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Age, Cohort, and Social Change:
Parental and Spousal Education and White Women's Health Limitations from 1967 to 2012

Joseph D. Wolfe
University of Alabama at Birmingham

Abstract

A large body of research finds that the association between educational attainment and health is at historic highs for white women. Rapid changes in labor force participation, access to high-paying jobs, and gender attitudes have radically altered the meaning of education for women's lives and their dependence on the socioeconomic attainments of their families. Drawing on three nationally representative, longitudinal surveys conducted from 1967 to 2012, this study examines how personal, parental, and spousal attainments contribute to the widening education gap in health for successive cohorts of white women ($N = 8,405$). Overall, the health of women did not change substantially across cohorts, but results did uncover cohort differences among low-educated women that were linked to parental and spousal educational attainments and personal earnings. These findings confirm growing educational inequalities in health and demonstrate the importance of historical context and family attainments when examining cohort variation in the education-health relationship.

Keywords: health disparities; life course; aging; family; socioeconomic status

The association between educational attainment and health is at historic highs and appears to be a factor in the general increase in all-cause mortality among midlife, non-Hispanic white women (Case and Deaton 2015; Montez and Zajacova 2014). Because this increase is contrary to previous patterns of mortality in the U.S. and current trends in other industrialized countries, these findings have caught the attention of many social scientists, as well as the news media (Dowd and Hamoudi 2014). Recent research in this area has identified a collection of socioeconomic and behavioral factors that help explain widening inequalities in health and mortality (Ho and Fenelon 2015; Montez and Zajacova 2013a), but important gaps still exist with respect to understanding the upstream social structures

that shape the distribution of education and health in the U.S.

First, research has not considered cohort differences in the associations between parental and spousal socioeconomic attainments and white women's health. The inequality of opportunity women experienced in the earlier half of the twentieth century gave way to the ideals of the feminist movement and the practical realities of a changing economy in the latter half of the century (Goldin 2006). As the consequences of parental and spousal attainments for women's lives and economic well-being have changed, the associations between family attainments and women's health may have also changed. However, research has not fully explored this possibility or

considered whether parental and spousal attainments are related to the steepening of the education-health gradient among white women.

Second, prior research has not followed multiple cohorts of white women longitudinally to examine how initial cohort differences in the association between education and health change over time. Research in this area typically uses cross-sectional or repeated cross-sectional data to estimate the effects of age and cohort on health and mortality (e.g., Delaruelle, Buffel and Bracke 2015; Lynch 2003; Montez and Zajacova 2013b). Although these studies provide strong evidence that educational attainment has a larger effect on health in more recent cohorts, they do not directly test whether cohort differences remain stable, grow larger, or shrink with age.

Third, prior research has not considered health limitations, which disproportionally impact women and are linked to self-related health and mortality (Idler, Russell and Davis 2000; Lee et al. 2008; Murtagh and Hubert 2004). Related, opioid-based medications like oxycodone are common treatments for health limitations that involve chronic pain (Chou et al. 2015). Addiction and overdose rates related to medications such as these are considered to be at epidemic levels (Nelson, Juurlink and Perrone 2015), making them one of the major risk factors behind rising mortality rates for white women (Case and Deaton 2015). Thus, clarifying the association between education and women's health limitations offers insight into a health issue that is particularly relevant to women's rising mortality risk.

To address these gaps in the literature, this study merges the National Longitudinal Survey's Mature Women (NLS-MW), Young Women (NLS-YW), and women in the Youth 1979 (NLSY-79) cohorts to examine almost 20 years of information on health and socioeconomic attainment for 8,405 non-Hispanic white women, their parents, and their spouses. In general, the health of women did not change

appreciably across cohorts, but the analysis did uncover an increasing cohort difference among low-educated women that appears linked to parental and spousal educational attainments and personal earnings.

THEORETICAL BACKGROUND AND HYPOTHESES

Social Change, Birth Cohort, and the Health of White Women

One of the organizing principles of the life course perspective is that social change impacts birth cohorts differently as the complex interactions between social circumstances and age leave an indelible and unique imprint on people born in similar historical periods (Elder and George 2016). Due to this process, studies often observe cohort variation in the consequences of broad social change, and very few social changes have been as sweeping and consequential as the rapid expansion of public education and the rise of gender equality (Goldin 2006). Over the course of the twentieth century in the U.S., a high school and college degree went from a privilege of white, male elites to a necessary, but often insufficient, requirement for nearly every occupation. From 1940 to 2009, for example, the U.S. population experienced a five-fold increase in college graduation rates (Ryan and Siebens 2012), and educational attainment is now more closely aligned than ever with economic and occupational achievement (Hout 2012). Alongside these widespread changes related to education, the U.S. experienced a narrowing between men and women in terms of labor force participation, paid hours of work, occupational prestige, and earnings (see Goldin 2014).

An unintended consequence of the expansion of education and gender equality appears to be an increase in the association between schooling and health for more recent cohorts of white women (Montez and Zajacova 2013b). Two principal explanations of this widening education-health gap for

women have been proposed—the composition and causation arguments (Montez and Zajacova 2014). The composition argument states that the current ubiquity of public education and its necessity in the labor market suggest that those who are not achieving at least 12 years of schooling are likely disadvantaged in unobserved ways that are hindering their educational attainment and damaging their health (Dowd and Hamoudi 2014). Thus, the increased association of education across cohorts does not represent a causal effect of educational attainment, but instead a change in the composition of low-educated women from a generally diverse group in older cohorts to a group of severely disadvantaged individuals in more recent cohorts. The causation argument, on the other hand, states that the social and economic forces that have solidified the role of education in the U.S. have also increased its necessity for health (Montez and Zajacova 2014). Whether the underlying process is best described by changes in composition, the causal effects of education, or some integration of the two, those who do not achieve academically clearly represent a socially and economically disadvantaged group. Thus, prior research provides strong evidence that low education will have a larger association with health in more recent cohorts of women.

Hypothesis 1: Educational inequalities in the health limitations of adult white women in the U.S. are widening across birth cohorts.

The Shifting Relevance of Family Attainments for Women's Lives

Women who were born in the earlier half of the twentieth century and came of age prior to the feminist and civil rights movements had far fewer educational and occupational opportunities than those in more recent cohorts (Goldin 2006). Most women coming of age during this period were expected to be mothers

and housewives. As a result, women's college graduation rates in the 1950s were at historically low levels (Jacobs 1996), which meant that most women were highly dependent on the socioeconomic attainments of their fathers and spouses. Although many important inequalities still exist, recent cohorts of women—particularly white women—have made great strides in accessing the opportunity structures that were previously only enjoyed by white men (Goldin 2014). In 2009, for example, 35 percent of women attained bachelor's degrees compared to only 27 percent of men (Ryan and Siebens 2012). Likewise, women's labor force participation rate rose from approximately 30 percent in 1950 to nearly 60 percent in 2010 (Bureau of Labor Statistics 2016), while gender differences in occupational prestige and earnings dropped considerably (Goldin 2014). With these changes to women's role in the family and labor force, the associations between parent and spouse attainment and women's health may have also changed.

Women who married in the first half of the twentieth century often relied on their spouse's attainment to provide key health-related resources because of gendered inequalities in educational opportunities and the exchange of human capital for labor market outcomes. Furthermore, while educational attainment helped some women marry higher attaining husbands, those who attained more than their husbands were more likely to divorce in older cohorts (Schwartz and Han 2014). Although these changes suggest that the association between spousal attainment and health has decreased as women have gained greater socioeconomic independence, this may not be the case. Younger cohorts of women have experienced stagnant wages and a deficit of employment opportunities amid multiple recessions, including the "Great Recession" of 2007 (Grusky, Western and Wimer 2011). The costs of health-related resources such as insurance, food with high nutritional

value, and safe housing in safe neighborhoods add up quickly and are often beyond the financial means of a single person, especially one with low educational attainment. Thus, these broader economic factors may make the attainment of a spouse even more important for the health of younger cohorts (Brown, Hummer and Hayward 2014; Montez and Barnes 2016). Together, these studies provide support for the following hypotheses.

Hypothesis 2a: The association between spousal attainment and health has decreased for more recent cohorts because white women are less dependent on the socioeconomic attainment of spouses.

Hypothesis 2b: The association between spouse attainment and health has increased for more recent cohorts because spousal attainment is now needed to afford health-related resources.

Prior research has shown that socioeconomic conditions in childhood are a significant predictor of health and mortality throughout the life course (Pudrovska 2014), and as education has aligned with labor market outcomes and health, the effects of parents' schooling on women's health may have also changed. However, the direction of the change is not clear. If social mobility has increased in recent cohorts, parents' attainment will be less likely to initiate a cumulative disadvantage process in the lives of their children. In this scenario, younger cohorts of women born into lower attaining families have less inequality of opportunity due to the expansion of education (Breen and Jonsson 2005), and as a result, are more likely than prior cohorts of women to achieve a higher socioeconomic status than their parents and avoid the cumulative health risks associated with low levels of attainment in adulthood (Willson, Shuey and Elder 2007). Although there is some evidence that social

mobility in the U.S. increased in the 1970s compared to the 1940s through 1960s (see Hout 2015), rising economic inequality since the 1980s suggests that mobility has stalled or even declined to previous levels (Beller and Hout 2006). Related, research finds that intergenerational mobility is weakest among those with especially low or high educational attainment (Torche 2011). In other words, upward mobility is most likely for those whose social origins provide sufficient resources to achieve but are not especially disadvantaged, whereas downward mobility is least likely among the children of highly educated parents. With respect to women's health, these studies suggest the following hypotheses.

Hypothesis 3a: The association between parents' educational attainment and white women's health is larger for older cohorts of women who generally experienced less social mobility.

Hypothesis 3b: The association between parents' educational attainment and white women's health is larger for younger cohorts due to the increased socioeconomic consequences of low-attaining parents.

Education, Aging, and Health

In general, two models of socioeconomic status and health over the life course, cumulative disadvantage and age-as-leveler, offer guidance in predicting differences between cohorts as they age (Masters, Hummer and Powers 2012). In the context of attainment and health, cumulative disadvantage occurs when some social event or condition initiates recurring disadvantages that over time increase health-related differences between those who experienced the initial disadvantage and those who did not (Willson, Shuey and Elder 2007). Some research suggests that the education-health cohort difference is in part due to the socioeconomic consequences of low educational

attainment. Evidence of this line of reasoning suggests that the growing association between education and health reflects a more severe cumulative disadvantage process being set into motion by low attainment in younger cohorts (Lynch 2003).

Another body of research finds support for the age-as-lever hypothesis (Brown et al. 2016; Dupre 2007). The primary explanation of this hypothesis is attributed to mortality selection. If the least healthy members of low-SES groups experience mortality earlier than the unhealthy members of higher-SES groups, then health differences between low and high-SES groups will appear smaller. Although research in this area typically finds that health differences are largest in midlife and narrow in old age (House et al. 1990), the abnormally high mortality risk in midlife for low-educated women in younger cohorts may mean that differences shrink as soon as white women reach their 40s and 50s (Case and Deaton 2015). Taken together, prior research provides evidence for the following hypotheses.

Hypothesis 4a: Cohort differences in the association between low education and health increase with age because low-educated, white women in younger cohorts accumulate more health-related disadvantages than their counterparts in older cohorts.

Hypothesis 4b: Cohort differences in the association between low education and health decrease with age because low-educated, white women in younger cohorts have disproportionately high mortality rates.

DATA

Data for this study were drawn from three sources, including the National Longitudinal Survey's Mature Women (NLS-MW), Young Women (NLS-YW), and Youth 1979 (NLSY-79) cohorts. These datasets contain nationally representative samples of women in the NLS-MW and NLS-YW and women and men in the

NLSY-79. For analysis, data from these surveys were merged and men and other races were dropped in order to create a single dataset of 10 survey waves covering nearly 20 years of information on three cohorts of white women (see Table 1).¹

The NLS-MW survey began in 1967 with 5,083 women ages 30-44, the NLS-YW began in 1968 with a cohort of 5,159 women ages 14-24, and the NLSY-79 began in 1979 with a cohort of 12,686 men and women who were between the ages of 14 and 22. The analysis uses 10 waves of data from each of these surveys, covering 1967 to 1982 for the NLS-MW, 1983 to 2001 for the NLS-YW, and 1994 to 2012 for the NLSY-79. These particular waves were chosen to ensure enough time for women in the NLS-YW and NLSY-79 cohorts to complete schooling and to make their age ranges comparable with the NLS-MW cohort. The age and year of entry thus becomes non-missing respondents 30 to 44 in 1967 for the NLS-MW, 29 to 39 in 1983 for the NLS-YW, and 29 to 37 in 1994 for the NLSY-79 women.

After excluding other races and men in the NLSY-79, the final sample is composed of 84,050 observations on the health limitations of 8,405 white women (NLS-MW $N = 3,606$, NLS-YW $N = 2,549$, NLSY-79 $N = 2,250$). As Table 1 shows, the initial levels of missing data are small in the first wave, but attrition leads to relatively large amounts of missing data in later surveys. Several precautions were taken to ensure that these missing data did not meaningfully influence results. First, missing data were addressed with multiple imputation to construct 20 complete datasets, the recommended number to ensure stable parameter estimates and standard errors (Graham, Olchowski and Gilreath 2007). Second, diagnostic tests indicated that the imputed values were nearly identical to the distributions of the original variables (Eddings and Marchenko

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¹ The data preparation, imputation, and analysis were conducted using Stata 15.1 (StataCorp 2015).

2012). Finally, supplemental analyses using other approaches to missing data also led to the same conclusions presented here (see online appendix for a more detailed discussion about missing data, multiple imputation, and the related sensitivity analysis).

--Table 1 about here--

Variable Operationalization

Health limitations are operationalized as a binary indicator of women who report at least one health problem that 1) inhibits their ability to work or 2) limits the amount or kind of work they can do. All women were asked about health problems or conditions that impact their work, regardless of labor force status. A challenge of using multiple observations from three different surveys is ensuring variable measurement remains consistent. The NLS-MW, NLS-YW, and NLSY-79 each contain a variety of health information, but only questions about work-related health limitations were consistently collected for each cohort and survey wave in analysis (National Longitudinal Surveys 2005). However, this variable represents an objective measure of health that is correlated with overall health status, disability, serious illness, and mortality risk (Murtagh and Hubert 2004; Pavalko, Gong and Long 2007). Furthermore, the NLS contains information on the duration of health limitations. Because previous research suggests that health problems can reduce educational attainment (Haas 2006), this information on the duration of health limitations was used to examine respondents whose current health limitation began before the age of 18 (NLS-MW N = 146, NLS-YW N = 98, and NLSY-79 N = 44). In supplemental analysis, this small group of women with long-term health problems was dropped, and the results were the same as those presented here.

For respondents and their spouses, educational attainment is operationalized as a categorical variable, including 0 to 11, 12, 13 to 15, and 16 or more years. To

adjust for their lower levels of schooling, the educational attainment of parents is operationalized with only three categories, including 0 to 11, 12, and 13 or more years of schooling. Similar educational categories have been used in other prominent studies of educational attainment and mortality (Montez and Zajacova 2013b).

To adjust for women without spouses, spousal education includes a category for women who did not report a spouse at the time of the survey. Although combining divorced, widowed, and never-married women into a single category is not optimal, creating comparable measures of marital status across cohorts was problematic due to a decrease in widows and an increase in single and divorced women in the more recent cohorts. To ensure that results were not affected by this coding decision, supplemental analyses examined other operationalizations of marital status without imputing missing (see online appendix). Regardless of the specific operationalization, results supported the conclusions presented here.

Analysis also adjusts for several relevant controls. First, models adjust for the log earnings of respondents and spouses. To create earnings, the NLS asked about the overall income from wages, salary, and tips. Although these datasets also contain measures of family income, the analysis used earnings in constant 2016 dollars to better parse the effects of personal and spousal earnings on health. Unfortunately, the NLS surveys do not include information on the earnings of parents. Second, to adjust for variation in family background, the analysis also includes non-nuclear family, which is measured as a binary indicator of women whose adolescent home did not include both biological parents. Finally, the analysis controls for living in the South because of its unique influence on the association between women's education and life expectancy (Montez and Zajacova 2014).

ANALYTIC METHODS

The analysis proceeds in three steps in order to test hypotheses and verify results. In the first step, the data are reviewed descriptively to establish baseline differences and similarities across cohorts. This step begins by reviewing descriptive statistics for all variables in analysis. Next, to illustrate cohort differences, five-year moving proportions of health limitations are calculated from ages 35 to 55. Plots of these values provide unadjusted cohort difference in health limitations and trends in the association between education and health over time.

In the second step, population-averaged (PA) models are estimated for each of the three cohorts. These models examine the association between women's education and health net of personal, parental, and spousal attainment and controls. Although the strength of the NLS data lies in its longitudinal design, multiple observations create time series dependencies (Hardin and Hilbe 2013). To address this issue, the analysis uses a Generalized Estimating Equation (GEE) approach and estimates a series of PA models for binary outcomes using Stata's *xtlogit* command (StataCorp 2017). Because the repeated observations on health have a natural order, the correlation structure is assumed to be a first order autoregressive process (Hardin and Hilbe 2013).² There are several advantages to analyzing data with the GEE approach. Most notably, PA models address non-independence in the data while also avoiding problematic assumptions that other longitudinal methods make about the data-generating distribution (Hubbard et al. 2010). In contrast to mixed effects or hierarchical models, which are subject specific (SS) models, PA models are also preferable when the aggregate response for the population is the focus

(Zeger, Liang and Albert 1988) and are thus well-suited for population-level comparisons of cohorts.

The final step of analysis examines PA models of health with interactions between age, cohort, and educational attainment. These models test whether the health limitations of cohorts grew larger or smaller as they aged. Because the interpretation of interactions in models with binary outcomes is not straightforward, this step in analysis examines predicted probabilities, rather than odds ratios, to illustrate cohort differences in the association between education and health limitations (Long 2009). All postestimation values were computed using Stata's *margins* command.

RESULTS

Sample Characteristics and Descriptive Comparisons

As shown in Table 2, a substantial portion of each cohort reports a health limitation – 28 percent in the 1922-37 cohort (the NLS-MW), 20 percent in the 1943-53 cohort (the NLS-YW), and 21 percent in the 1957-64 cohort (the NLSY-79). Although the proportion of women with health limitations appears to be substantially larger in the 1922-37 cohort, this is primarily due to differences in the age ranges across surveys. To adjust for age, Figure 1 plots a five-year moving proportion of health limitations for each cohort from the ages 35 to 55. The proportion of health limitations is still slightly larger for the 1922-37 cohort, but the proportion of women with health limitations follows a remarkably similar pattern across cohorts. Thus, while cohort differences may still exist with respect to education and health, age-related trends are very similar.

-- Table 2 about here --

-- Figure 1 about here --

While health limitations have been relatively stable, younger cohorts have a large increase in educational attainment, reflecting the rapid expansion of public

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² Multiple correlations structures were compared, and results supported the conclusions presented here.

education. Returning to Table 2, the distribution of women across categories of schooling shows a nearly complete reversal. Approximately 34 percent of the 1922-37 cohort attained 0 to 11 years of schooling compared to only 12 percent of the 1943-53 cohort and 9 percent of the 1957-64 cohort, whereas 24 percent of the 1943-53 cohort and 25 percent of the 1957-64 cohort completed 16 or more years of schooling compared to only 9 percent of the 1922-37 cohort. Parental and spousal education shows a similar trend. Over 60 percent of the 1922-1937 cohort had parents with less than 12 years of schooling, and only 15 percent had spouses with 16 or more years of schooling. Only 19 percent of the parents of the 1957-64 cohort had less than 12 years of schooling and 23 percent of their spouses had at least 16 years of schooling.

Before turning to PA models in step 2, Figure 2 provides a descriptive look at cohort differences in the relationship between education and health limitations. Each panel in Figure 2 represents a different cohort and contains a five-year moving proportion of health by educational attainment. The central difference across panels is the steeping of the educational-health gradient in the two younger cohorts. At 35, approximately 20 percent of those who had less than 12 years of schooling had health limitations, regardless of birth cohort. By 55, however, women with health limitations accounted for less than 40 percent of those with 0 to 11 years of schooling in the 1922-37 cohort compared to approximately 40 and 45 percent in the 1943-53 and 1957-64 cohorts, respectively. Thus, descriptive comparisons provide initial support for both hypotheses 1 and 4a. That is, cohort differences seem to exist, but primarily occur in later adulthood, which is indicative of a cohort difference in cumulative disadvantage processes.

-- Figure 2 about here --

Cohort Differences in the Association between Education and Health

Table 2 contains exponentiated coefficients from population-averaged regression predicting health limitations. Model 1 provides a base model with women's education and age in addition to controls for survey wave and living in the South (not shown). Because prior research and descriptive comparisons suggest that the largest cohort changes in women's mortality have occurred in populations with less than a high school education, the reference for respondent's schooling is 16 or more.

Model 1 shows that low educational attainment is associated with a large increase in the odds of a health limitation. In support of hypothesis 1, the odds ratio for low-educated white women in the youngest cohort is notably larger than the odds ratios for the two older cohorts. Model 2 adds measures of parental and spousal attainments and provides an initial test of hypotheses 2 and 3. Parents' schooling is only significant in the model of health limitations for the 1957-64 cohort ($p < .001$), whereas spousal educational attainment is primarily associated with the health of the 1922-37 cohort. Spousal earnings are significant for two cohorts, but cohort differences were not significant ($p > .05$). Model 3 replaces parental and spousal attainments with personal earnings and reveals that economic attainment is significantly related to health limitations for all three cohorts. However, the association between personal earnings and health is significantly larger for the 1957-64 cohort and noticeably reduces cohort differences in the odds of health limitations.

All variables are included in Model 4, and the odds of health limitations for low-educated women are substantially reduced from Model 1, as are the differences between cohorts. However, the attainment of spouses still appears more relevant to the health of older cohorts, and parents' attainment still appears more relevant to the health of younger cohorts. To

formally test differences observed in Table 3, supplemental analysis considered models with interactions between cohort and indicators of attainment, including women's education and earnings, parents' education, and spouse's education and earnings. This analysis confirmed that cohort differences were generally significant at the .05 level or lower, but in Model 4, only differences between respondents' earnings and parents' educational attainment remained significant. Thus, the results provide the most support for hypotheses 2a and 3b.

Finally, to ensure the results were robust to the operationalization of spousal education and marital status, a sensitivity analysis split the sample into those who were continuously married and those who experienced a spousal loss due to divorce or widowhood (seen online appendix). The results of these supplemental analysis not only supported the same conclusions discussed here but also uncovered an interesting elaboration of the association between parent education and women's health. That is, parents' education was only significantly related to the health limitations of women in the 1957-64 cohort who experienced a spousal loss. Thus, trends in parental attainment and marital dissolution are potentially key factors in widening educational inequalities in white women's health.

Cumulative Disadvantage or Age-as-leveler

To examine hypothesis 4, this step in the analysis considers two PA models with interactions between age, cohort, and educational attainment (not shown). The values plotted in Figure 3 represent the differences between cohorts with respect to the discrete change in probability of a limitation for low compared to high-educated women. In the first panel, Model 1 includes basic controls and reveals a clear increase in cohort differences with age. From 35 to 55, the difference between the 1957-64 and 1922-37 cohorts increases

from approximately 0 to .14 ($p < .05$). In the second panel, Model 2 includes controls for personal, parental, and spousal attainment, and when holding women with low educational attainment at high attainment values, the differences between cohorts are reduced to essentially 0 for the entire age range. Thus, results suggest that changing cumulative disadvantage processes may play a role in the widening education gap in white women's health. Specifically, low-educated women in younger cohorts seem to accumulate more health-related disadvantages in adulthood than their counterparts in older cohorts (hypothesis 4a). To test the age-as-leveler hypothesis (hypothesis 4b), the analysis also considered women's survival. Most women survived the age ranges under consideration, with only around 4 percent of each cohort deceased by the final wave (MW N = 151, YW N = 71, and Y79 N = 81). Results from models that dropped deceased women were identical to those presented here (see online appendix). Thus, the analysis provides no support for hypothesis 4b.

-- Figure 3 about here --

DISCUSSION

This study emphasized women's changing opportunity structures across the twentieth century as a means of identifying the upstream, social mechanisms underlying the widening education gap in white women's health. Rapid changes in women's equality of educational and occupational opportunities have created substantially different patterns of work and family life for more recent cohorts. The principal question of this study is whether these changes to women's life course have had different implications for their health.

First, results identified an increase in the association between low educational attainment and health limitations in more recent cohorts of white women. Specifically, white women in the 1957-64 cohort with

less than 12 years of schooling had substantially higher rates of health limitations in later adulthood than their counterparts in the 1922-37 cohort. This finding echoes a large body of research on cohort differences in health and mortality and lends further support to the view that broader social changes in women's opportunity structures have permanently changed the meaning of education in their lives.

Second, results provided evidence that the magnitude of the association between parental and spousal educational attainment and white women's health are conditional on cohort membership. Comparisons of the 1922-37 and 1957-64 cohorts show that the effects of spousal attainment on health were generally smaller for the younger cohort, whereas that the effects of parental attainment were largest for the 1957-64 cohort of women, those who experienced a spousal loss through divorce or widowhood in particular. Furthermore, cohort differences in the association between educational attainment and health were notably less pronounced after holding parental and spousal attainment constant across cohorts. Thus, the growing association between education and the health of white women in the U.S. is not only shaped by personal attainment but also the attainments of multiple family members (Brown, Hummer and Hayward 2014; Montez and Barnes 2016).

Third, results provide evidence that cohort differences in the association between education and health are due to younger cohorts of white women experiencing a more difficult cumulative disadvantage process when they do not attain at least 12 years of schooling. In their early 30s, white women with 0 to 11 years of schooling have relatively similar levels of health limitations across cohorts. As these women enter later adulthood, however, cohort differences in the education-health association grew substantially—primarily because of the concentrated lack of economic

attainment among low-educated women in more recent cohorts. Scholars debate whether changes in composition or causation explain the widening educational gap in health across cohorts of white women (Dowd and Hamoudi 2014; Montez and Zajacova 2014). This study acknowledges this debate by considering how both social background and current socioeconomic resources contribute to health limitations as women age, and although the true origins of cumulative disadvantage may lie early in life, cohort differences between the effects of education on health were not significantly different until later adulthood. Furthermore, the results of this study support previous research that suggests cohort differences are primarily the result of economic difficulties in adulthood (Montez and Zajacova 2013a). Thus, whether low educational attainment is the catalyst or a step in the cumulative disadvantage process these women experience, its impact on health limitations could be weakened by economic interventions in early adulthood.

This study provides a number of contributions to the current literature but is also limited in the following ways. First, a major limitation is that the availability of data only allows analysis to consider a single measure of health. Although the NLS-MW, NLS-YW, and NLSY-79 surveys contain detailed information on health, work-related health limitations were the only health-related questions that were consistently collected for each cohort in all of the interview years. Health limitations are an important indicator of more serious health problems and mortality, but they only capture a single dimension of health and multiple health indicators are important for unraveling the intersecting social influences that shape health. Ultimately, the measure of health limitations used in analysis provided valuable insight into cohort differences over time, but future research should consider other physical and mental health outcomes in order to establish whether the effects of parent and spousal attainments on multiple domains of

health have changed.

The second limitation is that estimates of cohort change in health assume models adequately control for period influences. Although the longitudinal design of the NLS is excellent for untangling the effects of cohort and aging, it is less suitable for parsing cohort and period shifts (Pavalko, Gong and Long 2007). Furthermore, scholars have expressed serious concerns about the arbitrary and untestable assumptions required by statistical methods aimed at simultaneously estimating age, period, and cohort effects (Luo 2013). However, even though models are unable to fully adjust for period effects, the analysis used a GEE approach that minimizes the influence of unobserved heterogeneity that might be caused by any omitted variables (Zeger, Liang and Albert 1988).

The third limitation is that the analysis did not fully consider the dynamic nature of family relationships. Supplemental analyses found that the association between parents' education and white women's health limitations was strongest for women in more recent cohorts who experienced a spousal loss. This finding implies that parents' schooling is either 1) providing a form of resource substitution for women in younger cohorts who have relationship problems (Brown, Hummer and Hayward 2014; Montez and Barnes 2016; Ross, Masters and Hummer 2012) or 2) developing a stronger association to the childhood adversities that initiate "chains of disadvantages" in social relationships and damage health over time (Umberson et al. 2014). To identify exactly why the association between parents' education and women's health has changed, future research should examine cohort differences in family structures (e.g., divorce and cohabitation, remarriage, family size, etc.) and relationship characteristics (e.g., weak/strong ties, emotional strain, physical distance, etc.).

Finally, this study provides preliminary evidence linking the widening education gap in health among

white women to family attainments, but an examination of the many combinations of parental, personal, and spousal educational categories was beyond the scope of this paper. Compared to their counterparts in older cohorts, low-attaining women in younger cohorts are more likely to have less-educated parents and spouses (Schwartz and Mare 2005; Torche 2011), creating a weaker familial safety net for those who are most likely to need it. This increased homogeneity of family attainments might help explain the steepening education-health gradient across successive birth cohorts. Thus, future research should extend this study by examining the intersections of family attainments. However, future research along these lines will need to use methods that can help identify meaningful clusters of family attainments, e.g., latent class analysis (Willson and Shuey 2016), or a much larger sample to accommodate the estimation requirements of regression models that include interactions between three or more correlated variables.

CONCLUSION

Despite its limitations, this study confirms prior findings on the increasing association between educational attainment and white women's health and provides new evidence on the reasons behind widening inequalities across cohorts. Overall, the health of women did not change across cohorts, but the analysis uncovered an increasing cohort difference among low-educated women that appears related to parental and spousal educational attainments and personal earnings. By considering the historical contexts of these three NLS cohorts of white women, this study finds that parental and spousal attainments are important factors to consider when studying women's health inequalities. Thus, future research should continue examining how socio-historical contexts determine the relevance of family attainments for one's quality of life

and, in turn, their health in midlife and later adulthood.

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Table 1. Year of Interview, Age, Sample Size, and Attrition by Cohort and Survey Wave (N = 8,405)

Data Source	Birth Cohort		Survey Wave									
			1	2	3	4	5	6	7	8	9	10
NLS-MW N = 3,606	1922-37	Year	1967	1971	1972	1974	1976	1977	1979	1981	1982	1984
		Median age	37	41	42	44	46	47	49	51	52	54
		Age range	30-44	34-48	35-49	37-51	39-53	40-54	42-56	44-58	45-59	47-61
		% attrition	0	10	11	14	17	21	24	27	30	32
NLS-YW N = 2,549	1943-53	Year	1983	1985	1987	1988	1991	1993	1995	1997	1999	2001
		Median age	34	36	38	39	42	44	46	48	50	52
		Age range	29-39	31-41	33-43	34-44	37-47	39-49	41-51	43-53	45-55	47-57
		% attrition	0	5	6	8	10	15	20	19	23	25
NLSY-79 N = 2,250	1957-64	Year	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012
		Median age	33	35	37	39	41	43	45	47	49	51
		Age range	29-37	31-39	33-41	35-43	37-45	39-47	41-49	43-51	45-53	47-55
		% attrition	0	5	6	10	12	13	15	15	17	20

Table 2: Medians or Proportions of Analysis Variables by Cohort (N = 8,405)

	Birth Cohort		
	1922-1937	1943-1953	1957-1964
Age	51	50	51
Health limitation	0.28	0.20	0.21
Schooling			
0 to 11 years	0.34	0.12	0.09
12 years	0.48	0.43	0.44
13 to 15 years	0.10	0.21	0.23
16 or more years	0.09	0.24	0.25
Log earnings	9.03	10.11	10.18
Parents' schooling			
0 to 11 years	0.64	0.35	0.19
12 years	0.22	0.40	0.45
13 or more years	0.14	0.25	0.36
Non-nuclear family at 14 or 15	0.22	0.16	0.22
Spouse's schooling			
0 to 11 years	0.32	0.13	0.05
12 years	0.28	0.24	0.28
13 to 15 years	0.09	0.15	0.15
16 or more years	0.15	0.24	0.23
No spouse	0.17	0.25	0.29
Spouse's log earnings	10.20	10.41	10.31
Lives in the South	0.32	0.35	0.35

Note: Values in this table come from the interview year in which the median age of each cohort was closest to 50. This was 1981 for the 1922-37 cohort (the NLS-MW), 2001 for the 1943-53 cohort (the NLS-YW), and 2012 for the 1957-64 cohort (the NLSY-79).

Table 3: Exponentiated Coefficients from Population-averaged Logistic Regression Models Predicting Health Limitations Among Three Birth Cohorts of White Women (N = 8,405; Observations = 84,050)

	Model 1			Model 2			Model 3			Model 4		
	1922-37	1943-53	1957-64	1922-37	1943-53	1957-64	1922-37	1943-53	1957-64	1922-37	1943-53	1957-64
Age	1.05*** (0.00)	1.05*** (0.01)	1.08*** (0.02)	1.04*** (0.00)	1.05*** (0.01)	1.08*** (0.02)	1.04*** (0.00)	1.04*** (0.01)	1.08*** (0.02)	1.04*** (0.00)	1.04*** (0.01)	1.09*** (0.02)
Schooling (ref. 16 or more)												
0 to 11 years	4.28*** (0.43)	4.64*** (0.42)	6.11*** (0.74)	3.41*** (0.38)	3.88*** (0.43)	5.21*** (0.72)	3.95*** (0.39)	4.20*** (0.38)	4.92*** (0.58)	2.97*** (0.33)	3.33*** (0.37)	3.91*** (0.54)
12 years	2.12*** (0.21)	1.88*** (0.15)	2.36*** (0.23)	1.91*** (0.20)	1.74*** (0.16)	2.41*** (0.27)	2.03*** (0.20)	1.86*** (0.14)	2.19*** (0.21)	1.76*** (0.18)	1.66*** (0.15)	2.10*** (0.24)
13 to 15 years	1.99*** (0.23)	1.43*** (0.13)	1.91*** (0.21)	1.92*** (0.23)	1.39*** (0.13)	1.94*** (0.22)	1.92*** (0.22)	1.42*** (0.13)	1.85*** (0.20)	1.82*** (0.21)	1.36*** (0.13)	1.80*** (0.20)
Log earnings							0.94*** (0.00)	0.93*** (0.00)	0.89*** (0.00)	0.93*** (0.00)	0.93*** (0.00)	0.89*** (0.00)
Parents' schooling (ref. 0-11)												
12 years				0.94 (0.05)	0.90 (0.06)	0.73*** (0.06)				0.94 (0.05)	0.91 (0.06)	0.75*** (0.06)
13 or more years				0.97 (0.07)	0.93 (0.08)	0.86 (0.09)				0.98 (0.07)	0.94 (0.08)	0.87 (0.09)
Non-nuclear family at 14/15				1.28*** (0.06)	1.16* (0.08)	1.48*** (0.11)				1.29*** (0.06)	1.17* (0.08)	1.47*** (0.10)
Spouse schooling (ref. 0-11)												
12 years				0.80*** (0.04)	0.91 (0.09)	0.87 (0.11)				0.77*** (0.04)	0.87 (0.08)	0.85 (0.11)
13 to 15 years				0.83* (0.06)	0.83 (0.09)	1.00 (0.14)				0.80** (0.06)	0.80* (0.08)	0.96 (0.14)
16 or more years				0.70*** (0.06)	0.81 (0.09)	1.15 (0.15)				0.63*** (0.05)	0.72** (0.08)	1.00 (0.14)
No spouse				1.00 (0.06)	1.22* (0.12)	1.05 (0.12)				1.13 (0.07)	1.38** (0.14)	1.13 (0.13)
Spouse log earnings				0.98*** (0.00)	1.00 (0.01)	0.98** (0.01)				0.99 (0.00)	1.01 (0.01)	0.98* (0.01)

Note: Standard errors in parentheses; ** $p < 0.05$, * $p < 0.01$, *** $p < 0.001$ (two-tailed tests). Models control for survey wave and living in the South.

Figure 1: Five-year Moving Proportion of White Women's Health Limitations by Birth Cohort

Figure 2: Five-year Moving Proportion of White Women's Health Limitations by Birth Cohort and Years of Schooling

Figure 3: Differences between the 1957-64 and the 1922-37 Cohorts in the Discrete Change in the Probability of a Health Limitation

Note: A positive value means that the increase in the probability of a limitation for a change from 16 or more years of schooling to less than 12 years of schooling is larger for women in the 1957-64 cohort compared to the 1922-37 cohort. Highlighted areas represent 95 percent confidence intervals. When confidence intervals do not overlap 0, the difference in discrete change is significant at the .05 level or lower. During postestimation for the full model in the second panel, schooling was held at 12 years for parents and 16 or more years for spouses, and respondent and spousal earnings were held at the median values of highly educated women.