Are the Health Returns to Education Changing?

An Examination of Education and Self-Rated Health in 1972 and 2011

Rachel Donnelly, B.A.

Ph.D. Student, Department of Sociology

Graduate Student Trainee, Population Research Center

University of Texas at Austin

Acknowledgements

Abstract

Substantial changes in educational attainment, income inequality by education, and health status of the US population signify the need to systematically assess changes in the strength of the education-health relationship over previous decades. I use data from two waves of the National Health Interview Survey (NHIS) to examine the age-specific relationship between education and self-rated health among U.S. adults, comparing 1972 to 2011. I find that the relationship between education and self-rated health has strengthened from 1972 to 2011, particularly for adults with a college degree or 5+ years of secondary education compared to a high school diploma, specific to ten year age groups. Moreover, this relationship differs slightly for gender and race subgroups. The findings indicate the increasing importance of higher education for favorable health outcomes in the United States and support the need for a focus on educational health disparities.

Introduction

The positive association between education and a robust variety of health outcomes has been well established by numerous studies. Out of all the measures of socioeconomic status (i.e., income, occupation, education), education is the strongest predictor of health, yet quite possibly the most difficult to explain (Lynch 2003). The relationship between education and health is one of the most powerful relationships in social science research (Lynch 2003). As the educational composition of the United States (US) continues to change, increasing importance is placed on observing and understanding the relationship between education and health outcomes. Even though more people have access to higher levels of education, disparities in adult health by education seem to have widened (Liu & Hummer 2008; Goesling 2007; Lynch 2003; Martin, Schoeni, Freedman, & Andreski 2007). Moreover, these health disparities are not distributed equally across population groups within the United States. Factors such as age, race/ethnicity, and gender have been found to influence educational disparities in health and changes in this relationship over time (Liu & Hummer 2008). This thesis uses data from two waves of the National Health Interview Survey (NHIS) to examine changes in the relationship between education and self-rated health from 1972 to 2011 for the general US adult population (ages 30-79), as well as within age, cohort, gender and race subgroups of the population.

Background

Educational Expansion in the United States

To better understand the relationship between education and health over time, it is essential to understand the changing educational composition of the U.S. population over the last half century. High school graduation had become widespread in the US by the 1920s. College

enrollment doubled in the 1960s, and increased five-fold from 1951 to the mid 1970s (Gumport et al. 1997). Upward social and economic mobility alongside nationwide growth further increased the demand for higher education (Gumport et al. 1997). Over the course of the 1960s, the civil rights and women's rights movements, along with Johnson's War on Poverty, all inspired policy aimed at increasing the number of women, minority, and low-income college students (Kinzie 2004; Gelb & Palley 1982; Levine & Nidiffer 1996). As Americans achieved an increasing amount of schooling, education emerged as a key component of social stratification.

In the 1990s, scholars debated whether education was dividing Americans too much. In their book *The American Occupational Structure* (1967), Peter Blau and Otis Dudley Duncan found that education increases social mobility more than it serves to pass on parents' position. Therefore, higher education could provide the means for mobility for individuals from lower-class families. Although first published in 1967, this book developed the status-attainment model still at the core of status attainment theory today. More recently, Schoon (2008) found that years of education is the most important determinant of status attainment, mediating social background and cognitive ability.

The problem remains that although education can increase mobility, access to higher education still varies across population subgroups. Racial minorities and economically disadvantaged populations continue to have lower levels of educational attainment. Socioeconomic differences in college enrollment widened between 1980-1982 and 1992, as enrollment stabilized in the lowest income quartile but rose in other income groups (Neckerman & Torche 2007). Because education develops cognitive skills, health knowledge, social networks, etc., differential access to education can contribute to social and health disparities.

Education and Health

While the association between education and health is well-known, the reasons for the relationship are less certain. The human capital perspective posits that higher educational attainment is associated with better health outcomes because it increases effective agency, a sense of control of one's life, and learned effectiveness (Mirowsky & Ross 2003; Ross & Wu 1995). Education provides individuals with many beneficial skills, including reading and writing, analytical thinking and reasoning, problem solving, personal control, goal-setting, and a future oriented perspective (Liu & Hummer 2008; Mirowsky & Ross 2003, 1998). Additionally, higher education often improves access to new health information and technology that can reduce morbidity and mortality (Link & Phelan 1995). Therefore, higher levels of educational attainment provide more than just increased income and improved living conditions. Highly educated individuals are also more likely to engage in a wide variety of positive health behaviors, from engaging in physical activity to eating healthy diets to abstaining from tobacco use (Link & Phelan 1995; Cutler & Lleras-Muney 2006).

Age Patterns in the Education-Health Relationship

The cumulative-advantage hypothesis is utilized to understand age variation in the relationship between education and health. Originally developed by R.K. Merton, it theorizes that any "favorable relative position becomes a resource that produces further relative gains" (DiPrete & Eirich 2006: 271). Advantage in some form accumulates over time, or, colloquially, "the rich get richer" and "the poor get poorer" (DiPrete & Eirich 2006).

When applied to health outcomes in the social science literature, it posits that the educational gap in health is wider at older ages than younger ages (Lynch 2003). Younger people

are generally healthier, resulting in less variation in health, and some mediators require a long time period to result in poor health (Ross & Wu 1996). For example, individuals are likely to experience the ill-effects of smoking later in life (Lynch 2003). Additionally, education is a component of human capital, which accumulates over the life course at different rates (Lynch 2003, Liu & Hummer 2008). Over the life course, the positive effects accumulate for some while the negative effects accumulate for others, resulting in the widening gap in health as people age.

Another perspective on the education-health relationship is the age-as-leveler hypothesis. It theorizes the opposite direction for life-course patterns, suggesting that education predicts health most strongly at younger ages (House et al. 1994; Lynch 2003). This is because health becomes more closely associated with the aging process at older ages; therefore, the influence from education declines. In other words, the elderly have health problems because of the natural aging process, not because of their level of educational attainment. Although it is often presented in competition with the cumulative advantage hypothesis, the age-as-leveler hypothesis simply suggests the slowing of the cumulative advantage process (Shuey & Willson 2008).

The convergence of trajectories in the age-as-leveler hypothesis cab be explained by age-targeted welfare state programs and selective mortality (Shuey & Willson 2008). The convergence of health gaps in older age could be the effects of social programs, such as Medicare and Social Security. These programs could be successful at countering earlier disadvantages and reducing inequalities in health in older age. Selective mortality hypothesizes that people with the lowest socioeconomic status become excluded from survey samples later in life due to disability or death (Shuey & Willson 2008). Therefore, samples including older age groups will not accurately reflect the education-health relationship because increased concentrations of people with high education levels remain in the survey sample at older ages.

Empirical results have been inconsistent and inconclusive; they have tended to support the cumulative advantage theory, the age-as-leveler theory, or a combination of the two. House et al. (1994) found support for the age-as-leveler hypothesis after examining self-rated health and functional status by education. The authors showed the nonlinear effect of education across the life course, with increasing then decreasing health disparities between the more and less educated. A study by Beckett (2000) provided similar support for the age-as-leveler hypothesis. However, Ross and Wu's (1995) findings supported the cumulative advantage theory, examining self-rated health and physical functioning by education. However, Ross and Wu's analyses of the cross-sectional sample did not estimate age effects for individuals, and therefore may have estimated cohort effects.

A study by Dupre (2007) addresses the inconsistencies found among the cumulative advantage and age-as-leveler hypotheses. By differentiating individual-level changes in health from those at the aggregate level, Dupre finds that, at the aggregate level, educational differences in disease prevalence peak at middle age and then decline. However, at the individual level, disease incidence increases with age. This happens at a greater rate for less-educated compared to well-educated individuals (Dupre 2007). Therefore, Dupre combines the two hypotheses, suggesting that the age-as-leveler hypothesis applies at the aggregate level and the cumulative advantage hypothesis applies at the individual level.

Trends in the Education-Health Relationship

In addition to age patterns, studies of the education-health relationship have examined period and cohort trends. A study by Martin et al. (2007) analyzed data from the National Health Interview Survey from 1982-2003 and found slightly narrowing educational differences in self-

rated health in the United States for adults aged 18-69, but slightly widening differences for seniors aged 70 and over. These findings were replicated in a study by Goesling (2007), who attributed the widening health disparities by education among older adults to increasing inequality in resources, behaviors, and access to health services. Consistent with these findings, Liu & Hummer (2008) found a trend of widening disparities in self-rated health for middle-aged and older adults, but stable or narrowing disparities for younger adults in recent years. Several studies focusing on cohort trends in the U.S. have found that the educational gap in health (Mirowsky & Ross 2008; Willson, Shuey, & Elder 2007), self-rated health (Lynch 2003), and mortality (Lauderdale 2001) increased with age and widened for recent both cohorts.

Education and Health: Subgroup Differences by Race and Gender

Although the relationship between education and health is well established, many studies fail to fully examine race/ethnic and gender patterns in this association. If studies do analyze these moderating factors, they often fail to observe them simultaneously. Because both the educational and demographic compositions of the population changed considerably over the 20th century, examining education and health trends while considering population heterogeneity is crucial.

Studies on gender differences in health reveal that women live longer than men, yet report poorer self-rated health throughout their lives (Case & Paxson 2005). Education level is more influential for women's self-rated health than for men's self-rated health (Ross, Masters, & Hummer 2012). However, the opposite is true regarding gender variation in the education-mortality relationship. Research finds that differences in mortality by education are greater for men than for women (Lin et al. 2003; Ross, Masters, & Hummer 2012). Moreover, the

differences in life expectancy by education have increased for men more than for women over period time (Preston & Elo 1995). Based on the cumulative advantage hypothesis, the advantages and disadvantages of higher or lower levels of education are hypothesized to be greater for men.

However, because the number of women seeking and earning degrees has increased so drastically over the last century, the changes in life expectancy between men and women may be changing rapidly. A study by Schnittker (2007) found that the gender differences in health have narrowed over time. Liu & Hummer (2008) found that the probability of reporting fair/poor health within each educational group remained stable from 1982 to 2003 for white men aged 42. However, for white women aged 42, the probability of reporting fail/poor health increased from 1982 to 2003, but more so for those with some college and a high school degree. These findings provide some support for the hypothesis that educational gaps in health have widened for women more than men in recent years. Whereas education has previously influenced health more for men than for women, recent studies are showing that education is having an increasingly influential impact on women's health.

Although the U.S. has witnessed a narrowing in the black-white gap in educational attainment, the rate of college completion for African Americans is still much lower than the rate of completion for whites (DiPrete & Buchmann 2006). Moreover, African Americans still rank significantly below their white counterparts in morbidity, mortality, disability, and injury (Mays et al. 2007). The death rate for African Americans in the United States in 2007 was equivalent to that of whites in America 30 years prior (Mays et al. 2007). The magnitude of these differences has encouraged researchers to identify factors leading to these health disparities. Because

education is an important stratifying variable within the African American community (Sakamoto, Wu, Tzeng 2000), it is an important factor to analyze.

As the education experience changes for minority subgroups, the impact on health should not be ignored. Studies aim to determine if the differences in health for the most and least educated are greatest for blacks or for whites. Kimbro et al. (2008) found that the educational gradient in self-rated health was steepest for U.S. born African Americans compared to other race/ethnic groups, not specific to age. Liu and Hummer (2008) found evidence of widening educational gaps in health for both black men and black women aged 50-79 from 1982 to 2003. However, their analysis also suggests that widening educational gaps in health are especially apparent among whites compared to blacks. Therefore, although the differences in health by education are increasing across time period and age, the differences are still more apparent for whites rather than blacks.

Hypotheses

Although the education-health relationship is well established, results on the relationship over age, period time, and cohorts have been inconsistent. Few studies have examined the extent to which age, period, race/ethnicity, and gender moderate the relationship between education and health in the United States. This study examines how the education-health relationship in the United States changed between 1972 and 2011, and how that change varies across age, cohort, gender, and race subgroups of the population.

I aim to understand whether the relationship between education and self-rated health has weakened, stayed the same, or strengthened in the United States between 1972 and 2011, specific to age. I hypothesize that (1) the relationship has strengthened, resulting in a greater

educational gap in health in 2011 compared to 1972. I also analyze the relationship within

specific cohorts by comparing the youngest age groups in 1972 to the oldest in 2011. I

hypothesize that (2) the gap will be greater in 2011, reflecting the increasing advantage of higher

levels of educational attainment as birth cohorts age throughout the life course. Finally, I

examine the relationship between education and self-rated health specific to age in 1972 and

2011, stratifying by gender and race. I predict that the widening disparities in self-rated health by

educational attainment will be more apparent for women (3) and for non-Hispanic blacks (4).

Data and Methods

Data and analytic sample

Data for this study are drawn from the 1972 and 2011 waves of the National Health

Interview Survey (NHIS), a repeated cross-sectional survey of the non-institutionalized

population of the United States (NCHS, 2000a). The NHIS, conducted annually by the National

Center for Health Statistics (NCHS), uses a multistage probability sampling technique. I applied

weights from the 1972 and 2011 NHIS in the analysis to allow my estimates to accurately reflect

the non-institutionalized population of the country for these two years.

I restrict the lowest age of my analysis to 30 because many individuals below age 30 are

still completing their education and most health conditions do not arise until after age 30. I

restrict the highest age to 79 due to concerns about estimation bias from mortality selection.

Moreover, a significant portion of the population above age 79 is institutionalized and, therefore,

not in the NHIS data. Each wave of the NHIS contains information on all members of the

household, but in this analysis only data from the primary respondent is used due to concerns

about the validity and reliability of proxy reports of health. Analysis is restricted to individuals

aged 30-79 who have valid data on education and self-rated health, and who identified as either non-Hispanic white or non-Hispanic black. The racial restriction is a result of limited sample sizes for other race/ethnic groups in 1972, as well as changes in racial/ethnic categories between 1972 and 2011. The total number of observations used for the two years is 108,137.

Variables and measurement

My outcome variable in the analysis is self-rated health. Because of changes in the measurement of self-rated health between the 1972 and 2011 samples, I dichotomized the variable into fair/poor health versus excellent/very good/good health. This corresponds with much previous literature (e.g., Liu and Hummer 2008; Goesling, 2007; Martin et al. 2007; Lynch 2003; Kimbro et al. 2008; Lynch 2006). The value of 1 indicates fair or poor health, while 0 indicates excellent, very good, or good health. Although a subjective measure, studies have found that self-rated health is a valid measure of health correlated with objective measures such as morbidities and functional limitations (Idler and Benyamini 1997; Farmer and Ferraro 1997). Self-rated health is also shown to predict mortality among elders better than physicians' assessments (Hays et al. 1996).

In this analysis, education is classified into five categories based on years of schooling completed. Educational categories include: (1) no high school diploma (11 or fewer years of schooling); (2) high school graduates (12 years of schooling completed); (3) some college (1-3 years of college); (4) college graduate (4 years of completed college); (5) 5 or more years of post-secondary education. High school graduates serve as the reference group for education. Many studies examining the education-health relationship either categorize education into groups

13

(e.g. Liu & Hummer 2008; House et al 2994; Lin et al. 2003; part of Russ and Wu 1995) or

examine education by one year increments (e.g. Dupre 2007; Lynch 2003; Lynch 2006).

Period time is indicated by the survey year, either 1972 or 2011. Because education-

health patterns vary considerably by age, I examine the relationship specific to age groups. Age

was separated into ten-year age groups: 30-39, 40-49, 50-59, 60-69, and 70-79. Age in one year

units is also controlled for in the analysis of education and health specific to age groups.

Table 1 presents descriptive information for the total sample, as well as separate

descriptives for the 1972 and 2011 sub-samples. Most of the respondents in the total sample

(82.4%) rated their health as good or better, while only 17.6% rated their health as fair or poor.

A higher percentage of people rated their health as good or better in 2011 compared to 1972

(84.2% compared to 80.8%). In the 1972 sample, 78.3% of respondents had a high school

diploma or less, while in 2011, only 44.4% of respondents reported having a high school diploma

or less. The 2011 sample had more African Americans than the 1972 sample (16.2% compared

to 9.1%). Gender composition was similar between the two samples, with slightly more females

in both samples (53.5% in 1972 and 52.8% in 2011). The mean age of both waves was almost

identical (50.7 years in 1972 and 50.8 years in 2011).

Statistical Methods

As a preliminary test, crosstabs were run to examine the strength of the association

between education and health for each of the two survey years. To fully test the first hypothesis

that the relationship between education and health in 2011 compared to 1972, specific to age, has

strengthened, I estimate binomial logistic regression models of self-rated health separately for

each age group. I do this for each sample in 1972 and 2011. I estimate the following model:

Logit(Poor/Fair SRH)=β_o+β_1Education+ β_2Age+ β_3Black+ β_4Female,

where Poor/Fair SRH represents the probability or reporting fair or poor health, Education indicates educational categories (described above), Age represents single years of age within each 10-year category, Black represents race (black or white), and Female represents gender. Separate analyses are conducted for each age group in the sample, while controlling for age, race, and gender. I then use the first model to conduct the cohort comparison analysis, comparing the youngest age group in 1972 (30-39) to its corresponding age group in 2011 (70-79). This tests the second hypothesis that the educational gap in self-rated health will be greater for the cohort in 2011 compared to 1972.

Finally, I conduct the analyses separately for the four gender and race subgroups to examine potential subgroup differences in the education-health relationship. This tests the third and fourth hypotheses that widening disparities in self-rated health by educational attainment will be more apparent for women and for non-Hispanic blacks. I estimate the following model:

Logit (Poor/Fair SRH)=β_o+β_1Education+ β_2Age+ β_3Black,

for each age group in 1972 and 2011 to compare self-rated health by education while stratifying by gender and controlling for age and race. Similarly, I estimate the following model:

Logit(Poor/Fair SRH)=β_o+β_1Education+ β_2Age+ β_4Female,

for each age group in 1972 and 2011 to compare the education-health relationship while stratifying by race and controlling for age and gender.

Results

Table 2 shows that the initial crosstabs of self-rated health by education for 2011 and 1972, respectively, revealed significant relationships in both sample years (p<.001). A strong gamma for both the 1972 sample (g=.5003) and the 2011 sample (.4407) supports the strength of the education-health relationship in both years.

Table 3 shows the coefficients from the binomial logistic regression models for estimated patterns in educational differences in self-rated health for the samples in both 1972 and 2011. These models offer an initial test of the first hypothesis that the education-health relationship has strengthened, by first examining the regression coefficients for the overall relationship, not specific to age. For both the 1972 and 2011 samples, the large coefficients for the less educated groups indicate a higher probability or reporting fair/poor health. Similarly, the smaller coefficients for those with a college degree and 5+ years of secondary education reveal the lower odds of these more highly educated individuals reporting fair/poor health. The coefficients for those with the lowest levels of education are similar in the 1972 and 2011 samples, but the coefficients for a college degree and more than 5 years of college are much smaller in 2011 compared to 1972. This indicates a stronger effect of higher levels of education on self-rated health in 2011. Clearly the strength of the education-health relationship differs in 2011 compared to 1972, supporting the first hypothesis.

Table 4 shows the odds of reporting fair/poor health by education specific to 10 year age groups for 1972 and 2011. As part of the first hypothesis, this table was used to examine whether

the education-health relationship changed across specific age groups. The education category "high school degree" was used as the reference group for each regression model due to the similar percentage of people with a high school degree in both samples. In both 1972 and 2011, the odds of reporting fair/poor health for each education level compared to high school graduates, net of the effects of other covariates, generally increased for each 10 year age group. This most likely reflects the cumulative advantage/disadvantage process.

The results in Table 4 were used to examine the relationship of education and self-rated health within each age category. For all age groups in both sample years, the odds of reporting fair/poor health were lower for each increase in education level compared to high school graduates, net of the effects of other covariates. For example, when compared to high school graduates, net of the effects of other covariates, the odds of reporting fair/poor health were 75% lower for 40-49 year olds with a college degree in 2011 and 50% lower for 40-49 year olds with a college degree in 1972. This shows that the education-health relationship is clearly evident in each age group and in both samples.

95% confidence intervals were used to determine whether the relationship between education and self-rated health changed between 1972 and 2011, specific to each age group. Overlapping confidence intervals for each age group indicate no change, while non-overlapping confidence intervals indicate change in the education-health relationship. This formally tests the first hypothesis that the relationship between education and health, specific to age, has strengthened between 1972 and 2011. Table 4 shows that, for almost every age group, there was a significant difference (p<.05) in the odds of reporting fair/poor health for college graduates and those with 5+ years of secondary education relative to high school graduates in 2011 compared to 1972, net of the effects of other covariates. This pattern exhibits strong support for the first

hypothesis that the relationship between education and self-rated health, specific to age, is stronger in 2011 than in 1972 for those with a college degree or more.

Table 4 also shows that there is no significant difference in the odds of reporting fair/poor health for some college or less than a high school degree between 1972 and 2011, except for the 30-39 year old age group. Overall, these results suggest that the relationship between education and self-rated health, specific to age, did not change between 1972 and 2011 for those without a high school diploma. This contradicts the first hypothesis that the relationship strengthened between 1972 and 2011, specific to age, for all education levels.

The odds ratios from the binomial logistic regression models were used to compare the education-health relationship for 30-39 year olds in 1972 to their same cohort in 2011, 70-79 year olds (Table 5). This analysis tests the second hypothesis that the educational gap in self-rated health has widened for this cohort in 2011 compared to 1972. Based on overlapping confidence intervals, there was not a significant difference in the odds of reporting fair/poor health for this cohort. This comparison could be compromised by selective mortality in the 70-79 year old cohort in 2011. Nevertheless, this cohort-specific comparison shows that there is no statistically significant change in the education-health relationship, which does not offer support for the second hypothesis.

Gender Variations

Table 6 presents the odds of reporting fair/poor health by education, specific to age, and stratified by gender for 1972 and 2011. This analysis tests the third hypothesis that the education-health relationship has strengthened between 1972 and 2011, more so for women than men. 95% confidence intervals were again used to test the significance, comparing men in 1972 to men in

2011, as well as women in 1972 to women in 2011. Specific to age, there were only a few statistically significant changes that were significant at the p<.05 level. This suggests that there was little change between 1972 and 2011 in the strength of the education-health relationship, specific to age, within gender subgroups, which does not offer support for the third hypothesis.

However, it is important to note that the ratio of odds between the lowest and highest levels of education is much different in 1972 and 2011. This ratio is used as a measure of the gap between the least and highest educated groups in the sample. Similarly, it is important to note the differences in the ratio of the most educated reporting fair/poor health compared to the least educated reporting fair/poor health between 1972 and 2011, specific to age. For each age group, the ratio is greater in 2011 compared to 1972, suggesting a greater difference in health between the least and highest educated in 2011. This suggests that the differences in health returns for the lowest and highest levels of education are much more pronounced for men and women in 2011 compared to 1972.

Race Variations

Table 7 presents the odds of reporting fair/poor health by education, specific to age, and stratified by race for 1972 and 2011. This analysis tests the fourth hypothesis that the relationship between education and health is stronger for African Americans in 2011 compared to 1972. Overlapping 95% confidence intervals were used to test the significance, comparing non-Hispanic whites in 1972 and 2011, as well as African Americans in 1972 and 2011. Specific to age, there were statistically significant differences in the odds of reporting fair/poor health in 2011 compared to 1972 for whites. However, there were no statistical differences in the odds of reporting fair/poor health for blacks in 2011 compared to 1972. This could be because fewer

19

African Americans in the 1972 sample had higher levels of education. Additionally, for some of the age groups in 1972, the relationship between education levels and self-rated health was not significant. This prevents a useful comparison of the education-health relationship, specific to age, between 1972 and 2011. The analysis reveals that the education-health relationship is stronger in 2011, but only for the white subgroup, which does not offer support for the fourth hypothesis.

Race and Gender Variations

This study explores the education and self-rated health relationship further by examining the odds of reporting fair/poor health by education, specific to age groups, and stratified by gender and race for both 1972 and 2011. This analysis combines the third and fourth hypothesis, comparing the strength of the relationship by combined race and gender subgroups. White women had some statistically significant differences in the odds of reporting self-rated health, but the other subgroups had no statistically significant differences. The lack of statistical significance is likely due to the small populations of black men and women completing higher levels of education in 1972. However, it is interesting to note the differences in the coefficients of determination (r squared) for the different race and gender subgroups. For white women, black men, and black women, the r squared value was larger in 2011 compared to 1972, perhaps suggesting that education explains differences in self-rated health for these subgroups better in 2011. For the 1972 sample, education may have been less of a determinant of self-rated health. Overall, the lack of significance based on overlapping confidence intervals does not offer support for the third and fourth hypotheses.

Discussion and Conclusion

The literature shows that US disparities in adult health by education have widened over the last few decades (e.g., Liu & Hummer 2008; Goesling 2008; Lynch 2003; Martin et al. 2007), emphasizing the need to focus on educational factors to reduce or eliminate health disparities. Has the relationship between education and self-rated health strengthened over a 40 year period, specific to 10 year age groups within the U.S. adult population? For example, are 40-49 year olds with a college degree in 2011 less likely to report fair/poor health compared to 40-49 year olds with the same college degree in 1972?

My results show adults with a college degree or 5+ years of secondary education in 2011 are less likely to report fair/poor health than adults with the same degree in 1972, specific to age. This suggests that the education-health relationship has changed over 40 years and is stronger in 2011 than in 1972. The returns to education have changed, emphasizing the importance of eliminating educational disparities. These findings add a new dimension to the literature as they examine a longer time span than previous research (40 years) and with a unique level of detail.

The results also add to the literature by examining cohort differences, as well as race and gender subgroups. The cohort comparison analysis revealed no significant changes in reporting fair/poor health for any education level across the 40 years. However, this is likely due to selective mortality in the 70-79 group. Adults in this sample were born in the 1930s, when the life expectancy was approximately 60 years. Adults in this cohort who died or were institutionalized before age 70-79 are more likely to be those with lower education levels, skewing the cross-sectional data in the 2011 sample. The fact that educational differences in health in this cohort did not narrow between 1972 and 2011, given selective mortality, provides further support for the very strong influence of education on health over the past 40 years.

This analysis highlights an important problem in understanding the changing education-health relationship over time, especially when examining race and gender subgroups. The small number of African Americans and women with college degrees and 5+ years of secondary education in 1972 makes comparison of odds ratios across survey years difficult. Additionally, these subgroups are less likely to have significant differences in self-rated health by education in the context of 1972. Not only were higher levels of education less attainable for racial minorities and women, but it was possible to make a decent living and have a decent quality of life with a high school degree. Adults who had completed their education by the time of the 1972 survey had lived in an era where a high school degree was the accepted norm. Only in the late 1960s and early 1970s did higher education expand, especially to low-income students, racial minorities, and women. The current analyses suggest that the relationship between education and self-rated health only strengthened significantly for white adults. Consistent with my results, Liu & Hummer (2008) found that the widening of self-rated health by education across time is more apparent for white adults rather than black adults. It is likely that future studies will find the relationship strengthening for other subgroups as the benefits of higher education emerge.

This study has important policy implications. In 2011, adults aged 30-69 with a college degree or 5+ years of secondary education were less likely to report fair/poor health than 30-69 year olds with the same degree in 1972 (p<.05). This reveals important changes in the returns to education in recent years. Because the relationship between education and health was stronger for the higher levels of education in 2011 compared to 1972, policy should aim to increase access to higher education in order to reduce health disparities. This is particularly difficult in an era of escalating college costs; however, it is important given the health and income disparities by education. Federal and state governments should continue to fund public institutions in order

to reduce the cost of tuition. Given the increasing cost of tuition, it is crucial to make need-based financial aid available for a wider range of family income levels.

This study has at least three limitations. First, because self-rated health is a subjective measure, perceptions and understanding of health may have changed between 1972 and 2011. The standards for reporting fair/poor versus good/excellent health may be different for adults in 1972 and 2011. However, studies have found that self-rated health is a reliable and valid measure for health, and a strong predictor of morbidity and mortality (Idler & Benyamini 1997; Farmer & Ferraro 1997; Hays et al. 1996). Second, I restricted the lowest age of analysis to 30 with the assumption that adults below age 30 could still be completing their education and adults above age 30 have finished. However, especially in recent years, it is not rare for adults to be continuing their education after age 30. Finally, many questions on the NHIS surveys were not consistent in 1972 and 2011, preventing the inclusion of other important control variables, such as income.

Future studies should aim to understand why the returns to education are changing in order to remedy health disparities by education. The results did not imply a significant strengthening of the education-health relationship between 1972 and 2011 for African Americans and women overall. However, because access to higher education only increased in the 1960s and 1970s for these subgroups, studies should examine how this relationship might change in future years as the benefits to higher education accumulate across the life course.

References

Beckett M. 2000. "Converging Health Inequalities in Later Life—An Artifact of Mortality Selection?" *Journal of Health and Social Behavior* 41:106–19.

Blau, Peter M. and Otis D. Duncan. 1967. *The American Occupational Structure*. New York: Wiley.

Case A, and Paxson C. 2005. "Sex differences in morbidity and mortality." *Demography* 42:189–214. [PubMed:15986983]

Cutler, David, and Adriana Lleras-Muney. 2008. "Education and Health: Evaluating Theories and Evidence." In *Making Americans Healthier: Social and Economic Policy as Health Policy*, House J, Schoeni R, Kaplan G, and Pollack H. New York: Russell Sage Foundation.

DiPrete TA, and Buchmann C. 2006. "Gender-specific trends in the values of education and the emerging gender gap in college completion." *Demography* 43:1–24. [PubMed: 16579206]

DiPrete TA, and Eirich GM. 2006. "Cumulative Advantage as a Mechanism for Inequality: A Review of Theoretical and Empirical Developments." *Annual Review of Sociology* 32:271–97.

Dupre ME. "Educational differences in age-related patterns of disease: reconsidering cumulative disadvantage and age-as-leveler." *Journal of Health and Social Behavior* 48(1):1–15. [PubMed:17476920]

Farmer MM and Ferraro KF. 1997. "Distress and Perceived Health: Mechanisms of Health Decline." *Journal of Health and Social Behavior* 39:298–311.

Gelb J and Palley ML. 1982. *Women and public policies*. Princeton, NJ: Princeton University Press.

Goesling B. 2007. "The rising significance of education for health." *Social Forces* 85(4):1621–1644.

Gumport PJ, Iannozzi M, Shaman S, and Zemsky R. 1997. "Trends in United States higher education from massification to post massification." Stanford, CA: National Center for Postsecondary Improvement.

Hays JC, Schoenfeld D, Blazer DG, and Gold DT. 1996. "Global Self-Ratings of Health and Mortality: Hazard in the North Carolina Piedmont." *Journal of Clinical Epidemiology* 49:969–79.

House JS, Lepkowski JM, Kinney AM, Mero RP, Kessler RC, and Herzog AR. 1994. "The Social Stratification of Aging and Health." *Journal of Health and Social Behavior* 35(3):213–34.

Idler EL, Benyamini Y. 1997. "Self-rated health and mortality: a review of twenty-seven community studies." *Journal of Health and Social Behavior* 38:21–37. [PubMed: 9097506]

Kimbro RT, Bzostek S, Goldman N, and Rodriguez G. 2008. "Race, ethnicity, and the educational gradient in health." *Health Affairs* 27:361–372.

Kinzie J, Palmer M, Hayek J, Hossler D, Jacob SA, and Cummings H. 2004. "Fifty Years of College Choice: Social, Political, and Institutional Influences on the Decision-making Process." *New Agenda Series* 5(3):1-76.

Lauderdale DS. 2001. "Education and survival: birth cohort, period, and age effects." *Demography* 38(4):551–561. [PubMed: 11723951]

Levine A, and Nidiffer J. 1996. *Beating the odds: How the poor get to college* (1st ed.). San Francisco: Jossey-Bass.

Lin CC, Rogot E, Johnson NJ, Sorlie PD, and Arias E. 2003. "A further study of life expectancy by socioeconomic factors in the national longitudinal mortality study." E*thnicity and Disease* 13:240–247. [PubMed: 12785422]

Link B, and Phelan J. 1995. "Social conditions and fundamental causes of disease. *Journal of Health and Social Behavior* 80-93 (extra issue).

Liu H, Hummer RA. 2008. "Are Educational Differences in U.S. Self-Rated Health Increasing? An Examination by Gender and Race." *Social Science Medicine* 67(11): 1898-1906.

Lynch SM. 2003. "Cohort and life-course patterns in the relationship between education and health: a hierarchical approach." *Demography* 40(2):309–331. [PubMed: 12846134]

Lynch SM. 2006. "Explaining life course and cohort variation in the relationship between education and health: the role of income." *Journal of Health and Social Behavior* 47:324–338. [PubMed: 17240923]

Martin LG, Schoeni RF, Freedman VA, and Andreski P. 2007. "Feeling better? Trends in general health status." *Journal of Gerontology*: *Social Sciences* 62:S11–S21.

Mays VM, Cochran SD, and Barnes NW. 2007. Race, race-based discrimination and health outcomes among African Americans." *Annual Review of Psychology* 58:201–225.

Minnesota Population Center and State Health Access Data Assistance Center, *Integrated Health Interview Series: Version 5.0.* Minneapolis: University of Minnesota, 2012. http://www.ihis.us

Mirowsky J and Ross CE. 2003. *Education, social status, and health*. New York: Aldine De Gruyter.

Mirowsky J and Ross CE. 2008. "Education and self-rated health: cumulative advantage, rising importance and their interaction." *Research on Aging* 30:93–122.

Neckerman KM and Torche F. 2007. "Inequality: Causes and Consequeces." *Annual Review of Sociology* 33:335-357.

National Center for Health Statistics. National Health Interview Survey. [Computer file]. 2nd ICPSR version. Hyattsville, MD: U.S. Dept. of Health and Human Services, National Center for Health Statistics [producer]; 2000a. 2000. Ann Arbor, MI: Inter university Consortium for Political and Social Research [distributor], 2002.

Preston SH and Elo IT. 1995. "Are educational differentials in adult mortality increasing in the United States?" *Journal of Aging and Health* 7:476–496. [PubMed: 10165966]

Ross CE and Wu C. 1995. "The links between education and health." *American Sociological Review* 60(5):719–745.

Ross CE, Masters RK, and Hummer RA. 2012. "Education and the gender gaps in health and mortality." *Demography*. 49(4):1157-83.

Sakamoto A, Wu H, and Tzeng J. 2000. "The declining significance of race among American men during the latter half of the twentieth century." *Demography* 37(1):41–51. [PubMed: 10748988]

Schnittker J. 2007. "Working More and Feeling Better: Women's Health, Employment, and Family Life 1974-2004." *American Sociological Review* 72:221-238.

Schoon, Ingrid. 2008. "A Transgenerational Model of Status Attainment: the Potential Mediating Role of School Motivation and Education." *National Institute Economic Review* 205(1):72–81

Shuey KM and Willson AE. 2008. "Cumulative Disadvantage and Black-White Disparities in Health Trajectories." *Research on Aging* 30:200-227.

Willson AE, Shuey KM, and Elder GH. 2007. "Cumulative Advantage Processes as Mechanisms of Inequality in Life Course Health." *American Journal of Sociology* 112(6):1886-1924.

Table 1: Demographic, Educational, and Health Distributions for US Adults Aged 30-79 for the 1972, 2011, and Total Samples

	1972	2011	Total
Age in years			
Mean (SD)	50.7 (13.0)	50.8 (13.0)	50.71 (13.0)
Gender (%)			
Male	46.5	47.2	46.9
Female	53.5	52.8	53.2
Race (%)			
White	90.9	83.8	87.7
African American	9.1	16.2	12.4
Education (%)			
Less Than High School	44.3	14.6	30.7
HS Degree	34	29.8	32.1
Some College	10.6	8.4	18.9
College Degree	6.4	16.9	11.2
5+ yrs of College	4.8	10	7.2
Self-Rated Health			
Fair or Poor	19.2	15.8	17.6
Good, Very Good, Excellent	80.8	84.2	82.4
Sample Size	58,849	49,288	108,137

Source: NHIS, 1972 & 2011

Table 2: Crosstab of Self-Rated Health by Education for 1972 and 2011

1972

Self-Rated Health	LTHS	HS	Some College	College	5+ College	Total
Excellent/Good	70.2	87.7	89.7	92.9	93.9	80.8
Fair/Poor	29.8	12.3	10.3	7.1	6.1	19.2
Total	100	100	100	100	100	100

Note: x2=3500 (p<.001) gamma=.5003 (p<.01)

2011

Self-Rated Health	LTHS	HS	Some College	College	5+ College	Total
Excellent/Good	67.4	81.4	86.4	93.5	95.2	84.2
Fair/Poor	32.6	18.6	13.6	6.5	4.8	15.8
Total	100	100	100	100	100	100

Note: x^2=2700 (p<.001) gamma= .4407 (p<.01)

Source: NHIS, 1972 & 2011

Table 3: Logistic regression coefficients for educational differences in fair/poor health among US adults aged 30-79 in 1972 & 2011

Fair/Poor Health	1972 Coef.	2011 Coef.
Education		
Less than HS	0.87***	0.86***
High School (ref)		
Some College	-0.23***	-0.36***
College	-0.61***	-1.14***
5+ College	-0.76***	-1.54***
Age		
30-39 (ref)		
40-49	0.43***	0.49***
50-59	0.88***	0.93***
60-59	1.13***	1.18***
70-79	1.16***	1.15***
Black (ref=white)	0.62***	0.58***
Female (ref = male)	0.12***	0.08**
Psudo R²	.09	.10
N	58,849	49,288

Note: *p<.05, **p<.01, ***p<.001. total N=108,137. DF=10
Source: NHIS, 1972 & 2011

Table 4: Odds Ratios of reporting Fair/Poor health by education among US adults aged 30-79 in 1972 & 2011, stratified by age, controlled for age, gender, and race

	1972			2011		
Age 30-39	Odds	95% CI		Odds	95% CI	
LTHS	2.95***	2.58	3.38	†1.46***	1.2	1.78
HS (ref)						
Some College	0.74*	0.58	0.95	0.67***	0.56	0.8
College	0.49***	0.33	0.72	0.26***	0.19	0.34
5+	0.43***	0.28	0.65	†0.12***	0.07	0.2
Age 40-49						
LTHS	2.52***	2.26	2.82	2.15***	1.83	2.52
HS (ref)						
Some College	0.82*	0.67	0.99	0.74***	0.64	0.86
College	0.51***	0.37	0.69	†0.26***	0.2	0.33
5+	0.43***	0.3	0.63	†0.2***	0.14	0.28
Age 50-59						
LTHS	2.26***	2.04	2.5	2.89***	2.49	3.35
HS (ref)						
Some College	0.7***	0.58	0.85	0.67***	0.58	0.76
College	0.56***	0.43	0.72	†0.3***	0.25	0.37
5+	0.4***	0.29	0.56	†0.19***	0.14	0.25
Age 60-69						
LTHS	2.27***	2.02	2.56	2.66***	2.27	3.12
HS (ref)						
Some College	0.87	0.7	1.09	0.7***	0.61	0.82
College	0.56***	0.42	0.74	0.35***	0.28	0.44
5+	0.61**	0.44	0.84	†0.25***	0.19	0.32
Age 70-79						
LTHS	1.93***	1.62	2.30	2.48***	2.07	2.98
HS (ref)						
Some College	0.94	0.70	1.26	0.66***	0.53	0.81
College	0.68*	0.46	0.99	0.51***	0.38	0.68
5+	0.58*	0.36	0.94	0.29***	0.20	0.44

Note: *p<.05, **p<.01, ***p<.001. †Significant difference in odds ratio between 1972 and 2011 based on non-overlapping confidence intervals.
Source: NHIS, 1972 & 2011

Table 5: Cohort Study: Odds Ratios of reporting fair/poor health by education among US adults aged 30-39 in 1972 and 70-79 in 2011, controlling for age, gender, and race

	1972			2011		
Age 30-39	Odds	95% CI		Odds	95% CI	
LTHS	2.95***	2.58	3.38			
HS (ref)						
Some College	0.74*	0.58	0.95			
College	0.49***	0.33	0.72			
5+	0.43***	0.28	0.65			
Age 70-79						
LTHS				2.48***	2.07	2.98
HS (ref)						
Some College				0.66***	0.53	0.81
College				0.51***	0.38	0.68
5+				0.29***	0.20	0.44

Note: *$p<.05$, **$p<.01$, ***$p<.001$. **†**Significant difference in odds ratio between 1972 and 2011 based on overlapping confidence intervals.
Source: NHIS, 1972 & 2011

Table 6: Odds Ratios of reporting fair/poor health by education among US adults aged 30-79 in 1972 & 2011, stratified by gender & controlled for age and race

	Men						Women					
	1972			2011			1972			2011		
Age 30-39	Odds	95% CI		Odds	95% CI		Odds	95% CI		Odds	95% CI	
LTHS	3.17***	2.52	3.98	1.24	0.93	1.65	2.84***	2.40	3.37	†1.71***	1.30	2.23
HS (ref)												
Some Col.	0.82	0.57	1.19	0.58***	0.43	0.77	0.68*	0.49	0.95	0.76*	0.59	0.97
College	0.51*	0.30	0.86	†0.19***	0.11	0.30	0.47**	0.27	0.83	0.31***	0.22	0.44
5+	0.43**	0.25	0.74	0.16***	0.08	0.33	0.43**	0.22	0.82	†0.1***	0.05	0.21
Age 40-49												
LTHS	2.55***	2.14	3.04	1.97***	1.56	2.49	2.48***	2.15	2.85	2.34***	1.88	2.91
HS (ref)												
Some Col.	0.8	0.60	1.06	0.71**	0.57	0.89	0.82	0.63	1.05	0.77**	0.63	0.94
College	0.46***	0.30	0.69	0.29***	0.20	0.41	0.54**	0.35	0.86	†0.24***	0.17	0.33
5+	0.43***	0.28	0.67	0.21***	0.13	0.36	0.42*	0.21	0.83	0.19***	0.11	0.31
Age 50-59												
LTHS	2.15***	1.85	2.49	2.79***	2.27	3.44	2.35***	2.06	2.69	3.0***	2.43	3.69
HS (ref)												
Some Col.	0.7**	0.54	0.90	0.64***	0.52	0.77	0.70**	0.54	0.92	0.69***	0.58	0.83
College	0.57***	0.40	0.80	†0.3***	0.22	0.40	0.55**	0.37	0.80	0.31***	0.23	0.41
5+	0.39***	0.26	0.59	0.2***	0.14	0.31	0.42***	0.24	0.71	0.17***	0.11	0.25
Age 60-69												
LTHS	2.19***	1.82	2.64	2.34***	1.86	2.95	2.34***	2.00	2.74	3.02***	2.43	3.76
HS (ref)												
Some Col.	0.92	0.67	1.28	0.65***	0.53	0.81	0.83	0.62	1.12	.75**	0.61	0.91
College	0.53**	0.35	0.81	0.38***	0.28	0.51	.58**	0.40	0.85	.31***	0.22	0.43
5+	0.76	0.50	1.16	†0.21***	0.15	0.31	.43**	0.26	0.73	.29***	0.20	0.42
Age 70-79												
LTHS	2.31***	1.71	3.12	2.33***	1.77	3.07	1.77***	1.42	2.20	2.59	2.03	3.31
HS (ref)												
Some Col.	1.06	0.64	1.75	0.73	0.53	1.01	0.89	0.62	1.29	0.60	0.45	0.80
College	1.01	0.58	1.76	0.53**	0.35	0.81	0.5*	0.29	0.86	0.48	0.32	0.71
5+	0.79	0.40	1.54	0.27***	0.16	0.45	0.45*	0.21	0.93	0.32	0.17	0.60

Note: *p*<.05, **p*<.01, ***p*<.001. †Significant difference in odds ratio between 1972 and 2011 based on non-overlapping confidence intervals.
Source: NHIS, 1972 & 2011

Table 7: Odds of reporting Fair/Poor health by education among US adults aged 30-79 in 1972 & 2011, stratified by race, controlled for age and gender

	Non-Hispanic White						Non-Hispanic Black					
	1972			2011			1972			2011		
Age 30-39	Odds	95% CI		Odds	95% CI		Odds	95% CI		Odds	95% CI	
LTHS	3.28***	2.82	3.82	†1.47***	1.18	1.83	2.01***	1.51	2.68	1.34	0.87	2.09
HS (ref)												
Some Col.	0.8	0.61	1.05	.64***	0.51	0.79	.52*	0.30	0.93	0.76	0.55	1.07
College	0.53**	0.35	0.80	†.26***	0.19	0.35	.26*	0.08	0.89	.24***	0.14	0.43
5+	0.47***	0.30	0.72	†.11***	0.06	0.19	.21*	0.05	0.89	.20***	0.08	0.49
Age 40-49												
LTHS	2.54***	2.26	2.86	2.17***	1.82	2.59	2.35***	1.73	3.19	1.94***	1.34	2.80
HS (ref)												
Some Col.	.77*	0.62	0.94	.73***	0.61	0.86	1.08	0.65	1.81	0.82	0.61	1.10
College	.52***	0.38	0.71	†.23***	0.17	0.30	.29*	0.08	1.00	.44***	0.27	0.73
5+	.42***	0.29	0.62	.20***	0.14	0.30	0.48	0.14	1.68	.16***	0.06	0.40
Age 50-59												
LTHS	2.36***	2.13	2.61	2.97***	2.51	3.50	1.39	0.98	1.96	2.54***	1.88	3.45
HS (ref)												
Some Col.	.69***	0.57	0.84	.65***	0.55	0.75	0.74	0.40	1.37	.75*	0.58	0.97
College	.55***	0.42	0.72	†.30***	0.24	0.37	0.83	0.31	2.22	.35***	0.23	0.52
5+	.43***	0.31	0.61	†.17***	0.12	0.24	.14**	0.03	0.60	.28***	0.15	0.55
Age 60-69												
LTHS	2.28***	2.02	2.58	2.85***	2.39	3.41	2.24*	1.27	3.93	1.9***	1.36	2.65
HS (ref)												
Some Col.	0.83	0.66	1.04	.71***	0.61	0.84	2.08	0.86	5.07	.65**	0.47	0.89
College	.55***	0.41	0.74	.35***	0.28	0.45	0.67	0.17	2.69	.38***	0.22	0.65
5+	.60**	0.43	0.84	†.25***	0.19	0.33	0.71	0.18	2.84	.26***	0.14	0.48
Age 70-79												
LTHS	1.92***	1.61	2.30	2.70***	2.21	3.31	2.06	0.86	4.92	1.41	0.94	2.11
HS (ref)												
Some Col.	0.96	0.72	1.30	.69**	0.55	0.87	0.43	0.07	2.53	.47**	0.28	0.78
College	.65*	0.44	0.97	.52***	0.38	0.71	1.60	0.28	9.19	.44*	0.21	0.91
5+	.58*	0.35	0.96	.29***	0.19	0.45	0.50	0.05	5.11	.29*	0.11	0.77

Note: *p<.05, **p<.01, ***p<.001. **†**Significant difference in odds ratio between 1972 and 2011 based on non-overlapping confidence intervals.
Source: NHIS, 1972 & 2011