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Educational and Gender Differences in Health Behavior Changes After a Gateway Diagnosis

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Abstract

Objective—Hypertension represents a gateway diagnosis to more serious health problems that occur as people age. We examine educational differences in three health behavior changes people often make after receiving this diagnosis in middle or older age, and test whether these educational differences depend on (a) the complexity of the health behavior change and (b) gender.

Method—We use data from the Health and Retirement Study and conduct logistic regression analysis to examine the likelihood of modifying health behaviors post diagnosis.

Results—We find educational differences in three behavior changes—antihypertensive medication use, smoking cessation, and physical activity initiation—after a hypertension diagnosis. These educational differences in health behaviors were stronger among women compared with men.

Discussion—Upon receiving a hypertension diagnosis, education is a more important predictor of behavior changes for women compared with men, which may help explain gender differences in the socioeconomic gradient in health in the United States.

Keywords

health behavior changes; education; gender; hypertension; Health and Retirement Study

Introduction

Educational disparities in U.S. adult health and mortality are wider now than they have been at any point in time during the past half-century (Goldman & Smith, 2011; Hummer & Hernandez, 2013; Montez, Hummer, Hayward, Woo, & Rogers, 2011). One key mechanism through which education influences health is health behaviors. Over the life course,

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educational differences in health behaviors and health outcomes increase until old age, at which point they decrease (Cutler & Lleras-Muney, 2010; Pampel, Krueger, & Denney, 2009; Rogers, Hummer, & Everett, 2013). Examining how groups of people react to new health problems is crucial to understanding disparities in chronic disease management and progression.

Our primary aim is to test whether there are educational differences in behavior changes when people receive a new hypertension diagnosis. We conceptualize hypertension as a "gateway diagnosis" because it is often the first chronic disease diagnosed in adulthood—preceding major health issues such as heart disease, diabetes, and stroke—and behavior changes at this time set the stage for managing health during the aging process (Rapsomaniki et al., 2014). Moreover, blood pressure screening is a standard part of most health care encounters, and hypertension is generally treatable with antihypertensive medications or behavioral modifications.

We examine educational differences in three health behavior changes among middle-age and older individuals after they are diagnosed with hypertension: medication use, smoking cessation, and physical activity initiation. We extend prior research in two key ways. First, we give attention to the time and resources needed to consistently implement the different health behavior changes. For instance, medication use requires less time than physical activity initiation or smoking cessation. Second, we examine whether gender moderates the association between education and health behavior changes. Patterns of behavior changes following a hypertension diagnosis may be important for showing how educational differences in health behaviors increase over time among some groups and contribute to shifting dynamics in health inequalities during middle to late age. Focusing on gender differences in the relationship between education and post-diagnosis health behavior changes may provide insights into why the education–health gradient is stronger among U.S. women compared with men (Ross, Masters, & Hummer, 2012; Ross & Mirowsky, 2010).

A New Diagnosis as a Catalyst for Behavior Changes

A new diagnosis (i.e., a health shock) can act as an important catalyst to prompt health behavior changes. Individuals are confronted with health information and advice about how to lessen their risk of developing even more serious chronic conditions. Prior research has found that older adults tend to behave healthier following a range of serious diagnoses (i.e., heart events, strokes, cancers, chronic lung disease, and diabetes) compared with periods when they have not been diagnosed (Clark & Etilé, 2002; Falba, 2005; Keenan, 2009; Margolis, 2013a, 2013b; Smith, Taylor, Johnson, & Desvousges, 2001). What is less clear, though, is whether people also make healthy changes when diagnosed with a less serious diagnosis and *which subgroups* of the population are more likely to make changes at this time.

We focus on health behavior changes after people are diagnosed with hypertension, a common chronic health problem among middle- to late-aged U.S. adults that is manageable through medication and health behavior modifications (American Heart Association, 2015). Hypertension is the first chronic disease diagnosis many people receive; thus, it presents an opportunity for modifications that set the stage for health in later life. Extending prior work on new health events, we assess whether there are educational differences that vary depending on the complexity of the health behavior and/or gender. Recent evidence indicates that socioeconomic differences in adult health are larger for women than for men in the United States (Ross et al., 2012; Ross & Mirowsky, 2010), motivating us to test whether education is a more important predictor of health behavior changes among women upon being diagnosed with hypertension.

Educational Differences in Health Behavior Changes

Prior research has shown that education may stratify the way people respond to a health shock: People with higher educational attainment are generally more likely to respond to very serious health shocks than those with less education (Clark & Etilé, 2002; Falba, 2005; Keenan, 2009; Smith et al., 2001). Those who are more educated might have a greater ability to decipher, understand, and react to new health information (Cutler & Lleras-Muney, 2010). They also tend to have higher levels of learned effectiveness (Mirowsky & Ross, 2003), enabling them to better adhere to treatment regimens, and they have typically acquired greater financial resources that can help facilitate (potentially expensive) behavioral changes (Cutler & Lleras-Muney, 2010; Link & Phelan, 1995). For example, Wray and colleagues (1998) found that those who had completed more schooling were more likely to quit smoking after a heart attack when compared with those who had less education. Margolis (2013a) also found strong educational differences in the likelihood of both smoking cessation and physical activity initiation following a new health event and adherence to these changes over time. In the United States, this evidence strongly suggests that educational attainment affects health behaviors as people encounter serious health problems in midlife.

The majority of prior research in this area has examined health behavior changes after serious medical diagnoses (i.e., heart attack) or after being diagnosed with any one of a sizable set of new chronic conditions. Hypertension, though, is typically not immediately life threatening and is thought to be less serious than other chronic conditions because it is so common and treatable. Behavioral modifications at this juncture provide a window into the way that people react to the aging process depending on their educational attainment and gender. Given that previous research has found educational differences in health behavior changes following more serious diagnoses, we expect that higher educational attainment will also be related to a higher likelihood of individuals making positive health behavior changes following a diagnosis of hypertension (Hypothesis 1).

In addition, educational attainment may be more important for prompting behavior changes that are more resource intensive compared with others. Evidence for this is found in Goldman and Lakdawalla's (2005) study where educational differences in the adherence to complex antiretroviral therapy for HIV were much greater than those for the relatively less complex medication regimen for antihypertension. For those diagnosed with hypertension, medication is easy to take (i.e., one pill/day), usually covered by health insurance, and commonly used. However, other recommended health behavior changes—smoking cessation and physical activity initiation—can be time-consuming, difficult to initiate because of addiction, and/or expensive. They may require that individuals feel safe in their neighborhoods to do physical activity, join a gym, buy nicotine patches, or have flexible time to devote to health. The substantial amount of resources that are needed to enact these more complex changes may result in larger educational differences compared with taking daily medication. Thus, we anticipate that educational attainment will be a stronger predictor of smoking cessation and physical activity initiation than the use of antihypertensive medication following a diagnosis of hypertension (Hypothesis 2).

Gender Differences in the Association Between Education and Health Behavior Changes

We also extend prior research by testing whether educational differences in health behavior changes differ by gender. A variety of studies have found a stronger association between educational attainment and physical and mental health among U.S. women compared with men (Ostrove & Adler, 1998; Reynolds & Ross, 1998; Ross et al., 2012; Ross & Mirowsky, 2006; Thurston, Kubzansky, Kawachi, & Berkman, 2005; Zajacova, 2006). We anticipate finding a similar gendered pattern of educational differences in health behavior changes after people are diagnosed with hypertension. Specifically, we expect highly educated women to be especially responsive to a new diagnosis of hypertension, whereas less educated women will be the least apt to exhibit health behavior changes.

One theoretical explanation for these differences is constrained choice theory, which argues that the health-related choices available to people depend on both their gender and socioeconomic status (Bird & Rieker, 2008). In the present case, less educated women may experience a double jeopardy (Mendelson, Kubzansky, Datta, & Buka, 2008) following a new health diagnosis because they have far fewer resources available to respond to life events, especially relative to men with more education (McLeod & Kessler, 1990). This imbalance is due, in large part, to the unequal gender distribution of unpaid family work (Bianchi, 2000), which affords less educated women fewer economic and time-related resources to make significant health behavior changes. Even more, highly educated women have been shown to exhibit especially positive health behaviors (Skalamera & Hummer, 2016); such patterns may be particularly evident in the context of emerging threats such as a new diagnosis of hypertension. Together, we expect that these patterns will *exacerbate* educational inequalities in health behaviors: Educational attainment will more strongly predict each of the behavioral modifications among women than men (Hypothesis 3).

Data

We use data from the Health and Retirement Study (HRS, 2011), a longitudinal study of aging that is nationally representative of the U.S. population above age 50 (Juster & Suzman, 1995) and provides important strengths for this study. We have information about a large sample of respondents over a long period of time, during which many report new chronic conditions and change their health behaviors. We can also control for demographic and confounding factors that have previously been linked to the behavior changes we examine. We utilize the harmonized RAND HRS data file for our analysis (RAND, 2011) and merge it with data from the original HRS. We include participants during the waves in which they were 50 to 75 during the study period 1992–2010. We limit the analysis to this age range because it is when a hypertension diagnosis is common (Centers for Disease Control and Prevention, 2011) and because most respondents have many potential years of life ahead. Additional detailed information on the study design, sample, and response rates is available elsewhere (Heeringa & Connor, 1995). We exclude the Assets and Health Dynamics Among the Oldest Old (AHEAD) respondents and limit our analysis to those who completed at least two waves of data and did not have missing data on key independent or dependent variables (i.e., education, health behavior, or hypertension diagnosis).

We examine three subsets of adults—subsets A, B, and C, respectively—who are at risk of making the three respective behavior changes; these subsets are labeled in each of the five tables for ease of interpretation. We begin by examining antihypertensive medication use among all respondents diagnosed with hypertension (subset A; $n = 3,877$). The next two parts of the analysis examine respondents who were at risk of quitting smoking and initiating physical activity, respectively. The second subsample consists of all respondents who reported being smokers and who were therefore at risk of quitting smoking (subset B; $n = 2,949$ smokers, 11,456 total observations; 857 smokers diagnosed with hypertension). For physical activity, we assess the odds of inactive individuals with a hypertension diagnosis initiating physical activity compared with the odds of making that same change when there is no new diagnosis of hypertension (subset C; $n = 10,038$ individuals, 34,485 total observations; 1,989 inactive individuals diagnosed with hypertension). Respondents were categorized “inactive” if they reported no physical activity (as opposed to either moderate or vigorous activity) in the prior wave.

Health Behavior Changes

Our three dependent variables reflect health behavior changes that are recommended to manage hypertension (American Heart Association, 2015), and each is asked in every wave of the HRS. For each behavior, we examine whether respondents changed between interviews (i.e., start taking antihypertensive medication, quit smoking, or start physical activity). Although we are not able to observe the exact timing of the new diagnosis and the health behavior change within the 2-year period, we assume that the new diagnoses likely stimulated the behavior change. Other empirical work has found that behavior changes are more likely in the 2-year period when a new diagnosis is reported than the period before or after reporting the new condition (Margolis, 2013a).

We examine whether respondents were taking antihypertensive medication in the interview after being diagnosed with hypertension, among all respondents diagnosed. For smoking and physical activity initiation, though, some at-risk respondents (i.e., respondents who smoked or were inactive in the wave prior to being diagnosed, respectively) who were *not* diagnosed with hypertension may have also quit smoking or started exercising. Therefore, we also examine whether the likelihood of making a change differed depending on whether they received a hypertension diagnosis in the same period. We define smoking cessation as smoking in one interview but not the next. Due to question wording on the HRS questionnaire, this excluded pipes or cigars. We examine whether the respondent increased physical activity from being inactive in one interview to reporting moderate or vigorous activity in the next.

Hypertension Diagnosis

In each interview, respondents were asked, "[h]as a doctor ever told you that you have high blood pressure or hypertension?" If respondents report *yes* for the first time, we consider this a first hypertension diagnosis.

Other Variables

Our key independent variables are educational attainment and gender. We measure educational attainment categorically (less than high school, high school degree or general education development [GED], some college, or college degree and higher). We also account for other factors potentially associated with health behavior changes, including age at interview, race/ethnicity (non-Hispanic Black, non-Hispanic White, and Hispanic/other race), and whether respondents were married/partnered. Because prior evidence suggests that serious new health events prompt behavioral changes (Clark & Etilé, 2002; Falba, 2005; Keenan, 2009; Margolis, 2013a, 2013b; Wray et al., 1998), we also control for key health conditions reported prior to the first hypertension diagnosis that would have prompted recommendations from physicians to modify behavior (including diabetes, a heart problem, or a stroke) at an earlier time. Likewise, we account for other simultaneously reported new diagnoses, including diabetes, a heart problem, stroke, cancer, and/or a psychological problem, because they likely increase the odds that individuals make behavior changes.

We also include additional controls relevant for each specific behavior change. When modeling antihypertension medication use, we control for health insurance status, because it enables respondents access antihypertensives. For modeling increased physical activity, we include measures of mobility limitations (sum of total mobility limitations) and employment status (full-time, part-time, or not working) because disability and work status are related to changes in physical activity. Finally, to take into account the fact that smoking is addictive and largely dependent on the quantity of cigarettes smoked previously, we control for the number of cigarettes smoked in the previous interview as well as the smoking status of the respondent's partner.

Analytic Approach

We estimate a series of logistic regression models to examine the likelihood of making each of three health behavior changes, and we begin our analysis by stratifying by gender. To examine antihypertensive use, we predict medication use in the interview when people report the new hypertension diagnosis. These models also control for demographic characteristics (age, race/ethnicity), educational attainment, previous and current other diagnoses, health insurance status, and other medication use. We follow an approach used by Margolis (2013a, 2013b) to model the odds of smoking cessation and initiating physical activity: We include an interaction term between education and new hypertension diagnosis to test whether the odds of making a behavioral change upon hypertension diagnosis differed by education. This education by behavior change interaction is not possible for antihypertensive use because respondents were only asked whether they used the medication if they had received a hypertension diagnosis. Finally, to examine whether the association between education and the latter two behavioral changes (i.e., smoking and physical activity initiation) differ by gender, we pool the gender subsamples and include a three-way interaction term (i.e., education by new hypertension diagnosis by gender).

We use logistic regression models rather than conditional logit models with fixed effects to examine patterns of behavior change for the whole sample at risk of making that particular change, an approach used elsewhere to examine behavioral changes after a new health event (Margolis, 2013a). Although fixed effects models would control for time-invariant unobserved factors, it would exclude respondents who did not experience a change in the outcome of interest. We wanted to focus on the likelihood of making various behavior changes, and how these patterns differed when there is a new hypertension diagnosis.

Results

In Table 1, we present the sample characteristics for each of our three subsamples (A, B, and C). Subsample A includes all respondents who were diagnosed with hypertension; we use this subsample to examine whether they take antihypertensive medication (columns 1A and 2A for females and males). Subsample B includes respondents who reported being a smoker in any HRS wave and are therefore at risk of smoking cessation (columns 1B and 2B for females and males). Finally, subsample C includes respondents who reported being inactive in any HRS wave and are therefore at risk of initiating physical activity (columns 1C and 2C for females and males).

The top three rows of Table 1 show the percentage of respondents who made each of the three behavior changes. Eighty-three percent of women and 79% of men were taking antihypertensive medication when reporting the diagnosis. When inactive, respondents initiated physical activity only a quarter of the time (22% of women and 29% of men) and when respondents smoked, only one in five quit in the subsequent wave (17% of women and about 19% of men). In this table, we also show that hypertension tends to be the gateway diagnosis for most respondents: Less than 13% report having a serious illness (at any time). The remaining rows show the demographic characteristics (i.e., age, partner status, race/ ethnicity) and other control variables. These descriptive statistics focus on respondents who reported unhealthy behaviors prior to their diagnosis (i.e., smoking or being inactive). However, a minority of "healthier" respondents (i.e., nonsmokers or active) reported changing their healthy behaviors. Focusing on all respondents diagnosed with hypertension, auxiliary analysis revealed that 78.4% were nonsmokers and 55.5% were engaged in physical activity in the waves prior to their diagnoses, respectively. Among these "healthy" respondents, a total of 2% of nonsmokers began smoking, and 23% of those who were physically active reported that they were no longer moderately or vigorously physically active.

In Table 2, we show how common each of these behavior changes is among respondents who reported a new hypertension diagnosis, by educational attainment and gender. Among those diagnosed with hypertension (column A), antihypertensive use was high among all gender and education groups, ranging from 77% to 85%. Reported use of antihypertensives was much higher than smoking cessation and physical activity initiation. Among smokers (column B) and those who were inactive (column C), only 15% to 35% quit smoking or increased physical activity once diagnosed with hypertension, with the lowest rates of change occurring among women with lower levels of education. The higher reported use of medications may be because it requires *relatively* less time and effort to take medication compared with quitting smoking cessation or initiating physical activity. Results from chi-square tests reported at the bottom of the table show that there are significant gender differences in the association between education and each behavior change after a hypertension diagnosis. Nearly double the proportion of college- educated women stopped smoking or initiated physical activity compared with the least educated women, representing a much larger educational gradient in health behaviors than for men.

Next, we examine these patterns in a multivariate framework. We start by examining whether educational attainment is associated with medication use following a new diagnosis of hypertension (Hypothesis 1). In Models 1 and 2 of Table 3, we stratify our analysis by gender. Educational attainment is significantly associated with antihypertensive medication use for women but not for men. Women with a high school degree, some college, or a college degree were significantly more likely to use medication compared with those who had not completed high school, net of controls. In contrast, regardless of education level, men with a new hypertension diagnosis were equally likely to take hypertension medication. We also predicted that this education–health behavior association would be stronger for women than for men (Hypothesis 3). We test this in Model 3, which pools males and females and includes an interaction term between education and gender (Table 3, Model 3). Compared with men who did not complete high school, the odds of using medication are 62% and 58% higher for women who completed high school or some college.

In Table 4, we present results that model the odds of smoking cessation and physical activity initiation among those “at risk” of making those changes (i.e., those who smoked or were inactive—subsamples B and C, respectively) and examine whether they changed their behaviors when diagnosed with hypertension. As with our analysis of medication use, we begin by stratifying each set of models by gender to show how these patterns work separately for women and men. Among women, a hypertension diagnosis was not a significant instigator of smoking cessation (see Model 1). When we interact education and a new hypertension diagnosis, though, we find that females with a college degree exhibited more than three times the odds of quitting smoking compared with those who did not complete high school (see Model 1). In contrast, Model 2 shows that a hypertension diagnosis is an equally important instigator of smoking cessation for men of all education levels: The main effects for education and hypertension are significant, but the interaction between the two is not.

The next set of models (Models 3 and 4) in Table 4 predicts physical activity initiation. A new hypertension diagnosis does not predict the initiation of physical activity for men or women. When we interact educational attainment and hypertension diagnosis, though, hypertension is a significant predictor of physical activity initiation among the most highly educated women compared with the least educated women. As with our previous models, among men, hypertension is similarly unimportant for making this change across education groups.

Finally, we test whether educational differences in each of these behavior changes differ by gender. For antihypertensive medication, we estimate a two-way interaction term between education and gender. We model smoking cessation and physical activity initiation differently, because we include respondents who were not diagnosed with hypertension: We estimate a three-way interaction term (hypertension diagnosis by educational attainment by gender). In each of these models, we include the same control variables shown in Tables 3 and 4. We present the predicted probabilities of these models in Table 5.

Focusing on antihypertensive medication use, the results from the interaction show that there is significantly more variation by education in antihypertensive medication use among women compared with men. For example, there is an 8% to 9% difference in the probability of taking antihypertensives among women with a high school degree or some college compared with those who did not complete high school. Among men, the probabilities differ by only .03 across education categories. Similarly, we find that the education differences in smoking cessation are significantly larger for women than men. For example, at the point of a new diagnosis, women with a college degree had more than twice the probability of smoking cessation than those with the least education (.33 vs. .14), whereas the differences were much smaller for men (.24 vs. .20). We see a similar pattern for physical activity, with a wider dispersion in behavior change upon a diagnosis among women than men. However, the three-way interaction between education, physical activity, and gender was not significant for predicting physical activity initiation.

Across the three health behaviors, the results support each of our hypotheses. Educational attainment was, indeed, positively associated with healthy behavior change following a new diagnosis of hypertension, but only for women. And finally, the results indicate that—among women—a higher level of education attainment was a very strong predictor of one of the most complex behavioral changes, smoking, compared with use of antihypertensives, a behavior that was relatively easier to adopt.

Discussion

Health behaviors are an important determinant of health inequalities throughout the life course (Hummer & Hernandez, 2013; Masters, Link, & Phelan, 2015). A gateway diagnosis, also referred to as a health shock, that serves as a turning point to prompt health behavioral changes may be particularly important for understanding how these health inequalities progress (Smith, 2005; Smith et al., 2001). We examined whether a hypertension diagnosis is one of these important events that differentially prompts healthy behavior changes among subgroups, contributing to disparities in health and longevity. If these patterns differ by education, it may set the stage for inequalities in chronic disease management and progression as people age. We extend prior research on educational differences in health behavior changes after a new health event in two ways: (a) We test whether the educational gradient differs depending on the type of health behavior change, and (b) we examine whether educational differences in behavior changes vary by gender.

We found educational differences for all three health behavior changes we examined, but not all behaviors among both genders. These results partially confirm our first hypothesis, that people with higher levels of education will be more inclined to make healthier behavior changes after being diagnosed with a gateway health event, and they mirror other findings that education stratifies the way people respond to a serious new health problem (Clark & Etilé, 2002; Falba, 2005; Keenan, 2009; Margolis, 2013a, 2013b).

The fact that education was associated with behavior changes for some subgroups provides motivation for our second and third hypotheses, which aim to distinguish the circumstances under which educational disparities in health behavior changes occur. We anticipated that education would be a more important predictor of health behavior changes that require a *relatively* greater amount of resources and time to enact (e.g., smoking). In comparing educational differences in antihypertensive medication use with smoking cessation, we find evidence to support our hypothesis that education is a stronger predictor of the more complex behavior change, particularly among those with the highest level of education. This finding reflects prior research by Goldman and Lakdawalla (2005) that compares medication regimens of varying complexity. In concert, these results support the notion that educational attainment plays an important role in structuring health behavior change when people are diagnosed with high blood pressure, but they also point to important differences depending on the complexity of the behavioral change at hand.

We found large gender differences in the association between education and health behavior changes. Education was a more important stratifier of behavior changes among women after they received their diagnosis, specifically for smoking cessation and initiating physical activity. These results offer one possible explanation for the finding that there are wider educational disparities in an array of health measures among women compared with men (Ostrove & Adler, 1998; Reynolds & Ross, 1998; Ross et al., 2012; Ross & Mirowsky, 2006; Skalamera & Hummer, 2016; Thurston et al., 2005; Zajacova, 2006). Upon receiving a diagnosis of hypertension, women at the lowest end of the education spectrum have the fewest resources available to them to modify their health behaviors. In comparison with their well-educated counterparts, who profit from the direct and indirect benefits of education, these low-educated, socially disadvantaged women are less able to successfully change their behaviors.

By returning to our descriptive findings in Table 2, we can observe the contribution of our findings in their entirety: We observe a clear distinction in the way that education level, complexity of health behavior change, and gender are associated with health behavior changes following a new health event. For instance, about 25% to 27% of men quit smoking —a relatively complex health behavior to change—regardless of their education level. Female smoking cessation varied quite a bit more, as only 15% of women who had not completed high school quit, compared with 35% who completed college. Here, and in our multivariate results, we find support for our hypotheses. Both the benefits of education, particularly among the most highly educated women, as well as the constrained choices among the most socially disadvantaged subgroup of women, contribute to the educational disparities we observe.

How can we explain the lack of educational disparities in health behavior changes among men following a new diagnosis of hypertension? Unlike women, men have largely been the focus of cardiovascular research and public health campaigns to improve “heart health” in the decades following the Framingham Heart Study (Lauderdale, 2001). Although awareness of cardiovascular risks among women has been slowly increasing over the past few decades (Mosca, Ferris, Fabunmi, & Robertson, 2004), men still benefit from higher levels of awareness. Moreover, this effect is likely amplified by the lower *quality* of care women receive for their cardiovascular health during the clinical encounter (Chou et al., 2007). These trends in knowledge and quality of care may help explain the lack of educational variation in behavioral modifications we observed among men; men may rely less upon individual educational attainment to better their health, instead benefiting from decades of public health campaigns and overall better quality cardiovascular care. Having not been the target of such efforts to improve their cardiovascular health (until recent years), behavioral changes among women may be dictated more by the direct and indirect benefits afforded by individual educational attainment.

There are some limitations to our analysis. First, the biennial interviews of the HRS allow us to examine health behaviors over time, but leave us unable to distinguish the precise timing of a diagnosis and behavior change between two interviews. Because of this, it is impossible to determine whether a diagnosis of hypertension preceded health behavior changes. However, as mentioned, behavior changes are more likely in the two-year period when a new diagnosis is reported compared with the period before or after that diagnosis (Margolis, 2013a). Second, another limitation of this survey design is that individuals may have made short-term behavior changes—perhaps starting and stopping a new behavior—that we cannot measure. However, longer term changes tend to matter more for health outcomes. Third, we are not able to observe specific physician recommendations, although each of the behavioral changes we test is standard given a new diagnosis of hypertension. Prior evidence suggests that if health care providers give different recommendations, they tend to do so in ways that intentionally or unintentionally benefit their socioeconomically advantaged patients (Smedley, Stith, & Nelson, 2003). Fourth, data were not available that would allow us to determine (a) who was hypertensive but undiagnosed or (b) who was able to manage his or her hypertension solely through behavioral modification. Yet, these subgroups may be associated with educational attainment and gender. We encourage future research to utilize data that include physical measures to account for this limitation.

Finally, our analysis does not cover the entire population and is instead focused on the subpopulation of people who were diagnosed with hypertension or engaged in specific unhealthy behaviors. To show how our samples compare with respondents not included in our analysis, we conducted chi-square tests to assess whether there were significant educational differences among smokers/nonsmokers and inactive/active respondents. Not surprisingly, both the smoking and inactive subsamples were significantly more likely to have lower educational attainment than nonsmokers and active individuals in the HRS, a finding that was true for both women and men. Educational attainment played an important role in helping to determine who was included in these two analytic samples. Yet, even among the less healthy individuals, who have lower levels of education, we still observe educational differences in healthy behavior changes.

Understanding whether a diagnosis of hypertension prompts people to change their behavior is key for health in middle or older age: Changes at this juncture may lead to habits that serve to improve health later in life, reducing the probability of other chronic conditions. Our results highlight notable subgroup differences in health behavior changes following this gateway event. It may be the case that health care providers should be especially cognizant about encouraging and facilitating healthy behavior changes among low-educated women following a diagnosis of hypertension, or at least ensuring that hypertensive patients receive equal health information and quality of care regardless of education level or gender. Policy makers could also account for subgroup differences (i.e., education level and gender) and complexity of health behavior changes when designing programs to improve cardiovascular health. We urge researchers to pursue this avenue of research to determine whether these findings extend beyond a hypertension diagnosis, because they provide a distinct perspective on the intersection between education, gender, and health. The unequal ways in which women with different levels of education respond to this gateway diagnosis speak to the large and widening socioeconomic inequalities in health by gender in the United States.

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Table 1

Sample Characteristics, HRS by Sex.

	Women			Men		
	1A	1B	1C	2A	2B	2C
	Hypertensive subsample	Smokers subsample	Inactive subsample	Hypertensive subsample	Smokers subsample	Inactive subsample
	%/*Mean* (*SD*)	%/*Mean* (*SD*)	%/*Mean* (*SD*)	%/*Mean* (*SD*)	%/*Mean* (*SD*)	%/*Mean* (*SD*)
Health behavior change						
Antihypertensive medication use	82.6%	—	—	78.8%	—	—
Smoking cessation	—	17.0%	—	—	18.5%	—
Physical activity initiation	—	—	21.9%	—	—	28.8%
Educational attainment						
Education (years)	12.3 (3.0)	11.6 (2.7)	11.8 (3.1)	12.2 (3.6)	11.5 (3.4)	12.0 (3.5)
Less than high school	22.3%	32.7%	28.7%	25.1%	31.5%	27.5%
High school degree	39.9%	40.9%	39.6%	34.5%	35.7%	34.6%
Some college	21.4%	18.5%	19.2%	19.4%	20.8%	19.1%
College degree	16.4%	7.9%	12.5%	21.0%	11.9%	18.9%
Prior chronic illness diagnosis						
Diabetes	7.9%	0.5%	0.5%	11.3%	0.8%	0.8%
Heart problem	7.3%	0.4%	0.4%	12.3%	0.9%	0.8%
Stroke	1.9%	0.2%	0.2%	2.7%	0.2%	0.2%
Simultaneous chronic illness diagnosis						
Diabetes	4.2%	2.8%	3.3%	5.4%	3.6%	3.6%
Heart problem	5.1%	4.0%	3.4%	6.5%	4.7%	4.1%
Stroke	2.2%	2.2%	1.5%	3.1%	2.4%	1.8%
Cancer	1.4%	1.7%	1.7%	3.1%	2.9%	2.5%
Psychological problem	3.3%	2.5%	2.5%	2.5%	2.5%	2.0%
Demographic characteristics						
Age	62.5 (6.5)	61.4 (6.2)	62.8 (6.5)	63.0 (6.1)	61.9 (5.9)	63.2 (6.1)
Partnered	66.8%	54.0%	61.0%	84.0%	74.4%	82.2%

	Women			Men		
	1A	**1B**	**1C**	**2A**	**2B**	**2C**
	Hypertensive subsample	**Smokers subsample**	**Inactive subsample**	**Hypertensive subsample**	**Smokers subsample**	**Inactive subsample**
	%/*Mean* (*SD*)	**%/*Mean* (*SD*)**	**%/*Mean* (*SD*)**	**%/*Mean* (*SD*)**	**%/*Mean* (*SD*)**	**%/*Mean* (*SD*)**
Race/ethnicity						
Non-Hispanic White	75.2%	71.1%	66.4%	74.5%	69.6%	72.7%
Non-Hispanic Black	14.7%	21.4%	22.6%	13.3%	21.4%	17.6%
Hispanic	10.1%	7.5%	11.0%	12.3%	9.1%	9.7%
Other measures						
Health insurance	88.5%	—	—	90.1%	—	—
Any other medication	18.6%	—	—	27.2%	—	—
Mobility limitation			1.5 (1.6)			1.1 (1.5)
Work full-time	—	—	23.4%	—	—	34.8%
Work part-time	—	—	7.0%	—	—	2.9%
Partner smoker	—	20.7%	—	—	26.4%	—
Partner nonsmoker	—	31.3%	—	—	45.9%	—
Partner smoking status missing	—	48.0%	—	—	27.7%	—
Sample size	2,256	1,564	5,760	1,621	1,385	4,278
Panel observations	2,256	6,299	20,980	1,621	5,157	13,505

Note. The table is divided by gender and splits into three subgroups at risk of making each particular health behavior change. The hypertensive subsample includes all respondents diagnosed with hypertension. The other subsamples include respondents who smoked or were inactive in the previous waves, respectively. Health behavior changes reflect a change between two waves among at-risk respondents. Prior chronic illness diagnoses were measured in the wave prior to health behaviors. Educational attainment, simultaneous chronic illness diagnoses, demographic characteristics, and other measures were all measured in the same wave as the health behaviors. HRS = Health and Retirement Study.

Table 2

Percent Reporting Behavioral Changes Following a New Hypertension Diagnosis by Sex and Educational Attainment.

	A	B	C
	Hypertensive subsample	**Smokers subsample**	**Inactive subsample**
	Antihypertensive medication use	**Smoking cessation**	**Increase physical activity**
Women			
Education			
Less than high school	77.6	15.0	18.3
High school	84.4	18.7	21.3
Some college	85.1	22.4	22.7
Bachelor's degree	82.1	34.8	34.1
n	2,256	464	1,223
Men			
Education			
Less than high school	77.6	27.3	29.1
High school	78.4	24.2	28.2
Some college	79.0	27.6	31.3
Bachelor's degree	80.6	25.5	32.3
n	1,621	393	766
χ^2			
Women vs. men	***	**	***

Note. Chi-square tests compare whether each behavioral change by education differs by sex (i.e., within each column).

* $p < .1$.

** $p < .05$.

*** $p < .01$.

Table 3

Odds Ratios From Logistic Regression Models Predicting Antihypertensive Medication Use.

	Antihypertensive use		
	A		
	Women	Men	All
	Model 1	Model 2	Model 3
Education (less than high school)			
High school	1.691***	0.986	1.016
Some college	1.797***	1.063	1.105
Bachelor's degree	1.475**	1.235	1.257
Female	—	—	1.108
Interactions (less than high school × male)			
High school × female	—	—	1.623**
Some college × female	—	—	1.579*
Bachelor's degree × female	—	—	1.141
Demographic (non-Hispanic White)			
Hispanic	1.034	0.663**	0.817
Non-Hispanic Black	1.006	1.255	1.094
Age	1.049***	1.052***	1.050***
Partnered	1.304**	1.232	1.281**
Simultaneous diagnosis			
Diabetes	0.532*	0.352***	0.428***
Heart problem	2.098**	2.530***	2.301***
Stroke	1.299	0.596	0.819
Cancer	1.103	1.607	1.380
Psychological problem	0.999	0.499*	0.752
Control variables			
Health insurance	1.607***	1.035	1.321**
Using any other medications	3.074***	4.668***	3.784***
Constant	0.083***	0.100***	0.085***
Sample size	2,256	1,621	3,877
Panel observations	2,256	1,621	3,877

Note. Reference categories shown in parentheses. All models also control for a prior diagnosis (i.e., diabetes, heart problem, or stroke), none of which were significant predictors of behavioral modifications.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

Table 4

Odds Ratios From Logistic Regression Models Predicting Smoking Cessation and Exercise Initiation.

	Smoking cessation		Physical activity initiation	
	B		C	
	Women	Men	Women	Men
	Model 1	Model 2	Model 3	Model 4
Education (less than high school)				
High school	1.002	1.055	1.011	0.983
Some college	1.244**	1.481***	1.129**	1.016
Bachelor's degree	1.169	1.365**	1.098	0.788***
First hypertension diagnosis	0.729	1.516*	0.953	1.131
Interactions				
Education by hypertension diagnosis (less than high school × hypertension diagnosis)				
High school × hypertension diagnosis	1.594	0.981	0.937	0.875
Some college × hypertension diagnosis	1.641	0.842	0.903	0.959
Bachelor's degree × hypertension diagnosis	3.142***	0.846	1.511*	1.025
Demographic (non-Hispanic White)				
Hispanic	2.095***	1.139	0.916	1.025
Non-Hispanic Black	1.467***	1.104	1.076*	0.971
Age	1.025***	1.025***	0.988***	1.006*
Partnered	1.066	1.196	1.128***	1.284***
Simultaneous diagnosis				
Diabetes	1.839***	1.765***	1.143	0.984
Heart problem	3.341***	3.302***	1.189*	1.393***
Stroke	2.520***	2.468***	0.600***	0.740*
Cancer	3.285***	2.911***	0.790	0.882
Psychological problem	1.241	0.934	0.797*	0.622***
Control variables				
Spouse smoking status (spouse non-smoker)				
Spouse smokes	0.485***	0.422***	—	—
Missing spouse smoking status	0.806	0.789	—	—
Mobility limitation	—	—	0.652***	0.645***
Employment (not employed)				
Full-time	—	—	0.829***	1.006
Part-time	—	—	0.965	0.988
Constant	0.038***	0.039***	0.964	0.340***
Sample size	1,564	1,385	5,760	4,278

	Smoking cessation		Physical activity initiation	
	B		C	
	Women	Men	Women	Men
	Model 1	Model 2	Model 3	Model 4
Panel observations	6,299	5,157	20,980	13,505

Note. Reference categories shown in parentheses. All models also control for a prior diagnosis (i.e., diabetes, heart problem, or stroke), none of which were significant predictors of behavioral modifications.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

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Table 5

Predicted Probabilities of Health Behavior Changes From Logistic Regression Models.

	A						B				C			
	Hypertensive subsample						Smokers subsample				Inactive subsample			
	Antihypertensive medication use						Smoking cessation				Initiate physical activity			
	Women	***SE***	**Men**	***SE***	**Women – Men**	***SE***	**Women**	***SE***	**Men**	***SE***	**Women**	***SE***	**Men**	***SE***
Two-way interaction: Education × Gender														
Less than high school	0.779	(0.02)	0.762	(0.02)										
High school	0.851	(0.01)	0.765	(0.02)										
Some college	0.857	(0.02)	0.779	(0.02)										
Bachelor’s degree	0.833	(0.02)	0.799	(0.02)										
Difference: women – men														
Less than high school					0.02	(0.03)								
High school					0.09	(0.02)								
Some college					0.08	(0.03)								
Bachelor’s degree					0.03	(0.03)								
Three-way interaction: education × gender × hypertension diagnosis														
New hypertension diagnosis														
Less than high school							0.14	(0.03)	0.20	(0.03)	0.22	(0.03)	0.29	(0.03)
High school							0.19	(0.03)	0.22	(0.03)	0.21	(0.02)	0.27	(0.03)
Some college							0.23	(0.04)	0.25	(0.05)	0.22	(0.03)	0.28	(0.04)
Bachelor’s degree							0.33	(0.07)	0.24	(0.06)	0.31	(0.03)	0.27	(0.03)
No new hypertension diagnosis														
Less than high school							0.17	(0.01)	0.15	(0.01)	0.23	(0.01)	0.27	(0.01)
High school							0.17	(0.01)	0.16	(0.01)	0.22	(0.00)	0.27	(0.01)
Some college							0.19	(0.01)	0.21	(0.01)	0.24	(0.01)	0.27	(0.01)
Bachelor’s degree							0.18	(0.02)	0.21	(0.02)	0.24	(0.01)	0.23	(0.01)
Difference: diagnosis – no diagnosis														
Less than high school							−0.03	(0.03)	0.05	(0.04)	0.00	(0.03)	0.02	(0.03)

	A						B				C			
	Hypertensive subsample						**Smokers subsample**				**Inactive subsample**			
	Antihypertensive medication use						**Smoking cessation**				**Initiate physical activity**			
	Women	***SE***	**Men**	***SE***	**Women – Men**	***SE***	**Women**	***SE***	**Men**	***SE***	**Women**	***SE***	**Men**	***SE***
High school							0.03	(0.03)	0.05	(0.03)	−0.02	(0.02)	0.00	(0.03)
Some college							0.04	(0.05)	0.03	(0.05)	−0.03	(0.03)	0.01	(0.04)
Bachelor’s degree							0.15	(0.07)	0.03	(0.06)	0.07	(0.03)	0.03	(0.04)

Note. Each regression model controls for the variables included in Tables 3 and 4, respectively.