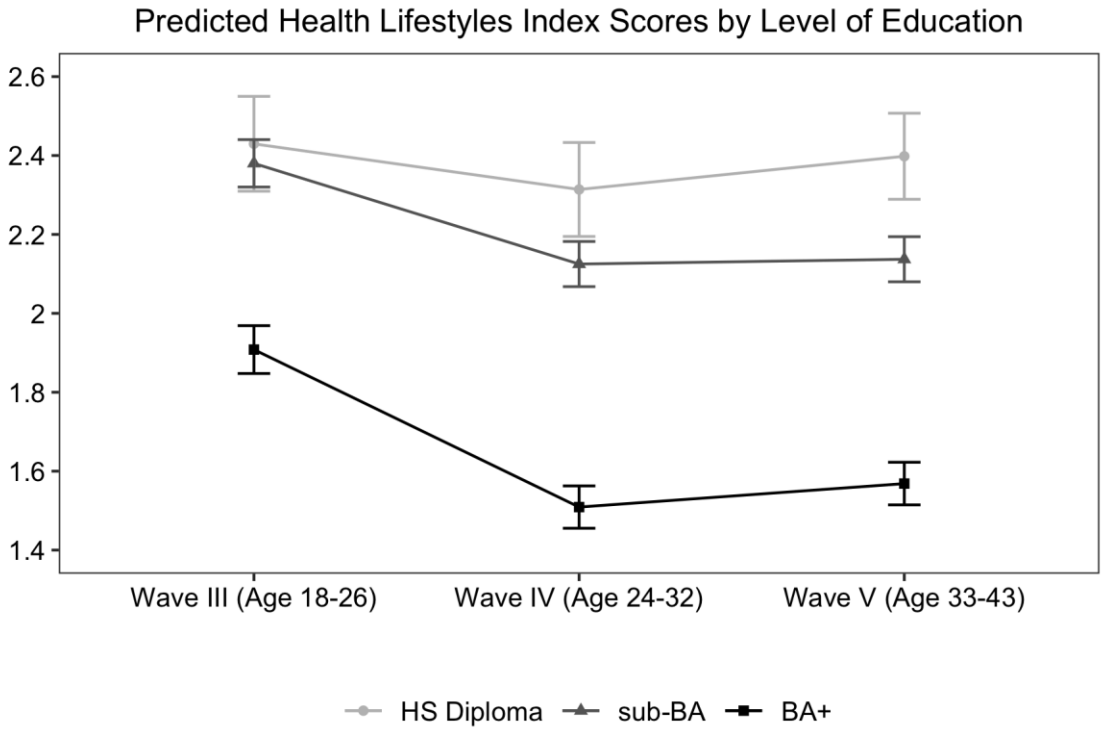
Table 4.2 Sample Characteristics

Table 4.2: Characteristics of the Target Population				
	Total Sample	High School	sub-BA	BA+
Level of Education				
HS Diploma (%)	12.6			
sub-BA (%)	44.0			
BA+ (%)	43.4			
Demographics				
Female (%)	52.5	38.0	52.6	56.6
Birth Year (mean)	1979.2	1979.0	1979.2	1979.2
Race/Ethnicity (%)				
Non-Hispanic White	71.2	66.9	69.5	74.3
Black	13.8	16.3	15.3	11.5
Hispanic/Latino	9.8	12.5	11.0	7.7
Other	5.2	4.4	4.3	6.4
N	7,391	823	3,088	3,480

Source: National Longitudinal Study of Adolescent to Adult Health.
All descriptive statistics include sampling weights to account for unequal probability of selection into the sample

Table 4.3 includes a series of fully adjusted ordinary least squares (health lifestyle index) and logistic (individual health behaviors) regression estimates. After controlling for differences in demographics, BA+ adults continue to exhibit significantly lower behavioral index scores (healthier lifestyles) across each wave of responses compared to their high school counterparts. In contrast, estimated index scores among those with sub-BA levels of postsecondary education remain comparable to those with a high school diploma in young adulthood (Wave III) with disparities emerging later in the transition to adulthood (Waves IV and V). To help visualize how behavioral disparities emerge throughout the transition to adulthood, predicted index scores are plotted in Figure 4.1, along with their corresponding 95 percent confidence intervals. These estimates support previous findings as postsecondary education-related behavioral disparities are found to emerge long before the education is completed in adulthood (Maralani 2014).

Figure 4.1 Predicted Health Lifestyle Index Scores



Source: National Longitudinal Study of Adolescent to Adult Health

Table 4.3 Regression Estimates (Health Lifestyles by Level of Education)

Table 4.3: Regression Estimates of Health Lifestyles by Level of Education

	Health Lifestyles Index (Regression Coefficients)					
Level of Education	Wave III		Wave IV		Wave V	
sub-BA	-0.05	[-0.18, 0.08]	-0.19**	[-0.32, -0.06]	-0.26***	[-0.38, -0.14]
BA+	-0.52***	[-0.66, -0.39]	-0.80***	[-0.94, -0.67]	-0.83***	[-0.95, -0.71]
	Individual Health Behaviors (Odds Ratios)					
	Binge Drinking					
Level of Education	Wave III		Wave IV		Wave V	
sub-BA	1.05	[0.84, 1.32]	0.88	[0.69, 1.13]	0.86	[0.67, 1.11]
BA+	1.00	[0.79, 1.25]	0.68**	[0.52, 0.87]	0.58***	[0.45, 0.76]
	Smoking					
Level of Education	Wave III		Wave IV		Wave V	
sub-BA	0.78*	[0.62, 0.97]	0.69**	[0.56, 0.86]	0.69**	[0.55, 0.86]
BA+	0.34***	[0.27, 0.42]	0.29***	[0.23, 0.36]	0.22***	[0.17, 0.29]
	Marijuana Use					
Level of Education	Wave III		Wave IV		Wave V	
sub-BA	1.14	[0.88, 1.48]	1.21	[0.91, 1.61]	1.09	[0.84, 1.41]
BA+	0.95	[0.73, 1.24]	0.68*	[0.50, 0.92]	0.68**	[0.52, 0.89]
	Lower Physical Activity					
Level of Education	Wave III		Wave IV		Wave V	
sub-BA	1.00	[0.80, 1.25]	0.80	[0.64, 1.01]	0.83	[0.66, 1.04]
BA+	0.74**	[0.59, 0.93]	0.59***	[0.47, 0.74]	0.66***	[0.53, 0.83]
	Poor Nutrition					
Level of Education	Wave III		Wave IV		Wave V	
sub-BA	0.95	[0.76, 1.17]	0.93	[0.72, 1.20]	0.77*	[0.61, 0.96]
BA+	0.63***	[0.51, 0.79]	0.46***	[0.35, 0.59]	0.51***	[0.41, 0.65]
	Obesity (BMI)					
Level of Education	Wave III		Wave IV		Wave V	
sub-BA	0.93	[0.73, 1.19]	0.85	[0.69, 1.06]	0.78*	[0.63, 0.96]
BA+	0.49***	[0.38, 0.63]	0.46***	[0.36, 0.57]	0.44***	[0.36, 0.55]
N	7,391		7,391		7,391	

Source: National Longitudinal Study of Adolescent to Adult Health
Estimates include sampling weights to account for unequal probability of selection into the sample
Regression coefficients and odds ratios shown (ref = high school diploma)
Each model controls for gender, birth year, and race/ethnicity

Estimated differences across the individual behaviors provide additional insights about how and when postsecondary education-related behavioral disparities emerge. For example, after controlling for demographics, young adults (Wave III) are found to have comparable odds of binge drinking and marijuana use regardless of their level of education in adulthood; however, compared to their high school counterparts, BA+ adults exhibit significantly lower odds of engaging in the remaining health behaviors throughout the entire transition to adulthood. In contrast, adults with lower levels of education (high school and sub-BA) exhibit similar odds of engaging in the individual health behaviors across waves. There is one notable exception whereby those with sub-BA levels of postsecondary education have significantly lower odds of smoking throughout adulthood compared to their high school counterparts.

Appendix Table 4.2 accounts for a potential reverse association whereby adolescent measures of academic performance, health and health behaviors, and parental background (see Appendix Table 4.1) may influence the relationship between postsecondary educational attainment and adult health lifestyles. These estimates are calculated using propensity scores related to BA+ completion in adulthood (Wave V), with lower levels of education (high school and sub-BA) serving as reference. After additionally controlling for differences in demographics, the observed relationship between the likelihood of BA+ completion and both the health lifestyle index and individual behaviors corroborate estimates reported in my earlier findings. Respondents with greater likelihoods of completing at least a bachelor's degree are found to have significantly lower index scores (healthier lifestyles) throughout the transition to adulthood. The patterns across the individual behaviors also remain largely the same as those reported earlier; however, after accounting for a potential reverse association, education-related disparities in alcohol consumption appear to emerge slightly later in adulthood (Wave V).

4.5 Discussion

Despite the large and robust effects of a postsecondary education on adult health lifestyles (Kirkpatrick Johnson et al. 2016; Link and Phelan 1995; Schüz et al. 2020), we have known little about how and when these associations begin to emerge. This is a critical omission as health behaviors serve as important precursors for many chronic

illnesses later in life (Hanson and Chen 2007). There has also been some evidence to suggest that postsecondary education-related behavioral disparities may emerge long before education is completed in adulthood (Maralani 2014). I therefore address this gap and extend prior work by examining the relationship between completed levels of postsecondary education in adulthood and health lifestyles measured at multiple time periods to determine how and when these associations develop during the transition to adulthood.

My initial findings indicate that there is substantial behavioral heterogeneity between adults with lower levels of education (high school and sub-BA) and those with at least a bachelor's degree (BA+). Using a summation index of unhealthy behaviors (which reflects a combined six-point scale), I find that higher-educated adults (BA+) exhibit significantly better health lifestyles throughout the transition to adulthood compared to those with lower levels of education. In contrast, those with a high school diploma or sub-BA levels of postsecondary education exhibit comparable behavioral index scores in young adulthood (Wave III) with disparities subsequently emerging later in the transition to adulthood (Waves IV and V). The observed pattern remains largely the same when examining the individual health behaviors assessed in this study.

These combined estimates support both the life course and health lifestyles theoretical frameworks and highlight how social conditions and individual life chances can display both continuity and change in behavioral practices throughout the transition to adulthood. Moreover, my initial estimates provide further evidence that postsecondary education-related disparities in health lifestyles emerge long before education is completed in adulthood, particularly among those with at least a bachelor's degree (BA+).

My initial estimates also support numerous existing studies that have linked BA+ levels of postsecondary education to better health behaviors and outcomes in adulthood (Carroll et al. 2017; Case and Deaton 2021; Cowell 2006; Jehn 2022; Kirkpatrick Johnson et al. 2016; Lawrence 2017; Walsemann et al. 2018; Zheng 2017). There has also been a growing number of studies that suggest sub-BA adults have a higher prevalence of a broad range health and pain-related conditions compared to high school graduates that

never attended college (see Rosenbaum 2012; Skalamera and Hummer 2016; Zajacova and Lawrence 2021).

Next, estimates from my fully adjusted regression models reveal additional insights about postsecondary education-related disparities in adult health lifestyles throughout the transition to adulthood. After controlling for differences in demographics, estimates across levels of education (high school, sub-BA, and BA+) remain largely the same as the unadjusted estimates reported earlier. However, there is one notable exception as respondents were found to have comparable odds of binge drinking and marijuana use regardless of their level of education in young adulthood (Wave III) with disparities subsequently emerging later in the transition to adulthood (Waves IV and V). These estimates support prior work as both gender and race/ethnicity have been found to influence returns to postsecondary educational attainment (Jehn 2022; Mollborn et al. 2014; Ross et al. 2016).

4.5.1 Limitations

Although I provide estimates for both multiple time periods and health behaviors across the transition to adulthood, this work has limitations that future research could address. For example, while I control for differences in demographic characteristics, future research could further examine social and contextual determinants of health lifestyles at various stages of adulthood. Attention should be paid to how the relationship between these potential explanatory factors and adult health lifestyles may change or interact over time. Moreover, future research could examine postsecondary education-related disparities in health lifestyles across longer trajectories of adulthood as these critical insights may help improve our understanding of population health.

4.5.2 Conclusion

In this article, I describe how and when significant postsecondary education-related disparities in health lifestyles emerge during the transition to adulthood. The observed patterns remain largely the same across both a measure of health lifestyles and individual health behaviors even after controlling for differences in demographic characteristics. My findings support both the life course and health lifestyles theoretical frameworks and

highlight how social conditions and individual life chances can display both continuity and change in health lifestyles throughout the transition to adulthood. I also address limitations to my study and provide potential directions for future research. Lastly, I strongly encourage scholars to continue to pay close attention to how risk-related behaviors may change or interact during the transition to adulthood.

4.6 References

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Appendix Table 4.1 List of Adolescent Covariates

Appendix Table 4.1: Covariates Used to Inform Probability of BA+ Completion	
Measures of Academic Performance	Measures of Adolescent Health
Ever Repeated a Grade	Self-Rated Health
Ever Truant	Depression Scale
Ever Suspended	Adolescent Disability Status
Ever Expelled	Alcohol Consumption
Vocabulary Score	Number of Close Friends That Drink
Most Recent English Grade	Tobacco Consumption
Most Recent Math Grade	Number of Close Friends That Smoke
Most Recent History Grade	Physical Activity Scale
Most Recent Science Grade	Vegetable Consumption Scale
Desire for College Attendance Scale	Body Mass Index
Parental Background Characteristics	
Two-Parent Household	Parental Closeness Scale
Parent Graduated College	Expectation to Complete College
Household Income	Parent Receiving Public Assistance

Source: Wave I National Longitudinal Study of Adolescent to Adult Health

Appendix Table 4.2 Regression Estimates (BA+ Completion)

Appendix Table 4.2: Regression of Health Lifestyles by Probability of BA+ Completion						
	Health Lifestyles Index (Regression Coefficients)					
	Wave III		Wave IV		Wave V	
Probability of BA+ Completion	-0.91***	[-1.06, -0.76]	-1.08***	[-1.23, -0.94]	-1.23***	[-1.37, -1.10]
	Individual Health Behaviors (Odds Ratios)					
	Binge Drinking					
	Wave III		Wave IV		Wave V	
Probability of BA+ Completion	1.21	[0.94, 1.54]	0.92	[0.69, 1.23]	0.47***	[0.34, 0.64]
	Smoking					
	Wave III		Wave IV		Wave V	
Probability of BA+ Completion	0.26***	[0.20, 0.34]	0.26***	[0.20, 0.34]	0.13***	[0.10, 0.18]
	Marijuana Use					
	Wave III		Wave IV		Wave V	
Probability of BA+ Completion	0.98	[0.73, 1.32]	0.69*	[0.48, 0.99]	0.54***	[0.39, 0.76]
	Lower Physical Activity					
	Wave III		Wave IV		Wave V	
Probability of BA+ Completion	0.50***	[0.39, 0.64]	0.50***	[0.39, 0.64]	0.65***	[0.51, 0.83]
	Poor Nutrition					
	Wave III		Wave IV		Wave V	
Probability of BA+ Completion	0.37***	[0.29, 0.47]	0.25***	[0.18, 0.34]	0.36***	[0.28, 0.47]
	Obesity (BMI)					
	Wave III		Wave IV		Wave V	
Probability of BA+ Completion	0.17***	[0.12, 0.23]	0.20***	[0.15, 0.26]	0.19***	[0.15, 0.25]
N	7,391		7,391		7,391	

Source: National Longitudinal Study of Adolescent to Adult Health
Estimates include sampling weights to account for unequal probability of selection into the sample
Probability of BA+ completion represents propensity scores based on Wave I background characteristics
Regression coefficients and odds ratios shown (ref = high school diploma or sub-BA)
Each model controls for gender, birth year, and race/ethnicity

Chapter 5

5 Conclusion

5.1.1 Summary of Findings

My dissertation is comprised of three empirical studies that assess the relationships between a postsecondary education and adult health lifestyles. I address three important knowledge gaps by providing a comprehensive exploration and decomposition of adult health lifestyles, with a particular focus on differentiation in levels of postsecondary educational attainment. As risk behaviors profoundly influence chronic illness and mortality in adulthood, postsecondary education-related behavioral disparities represent a critical area of study for advancing our understanding of population health (Case and Deaton 2021; Hanson and Chen 2007; Lawrence et al. 2020). There has also been an increasing divide in health-related behaviors between adults with incomplete or lower-level postsecondary credentials (sub-BA) and those with at least a bachelor's degree (BA+). In fact, Americans with sub-BA levels of postsecondary education have seen rising death rates from preventable behavioral causes of early mortality, such as alcoholic liver disease (Case and Deaton 2015, 2021; Sasson 2016). These important distinctions in the associations between levels of postsecondary education and adult health lifestyles necessitate further empirical investigations.

In Chapter 2, I document the prevalence of important health behaviors across detailed levels of postsecondary educational attainment, which range from vocational training to a doctorate or professional degree. Estimates are provided both in aggregate and across gender and race/ethnicity population subgroups. My findings indicate that while adults in their thirties and forties exhibit relatively low rates of binge drinking, smoking, and marijuana use, they are substantially more likely to exhibit physical inactivity, consume an above average amount of fast food, or experience obesity. My estimates also reveal that improved health behaviors appear to be concentrated at the highest rungs of the education ladder perpetuating social disadvantages. Estimated gender differences in these behaviors indicate that men are more likely to engage in unhealthy behaviors than

women. These differences, as well as a steeper education-health gradient, suggest that women benefit more from a postsecondary education than men. Finally, I also found important race/ethnicity differences in returns to higher levels of postsecondary education as comparable behavioral patterns are observed among both the Hispanic/Latino and non-Hispanic White population, while Black Americans experience a significantly attenuated education-health gradient.

In Chapter 3, I provide both an examination and decomposition of adult health lifestyles across the sub-BA and BA+ population. Using theoretically and empirically selected explanatory factors including demographics, parental background, social contexts, economic well-being, and employment characteristics, I found substantial behavioral heterogeneity in adult health lifestyles. Adults with at least a bachelor's degree (BA+) were found to exhibit significantly better health lifestyles than those with either incomplete or lower-level postsecondary credentials (sub-BA). Using a decomposition model, I was able to explain approximately a third of the postsecondary education-related disparities in health lifestyles between sub-BA and BA+ adults. Differences in measures of economic well-being explain the greatest percentage of the observed disparities. Demographics, parental background, and social contexts are also found to explain a significant percent of the disparities. However, after controlling for personal and household income, employment characteristics are not found to explain a significant percentage of the behavioral disparities between sub-BA and BA+ levels of postsecondary education.

Finally, in Chapter 4, I examine the relationship between completed levels of postsecondary education in adulthood and health lifestyles measured at multiple time periods to determine how and when these associations develop during the transition to adulthood. After controlling for differences in demographic characteristics including gender, race/ethnicity, and age, my findings indicate that respondents with at least a bachelor's degree (BA+) in adulthood exhibit significantly better health lifestyles across each wave of responses (time periods) compared to their high school counterparts. In contrast, those with sub-BA levels of postsecondary education are found to have comparable health lifestyles to those with a high school diploma during young adulthood

with disparities emerging later in the transition to adulthood. These estimates provide further evidence that postsecondary education-related disparities in health lifestyles emerge long before education is completed in adulthood, particularly among those with at least a bachelor's degree (BA+).

5.2 Directions for Future Research

My dissertation addresses three important knowledge gaps and contributes to our understanding of the relationship between postsecondary education and adult health lifestyles by assessing potential differences in returns to higher education. I also identify new and interesting areas of further exploration that future research can address.

Future work should seek to explore how the self-reporting of health behaviors by respondents may influence population estimates. For example, respondents may underreport their level of engagement in negative health behaviors, such as smoking and alcohol consumption. Researchers should also examine additional explanatory factors that might influence the associations between a postsecondary education and health lifestyles at various stages of the adult life course. Particular attention should be paid to how explanatory factors might interact with and influence one another as well as how behavioral practices persist or change over time. Further examination of this critical area of study across the transition to adulthood will help advance our understanding of population health as well as trajectories of chronic illness and mortality (Case and Deaton 2021; Hanson and Chen 2007; Lawrence et al. 2020)

In my own future work, I plan to incorporate broader operationalizations beyond objective measures of health lifestyles or individual behaviors. By developing a large-scale survey, I will seek to measure local or cultural definitions of health behaviors by incorporating multiple group-based identities and norms. I will then identify how particular behaviors are perceived across local communities and seek to uncover other critical explanatory factors that have yet to be explored.

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