Education of Children and Differential Mortality of Parents: Do Parents Benefit from Their Children's Attainments?

Esther M. Friedman
Robert Mare

PWP-CCPR-2010-011

September 2010

California Center for Population Research
On-Line Working Paper Series

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Esther M. Friedman and Robert D. Mare
University of California, Los Angeles

September 03, 2010

This research was supported, in part, by the UCLA Interdisciplinary Relationship Science Program sponsored by the National Science Foundation and the resources of the California Center for Population Research, which receives core support from the NICHD. We are grateful to Judy Seltzer, Suzanne Bianchi, and Kathleen McGarry for helpful advice as we developed the paper. Previous versions of this paper were presented at the Research Committee 28 Conference on Social Stratification and Mobility (RC28), Florence, Italy and at the Population Association of America (PAA), Detroit, MI. Please direct all correspondence to Esther M. Friedman, Department of Sociology, University of California – Los Angeles, 264 Haines Hall, Los Angeles, CA 90095-1551, USA; email: efriedman@ucla.edu.

ABSTRACT

Contemporary stratification research on developed societies usually views the intergenerational transmission of educational advantage as a one-way effect from parent to child. However, parents' investment in their children's education may yield significant returns for parents themselves in later life. Well-educated children have greater knowledge of health and technology to share with their parents and more financial means to provide for parents than do their less-educated counterparts. This paper considers the effects of children's educational attainment on the survival of parents, net of parents' own socioeconomic status. We use data from the Health and Retirement Study (HRS) to examine whether children's educational attainment affects parents' survival and how these effects compare with those of parents' own income and wealth. Our findings suggest that one's own education, income, and wealth are, in fact, associated with mortality. More importantly, though, we find that sons' and daughters' education have independent effects on parents' mortality. We also find that at least part of the association between children's education and parents' survival can be explained by the health behaviors of parents.

The association between one's own socioeconomic status (SES) and health and survival is, by now, well-documented (Mare, 1990; Smith and Kington, 1997; Liang et al. 2000; Lynch, 2003). Higher levels of education, in particular, are associated with better health, even more so than income. The literature on the relationship between SES and health is vast. Despite an extensive body of work, however, few studies have considered socioeconomic status of the family – beyond that of the married couple pair -- and its effects on health and survival.

In this paper we investigate whether education should be viewed as a family resource, benefiting not only the educated individuals but their parents, as well. We argue that the same mechanisms that work through one's own education to improve survival – such as greater access to health information, more income, flexible jobs, and a healthier lifestyle overall – may be provided to parents by their educated children. Adult children who exceed parents in educational attainment may, therefore, enable less-educated parents to achieve the health privileges enjoyed by the more educated. Additionally, even more educated parents may not be fully aware of the latest technology and health information, and educated children may help them stay informed. The influence of children's education on parents' health behaviors could conceivably occur in a number of very different ways. For example, such influence could take a direct form, with children consciously providing parents with information and care that improves their health. Alternatively, it may be indirect, with parents' exposure to educated children's health behaviors and lifestyles influencing them to adopt healthier behaviors of their own.

By considering upward educational advantage flowing from children to parents, this research also has important implications for the growing body of work on the interdependence of intergenerational stratification and demographic processes (e.g., Mare 1990; 1991; 1996; Mare and Chang, 2006; Mare and Tzeng, 1989). This paper is a first step toward understanding the

potentially bidirectional flow of gains in the intergenerational transmission of education and whether those benefits are manifested in parents' survival.

BACKGROUND

Education and Mortality

The research on one's own socioeconomic status (SES) and its relationship with health is vast, and has included such topics as variations in this relationship over time (Preston and Elo, 1995; Ross and Wu, 1996; Lynch et al., 1997; Liu and Hummer, 2008), across space (Pickett and Pearl, 2001), and the causal mechanisms underlying it (Ross and Wu, 1995; Ross and Mirowsky, 1999; Adda, Chandola, and Marmot, 2003). Importantly, the association between education and mortality persists even after extensive controls for demographic and socioeconomic factors, including income and occupation (Elo and Preston, 1996; Cutler, Lleras-Muney, and Vogl, 2008), and regardless of how health is measured (e.g., Kitigawa and Hauser 1973; Lynch 2003; Marmot 2001).

The fact that the relationship between education and mortality remains even after controls for income, occupation, and race suggests that differences in health by education are not solely attributable to labor market and other socioeconomic returns to higher education. In fact, recent work shows that health behaviors, preventative medicine, and better medical care explain at least part of the relationship between education and health. The better educated are less likely to smoke or drink excessively and have better diets than the less educated. Individuals with more education are also more likely to obtain preventative care and manage existing conditions better (Cutler and Lleras-Muney, 2007). One study even finds that health behaviors account for over 40 percent of the relationship between education and mortality (Cutler, Lleras-Muney, and Vogl,

2008). This supports Link and Phelan's (1995) hypothesis that higher levels of education provide individuals with better access to health information and newer medical technologies.

Education as a Family-Level Resource

Given the breadth of research on individual-level socioeconomic status and health, it is surprising how few studies have considered family-level measures of socioeconomic status that go beyond the married couple pair. We know that the socioeconomic resources of one member of a married couple affect the survival of the other (Mare and Palloni, 1988; Smith and Zick, 1994), but less work has been devoted to the effects of children's education on their parents' health and survival. A notable exception is a recent body of work by Zimmer and colleagues, which demonstrates that children's education is associated with older parents' physical functioning in China and Taiwan and with mortality in Taiwan (Zimmer et. al 2002; Zimmer and Kwong 2003; Zimmer et. al, 2007). Although children's education may be more influential on a parent's outcomes in a collective society, such as that of Taiwan, than that of the United States, for example, there is certainly reason to believe that Western parents can benefit from their children's education as well, despite a more individualistic outlook and lower rates of coresidence of parents and children. Many U.S.-based studies have found, in fact, that although most intergenerational exchange flows from parents to children, children – particularly daughters – are likely to provide for parents in older age (Spitze and Logan, 1990; Silverstein et al., 2002; Lye, 1996; McGarry, 1998). In addition, most children who provide for parents do so despite not living in the same household as those parents (McGarry, 1998).

How Might Highly-Educated Children Improve Their Parents' Health?

There are many ways through which individuals with higher SES, who engage in healthier behaviors and lifestyles and have more economic and more useful social resources, can transmit the consequent benefits to others. For example, in a theoretical paper conceptualizing the role of social networks on health outcomes, Berkman et al. (2000) enumerate several means through which social networks– including family and even broader networks of neighbors and friends – influence health. Although our focus is child-to-parent transmission, the study of transmission through broader social networks provides a useful illustration of the way in which the health-enhancing aspects of some people's lives improve those of others. Some of these means are more direct, such as enhanced access to material goods and resources within the network, the role of person-to-person contact in transmitting diseases or behaviors and level of social involvement. Others are less direct and include the social influence that extends from the network's values and norms. It may be any combination of the kinds of mechanisms enumerated by Berkman et al. that explains the effect of children's schooling on parents' survival.

To explain that effect, we might consider two broad categories of mechanisms: indirect and direct. Children may indirectly affect parents' health through health "spillover" or "contagion" effects. That is, more educated children will engage in healthier behaviors and have healthier lifestyles and their parents may come to imitate or adopt them. Alternatively, a more direct mechanism through which children may influence parental health is by providing them with better care should they become ill, connecting them to doctors and resources they need, convincing them to get check-ups and annual exams, or helping them understand and navigate the health system. This is not to say that lesser-educated children do not support their parents in these ways. But more educated children have more money, are more aware of the latest health

advances, particularly where these are technical in nature,, and may also have more flexible jobs and a greater ability to care for older and ailing parents.

Health Spillovers. The idea that the health characteristics and behaviors of others in one's family and broader network can influence the whole network is hardly new (for a complete review of the effects of social networks on health, see Smith and Christakis, 2008). Research on the health interdependence of the married couple pair has a long history. It is well known that marriage is good for later-life health (Zick and Smith 1991; Seeman et al., 1993; Lillard and Waite, 1995) and that the death of one spouse can signal the impending death of the other (Lillard and Waite, 1995; Elwert and Christakis, 2006). It is not only spouses, moreover, who influence the health of someone else in their network. Adolescent siblings influence each other's smoking and drinking behaviors (Boyle et al., 2001; Rajan et al., 2003), and this influence is – not surprisingly – stronger for closer siblings (Rende et. al, 2005). Moreover, these effects do not end in adolescence. A recent body of work analyzing the Framingham Study finds that smoking, obesity, and even happiness on the part of one individual leads others within both the family and the broader friendship group to adopt like traits (Christakis and Fowler, 2007; Christakis and Fowler, 2008; and Fowler and Christakis, 2008). These findings suggest that, inasmuch as obesity and smoking behaviors are correlated with educational attainment, the education of particular family members may matter for the health and survival of the family as a whole.

Direct Care. A growing body of work investigating child-to-parent transfers shows that although most transfers occur from parents down to their children, children do provide a fair amount of time and help once parents need it. Among elderly adults who need help, most receive it from family members, with spouses and children more likely than other relatives to

provide it (McGarry, 1998). Children and children-in-law provide over a third of the care older adults receive and account for half of the care elderly widows and widowers receive (McGarry, 1998). As parents age, they are likely to have less money, fewer resources, and poorer health, and thus need more support. It is primarily their children who provide that support (Silverstein, et al., 2002; Spitze and Logan, 1990; Stoller, 1983).

However, some children are better equipped to help than others. Children who themselves need assistance because of poor health or limited financial resources are less likely to be able to provide for their parents (Hogan et al., 1993). Children with more education, on the other hand, have more resources and more flexible jobs – both of which will make them more likely to provide care. Some studies have found, in fact, that adult children with a college degree are more likely to help parents (McGarry and Schoeni, 1995). Findings, however, are mixed (Henretta et al., 1997), in part because educated children may provide different types of help than their lesser educated siblings. Highly educated children have a greater premium on their time and thus tend to provide less time-consuming help than lesser-educated siblings, but they do provide more financial assistance to their parents (Couch, Daly, and Wolf, 1999; Henretta et al., 1997). In addition, more educated children have better health themselves, and children with better health are not only good influences on parental behaviors, as suggested above, but may also be more likely to provide support than their counterparts in poor health (Eggebeen and Hogan, 1990). For these reasons, having highly educated children could be better for parental health than having less-educated ones.

In addition to being better able to provide care to parents who need it, more educated children may provide *better* care, as well. People with more education may have better access to health knowledge, possibly in part due to greater access to and more familiarity with doctors,

health research in the media, and health information obtained over the internet. The internet, in particular, is becoming an increasingly important means of obtaining health information and is therefore an obvious way the younger generation can link the elderly to key health knowledge they might not otherwise obtain. However, a large sector of the population has limited access to this resource, and there remains a significant "digital divide" by education and income, among other factors (see DiMaggio et al., 2001 for a review).

The Value of Highly Educated Children

The value of highly educated children is difficult to quantify. Clearly the value to parents of having educated children goes well beyond the health benefits they receive. Yet, in an aging world it becomes necessary to evaluate how much investment in the next generation compares to more direct investments in one's own health – especially since investment in children's schooling is on the rise. Even more generally, it is important to understand how much of a person's health care costs are being met through informal care by family and others. One study estimates the value of informal care from family and friends at $196 billion in 1997, more than expenditures for formal home health care and nursing home care combined (Arno et al., 1999). Other papers find that care and support from family members significantly reduces the risk of long-term nursing home stays, which can save the elderly and even the government significant costs, at least insofar as nursing home stays are frequently subsidized (Boaz and Muller, 1994; Charles and Sevak, 2005). In this study, we hope to quantify the degree to which children's educational attainment is related to the years a parent lives.

In sum, the advantages that more educated children have -- better health, better access to information, and greater resources to provide for older parents -- may make them *more likely* to

provide care to their elderly parents than their less educated counterparts. In addition, children with more education may provide *better* care for their parents, at least inasmuch as education is associated with a greater knowledge of preventative health, and more access to doctors and health technology. Finally, just having highly educated children at all may influence parents to engage in healthier behaviors. The primary purpose of this study is to examine the extent to which having educated children influences a parent's health and survival. In addition, we look at some of the factors that explain how highly educated children improve their parents' health.

CURRENT STUDY

The analyses to come extend current work examining the relationship between education and mortality by looking at the "upward" intergenerational effects of education on survival -- the effects of children's education on their parents' survival. Using nationally representative data from the Health and Retirement Study, we ask: Does children's education affect parents' survival and, if so, how?

We investigate this question by examining the risk of dying as a function of children's education, net of one's own socioeconomic status. We then use two methods to examine some of the mechanisms through which highly-educated children improve their parents' health. First, we investigate the extent to which children's education is related to parents' cause of death, grouping deaths into those that are more closely linked to health behaviors, such as those resulting from smoking behaviors or excessive alcohol consumption. We also look directly at smoking and exercise behaviors to see if they explain some of the relationship between children's education and parents' survival. In the sections to come, we present the data, variables, and

statistical methods used in our analyses. We then discuss the findings, ending with conclusions and implications of this study.

DATA

For this study, we analyze 14 years of data from the 1992 – 2006 waves of the Health and Retirement Study (HRS). The HRS[1] is a nationally representative sample of individuals in the U.S. over the age of 51, along with their spouses or partners, if any. The study was first launched in 1992 and currently involves five birth cohorts: individuals born prior to 1923,1924-30,1931-41,1942-47, and 1948-53. Data are collected biennially, with respondents providing detailed information about their education, income and assets, and their children's educational attainment in all waves. Respondents fill out child rosters in each wave with complete information on each child.

In this analysis, we draw our sample from four of the five cohorts: the AHEAD cohort (born before 1925), the HRS cohort (born between 1931 and 1941), the CODA cohort (born 1924-1930), and the War Babies (born 1942-1947). We do not include the Early Baby Boomers Cohort (born 1948-1953) in this analysis as there are too few deaths in this cohort between 2004, when data for this cohort were first collected, and 2006, the most recent survey wave. We primarily use the RAND-HRS[2] version of these data, a cleaned and streamlined collection of variables derived from the HRS. While not officially part of the HRS, these files are publicly available through the HRS website. However, the child roster data used in this analysis are not

[1] In the paper, we use HRS to refer to all Health and Retirement Study (HRS) cohorts.
[2] RAND HRS Data, Version J. Produced by the RAND Center for the Study of Aging, with funding from the National Institute on Aging and the Social Security Administration. Santa Monica, CA (March 2010).

available in the RAND-HRS data. We therefore draw our respondent level data from this data set, but merge in child variables from the raw HRS data.

The respondent selection of the HRS data is somewhat involved. After selection of a household, the number of age-eligible persons within the household was determined. In households with one age-eligible member, this individual became the respondent. In households with two age-eligible married individuals, both individuals were treated as respondents. In households containing more than one age-eligible person who was not married or coupled, one family unit was randomly selected and both respondent and spouse of the randomly selected family were interviewed. It should be noted that if at least one age-eligible individual is present in the household, spouses are interviewed regardless of age eligibility. For the purposes of our investigation, we include information on both members of a couple as covariates in our models, but only consider individuals as respondents for years in which they are age-eligible (51 or over). Data are limited to families with no children or with complete information on all adult children aged 25 or over, including their educational attainment, gender, and age, or with complete information on respondent's and spouse's educational attainment, household income, and on respondent's year of birth and death status, and other key model variables. This leaves us with a final sample of 25,828 individuals and over 80 million person-days of data.

The longitudinal nature of these data, along with the extensive information on the respondent's own socioeconomic and the characteristics of their children, make the HRS well-suited for investigating the link between children's education and parent's mortality. This dataset is one of only a few sources of U.S. data with complete information on all children. In addition, for respondents and their spouses, the HRS includes detailed income information in each wave of the study, complete employment life histories, and detailed wealth data. Even more traditional

studies examining own SES and mortality have rarely considered wealth in addition to income[3]. In later life, however, wealth becomes a more telling measure of socioeconomic security than income or occupation. For this study, in particular, it is critical that we incorporate as many measures of SES into our models as possible; in order to be sure that any effect of children's SES that we capture is truly independent of parents' own status. To that end, the HRS, more so than most other data sources, provides a vast array of socioeconomic variables for the respondents.

MEASURES

Age of death. We use a combination of two strategies to determine age of death. In 2006, data were merged with the National Death Index (NDI) for exact date of death. For respondents for whom this information is not available, we use reports of date of death from next living kin, which were obtained during survey tracking operations. There remain a handful of individuals who we know are dead, but for whom year of death information is unavailable. We treat these individuals as censored as of their date of last interview.

Parents' SES. As already mentioned, in these analyses, we treat the respondent as the "parent" and look "downward" at his or her children's educational attainment. We chose to look down from respondent to children (rather than up to respondents' parents) in order to take advantage of the rich socioeconomic data available for respondents. Those data are crucial, because in this analysis, it is particularly important that we adequately control for parents' own socioeconomic status in order to be sure that we are truly picking up a child effect and not just

[3] Although we consider wealth as a covariate in our preliminary analyses, in most models we exclude wealth as a covariate. We do this because parents have the choice to either invest their wealth in their children's education and receive the benefits from educated children in later life, or to hold onto their wealth and use this money to help themselves as they see fit. That said, parents who do not invest in their children's education may have more wealth than those who do not. Wealth is therefore endogenous to children's education and may confound the results of these models.

some other component of parent's SES that was missed in our models and is indirectly manifested in children's attainments. To this end, we use several measures of SES, including total family income and total family wealth as time-varying covariates and own education as a fixed covariate. We also consider spouse's education[4], in addition to respondents' own education, and allow this to vary in case a new spouse enters the household. This information is obtained directly from the spouses (if they are in the study). When spouses die, separate, or divorce, we retain the educational attainment of the most recent spouse. If the spouse is never a respondent in the study, there is no spouse during the study period, or educational information is simply unavailable for the spouse, spouse's education is coded missing/no spouse. In both datasets, parents' education includes dummy variables for 5 levels of education: Less than 12 years; 12 years; 13-15 years; and 16+.

Children's education. The HRS contains child rosters in each year with time-varying information on age, sex, and education for all of a respondent's and a respondent's spouse's children, grandchildren and children-in-law[5]. In order to limit data to children who have completed their schooling, we only include information for children over the age of 25. Because we consider only children aged 25 or over, all education variables and child variables are time varying, with children only counted when they reach their 25th birthday. (For details regarding drops and recoding of the child data, please see the tables in Appendix A).

As most of the families in this analysis have multiple children, there are many ways to construct the education of the children in the family. In preliminary analyses not shown here, we considered and compared several constructions of education, including (1) whether any child has a college education, (2) the number of children with college, (3) the average years of schooling

[4] The correlation for husband and wives education is 0.60.
[5] In these analyses, we only include respondents' and spouse's biological, adopted, and step- children.

of all the children, and (4) a measure of cumulative educational exposure[6] over time. However, the initial model comparisons suggest that the four constructions of education fit the data equally well and results were comparable across them. In this paper, we primarily focus on children's education as a categorical variable similar to that used to measure their parents' education. We separately code sons', daughters', and all children's education into the porportion in each of several educational categories, including the porportion of sons, daughters, and children in the family with: less than 12 years of schooling; 12 years of schooling; 13-15 years of schooling; and 16+ years of schooling. The advantage to viewing children's education as a categorical variable rather than an average is that gains from children's education need not be linear: perhaps once children are educated beyond a particular threshold, say, college, only then does their education affect their parents' survival. This construction is also more similar to how we categorize mothers' and fathers' educational attainments. We consider sons' and daughters' education separately, as it is likely that parents may benefit more from the educational attainment of a child of one gender than that of another. More specifically, prior research has indicated that daughters provide more help and care to parents than sons (Spitze and Logan, 1990).

Cause of death. Cause of death information is obtained from a match to the National Death Index (NDI). We use this information to investigate whether children improve the health behaviors of parents and thereby improve their parents' health. We use these data to estimate

[6] Another way of thinking about children's education as it affects parents is in terms of three component parts: the average children's education (as described above), the number of children from whom parents receive educational benefit, and the number of years parents were exposed to adult children. Parents who have children early, will have more years of educational exposure than parents who have their children later and there may be important benefits associated with each additional year of exposure. In addition, parents with the same a average children's education may fare differently depending on just how many children they have. In an early version of this paper we calculated a variable which we called: Cumulative educational exposure (CEE), which was measured as: CEE = Number of children * Mean years of education * Total years of exposure to adult children. However, we found that children's education was the main factor guiding the effects of children on their parents and we therefore consider only children's education as it affects parents' survival, in this version of the paper.

cause-specific proportional hazards models for the most common causes of death in the United States and in our data. These cause-specific death categories include groupings of underlying causes of death categorized from the International Classification of Diseases (ICD)-10, specifically: (1) cardiovascular disease, (2) cancers, (3) chronic lower respiratory diseases, (4) accidental and violent deaths and alcohol-related disease (cirrhosis), (5) diabetes mellitus, influenza, and pneumonia. We hypothesize that causes of death with a strong behavioral component, such as those relating to accidents, alcohol, smoking behaviors (lower respiratory), and diabetes will be more strongly affected by children's education than others. The groupings we use are in keeping with other work investigating behavioral hypotheses and cause-specific mortality (Montez, Hayward, Brown, and Hummer, 2009). However, a more limited sample size prevents us from breaking down categories as much as we would like. To remedy this, in addition to investigating the cause of death, we also look more explicitly at a few health behavioral mechanisms, to be described below.

Health Behaviors. A more direct way to assess whether the health behaviors of parents mediate the relationship between children's education and parents' survival is to control for the health behaviors of respondents over time. We include three time-varying dummy variables for health behaviors in these models, including: whether the respondent (1) ever smoked, (2) smokes now, and (3) is not currently engaged in vigorous exercise 3 or more times a week[7]. In preliminary analyses, we found smoking and exercise behaviors to be highly linked to one's own socioeconomic status, even net of demographic controls. One limitation to these health behavior data in the HRS is that the wording varies from year to year. This is particularly true for the questions about exercise. The RAND-HRS dataset includes streamlined versions of these data

[7] Questions asking about vigorous activity were not asked of the 1993 AHEAD respondents. This variable is therefore treated as missing for these respondents in that wave.

that are recoded, as best as possible, for consistency across waves. Despite this limitation, these variables are a useful way to get a sense of whether how children's education is translated into health benefits to parents is by improving parents' health behaviors.

Other controls. Respondents may be in any of several birth cohorts and as it is well-documented that mortality risks differ among birth cohorts, we also control for cohort in the models. For simplicity, we construct 5-years age grouping. However, due to small cell sizes, we group the youngest respondents into the pre-1905 cohort and the oldest respondents into the 1950+ cohort. This gives us 11 cohorts (i.e. those born pre 1905; 1905-1909; 1910-1914; 1915-1919; 1920-1924; 1925-1929; 1930-1934; 1935-1939; 1940-1944; 1945-1949; 1950+). In addition, we allow the baseline hazards to vary by the sampling variables which were used to oversample individuals with certain characteristics. These variables include a dummy indicator for Florida resident at time of initial 1992 HRS sample collection and race (i.e. White, Black, Hispanic, and Other). Models also include dummy variables controlling for respondents with no children.

METHODS

For these analyses, we use a Cox continuous time event history approach, as we have exact age in days of birth, death, and interview. The clock is based on age in days and starts when respondents enter the study or at age 51 whichever is later and the clock ends at death or censoring due to nonresponse or the end of the study period. We model survival curves for men and women as a function of their own socioeconomic characteristics (i.e. education, income, and wealth), their spouse’s socioeconomic characteristics, their family composition, the educational attainments of their children, and other controls (race, region, birth cohort, etc.). Data on men

and women of various ages are pooled in these analyses, yet we allow baseline hazards to vary by sex and birth cohort of the respondent. As we have numerous waves of data, all socioeconomic and family variables are allowed to vary over time. As households may include up to two respondents, standard errors are adjusted for clustering of respondents within households.

RESULTS

Descriptive Statistics

Table 1 shows descriptive statistics weighted by sampling weight for the HRS analyses for a respondent's year of entry into the study.

TABLE 1 HERE

Descriptive statistics are displayed stratified by respondents who remained alive or were censored between 1992 and 2006 and those who died during the period surveyed. Spouses can change over the years, as can income, wealth, and child characteristics and information. Time-varying covariates are collected at each wave of the study, for a maximum of eight time points (there are 8 biennial surveys between 1992 – 2006). Spouse information is for the most recent spouse. Income and wealth information are measured as of the last date of interview.

In terms of their own SES, about a third of respondents have less than a high school degree, a third have a high school degree, and a third have more than high school. Respondents also have $26,000 in income upon entering the survey, and have over $82,000 in total household wealth. Not surprisingly, children are more educated, on average, than their parents at baseline.

Only 8 percent of children have less than 12 years of schooling and over half have at least some college.

Effects of Children's SES on Parents' Mortality

Table 2 displays the results of nested Cox survival models predicting time to death. The first model in Table 2 reveals the effect of children's educational attainment on parents' survival without any controls for the respondent's own and her spouse's SES (these models are stratified by sex, age cohort, race, and Floridian sampling indicator of the respondent, as described above). Model 2 adds in respondent's education; Model 3, spouse's education; Model 4 family income; and Model 5 wealth.

TABLE 2 HERE

Model 1 shows that with only the children educational variables in the model but no controls for respondent's SES, for an increase from 0 to 1 child with less than a high school degree, the relative odds of dying doubles ($e^{.70}$) compared to that same increase for children with a college degree or more. Each percentage increase in children with a high school degree increases the risk of mortality by about 1.5 times, and even an increase in the percent of children with some college significantly increases the risk of dying compared to children with a college degree or more.

Even once controls for respondents and spouse's education and family income and assets (Model 5) are added, the effect of children's education on parents' survival persists, although these effects are, of course, weakened. This suggests that children's education does indeed matter, with more educated children increasing parents' chances of survival. In addition, these

differences are not merely for children with college as compared to those with lower levels of education. There is a clear educational gradient in survival, by children's education level.

In analyses not shown here, we also investigate whether there are differences in the effects of children's education on parents' mortality by gender of parent and whether we distinguish between education of sons and that of daughters. Although, theoretically, sons and daughters might have differential effects on mothers and fathers, we do not find significant differences. For instance, when we consider the interaction between parents and children's gender, it appears that the key gender difference is that *having daughters* is more beneficial to mothers than to fathers. However, other gender differences in the effects of sons' and daughters' education on mother's and fathers' survival are not statistically significant, and we see no indication that sons and daughters educational attainments have differing effects on parents of different sexes. Because we do not find gender differences, the following models consider only children's education and does not break down education into sons' vs. daughters' attainments.

We also considered parents' education and parents' age as other potential demographic factors that might moderate the association between children's education and parents' survival. We do not find significant differences by education of parent. We do, however, find a weakening effect of children's education on mortality over the life-course, which is consistent with other literature on SES and survival. This suggests that the real benefit to educated children comes early and is not as relevant at the oldest ages.

What Explains this Association?

In Tables 3 and 4 we look at possible mechanisms that may explain the relationship between children's education and parents' survival. We do this two ways: first, we look at cause-

specific mortality to determine whether children's educational attainments are related to the cause of death of their parents. Next, we look more directly at two health behavioral mechanism: smoking and exercise. We hypothesize that parents of highly educated children will change their behaviors and lifestyles in response to highly educated children (either due to direct prompting on the part of children or indirect influence). If this is so, parents of more educated children should be less likely to smoke and therefore less likely to die of lung cancer or respiratory ailments associated with lifetime smoking behaviors. We begin with an investigation of cause-specific mortality for the common causes of death in these data.

Cause of Death. Whatever the mechanism, if children do indeed improve their parents' health behaviors, these effects should be noticeable both in terms of the raw odds of dying in a given year and also in the specific causes of death. For instance, if parents of more-educated children are less likely to smoke and more likely to eat right, on average, than are parents of less-education children, they should both live longer and also be less likely to die of such illnesses as coronary heart disease and lung cancer. However, we would not necessarily expect to see cause-specific mortality differentials when it comes to other ailments.

TABLE 3 HERE

To obtain the results in Table 3, we run the same models as above, this time considering whether children's education affects cause-specific mortality. The results for each cause of death column come from separate models in which we censor people who did not die and those who died of all other causes of death. We see that death from diseases with a strong behavioral link, including those from alcohol and accidents, diabetes, and lower respiratory ailments are more

strongly predicted by children's education and are highly significant. This is as we would have expected, as more educated children might help educate parents and might be able to help parents avoid deaths such as these which, with treatment and/or lifestyle changes, may be avoidable. On the other hand, having less educated children increases a parents' risk of dying of these ailments. These effects are less pronounced for cancer, for instance, which, on the whole is not related to health behaviors and life style choices (lung cancer is the exception, of course, however, this group is too small in these data for an independent analysis).

In addition, it is already known that low SES individuals at all stages of life are more likely to be involved in fatal accidents. It is not surprising, then, having children with less than a high school degree increases the likelihood of dying of an accident. Unlike with the other causes of death, where we see a more pronounced gradient by education, the real difference here is between children with less that high school and those with college (based on statistical tests not shown), all other groups produce relatively comparable effects on the risk of dying from an accident.

Health Behaviors. A more direct way to investigate whether children improve their parents' health by changing their health behaviors is to directly investigate whether health behaviors mediate the relationship between children's education and parents' survival.

The first model in Table 4 shows the results of the original Cox model run above, this time for a slightly smaller subsample of respondents for whom smoking and exercise information is available. The coefficients are comparable to those in the larger model. Model 2 adds in a control for whether the respondent ever smoked. Model 3 controls for whether the respondent currently smokes, Model 4 controls for whether the respondent is not engaged in vigorous exercise at least three times a day, and Model 5 includes controls for all three: ever smoked,

smokes now, is not engages in regular vigorous exercise. This table displays these results for own education (panel 2), spouse's education (panel 3), and children's education (panel 1).

TABLE 4 HERE

First, let us consider the mediating role of smoking behaviors on the relationship between a respondent's own education and his survival. This can be seen in the second panel of Table 4. Whether a respondent ever smoked, smokes now, or does not exercise (Models 2, 3, and 4, respectively), all reduce the magnitude of the coefficients for educational attainment. In the most extreme case, when all health behaviors are in one model (Model 5), the coefficient drops from 0.20 to 0.14 (change of 0.06) for the less than high school degree group. This can be thought of as a 7% decrease ($e^{0.20}$ - $e^{0.14}$) in the relative odds of dying. Although not a huge reduction in the risk of dying, given that all we have in these models are crude measures of smoking and exercise behaviors, this is suggestive, at least, that health behaviors explain some of the SES differences in mortality. Even more interestingly, the effect of spouse's education on respondent's mortality (Panel 4) is not explained by these health behaviors. Educated spouses do influence their partner's health, but it is through some other mechanism.

The first panel of the table displays the model coefficients and standard errors for our three categories of children's education (with percent college educated as the reference category). When we compare Models 1 and 2 (the original model to one with ever smoked as a control), we do not see a lot of change in the coefficients for children's education. In fact, the most we see is a change of a magnitude of 0.02 for the less than high school group (0.43-0.41). This is as expected, because children's education should not have a very strong effect on whether

parents ever smoke. They might have smoked well before their children were educated or even born. More likely, educated children will encourage smoking parents to quit. This indeed appears to be supported by these data. When we compare Model 1 with Model 3 (smoking now), the magnitude of change is much greater. For the less than high school group, we now see a change in magnitude of 0.05, or a 7.5% decrease in the relative odds of dying ($e^{0.43}$ - $e^{0.38}$). This is in contrast to the results for respondent's own education, where the mediating effect of smoking is similar regardless of whether we control for whether they ever smoked or whether they currently smoke. This finding supports the idea that children may be influencing parents to quit smoking and engage in healthier behaviors.

The mediating effects of health behaviors in explaining the relationship between children's education and parents' survival is even more pronounced when we consider the most complete model (Model 5). The coefficient for the percent of children with less than a high school degree drops from 0.43 to 0.31 -- a decrease in the odds of dying of 17 percent. Importantly, this effect size is even greater than what we saw above for one's own education. This indicates that smoking and exercise behaviors influence the relationship between one's own SES and survival, but it explains *even more* of the relationship between children's education and their parents' survival.

Admittedly, the coefficients for children's education remain statistically significant in the last model – even after controls for parents' smoking and exercise behaviors. However, we did not intend to "explain away" the entire relationship between children's education and parent's mortality through exercise and smoking. There are many other mechanisms – both behavioral and relating to direct care from children -- that are not included these models and would explain

even more of this relationship. Nevertheless, our hypothesis that health behaviors are part of how children's education is translated into survival gains for parents is supported by these results.

DISCUSSION

These results reflect the importance of taking a broader view of education than is common in the literature investigating the association between SES and mortality. In line with prior research, we find that one's own education is associated with an increase in one's hazard of mortality, net of other measures of SES. However, these findings further suggest that children's education has independent effects on parents' mortality. We find that those effects are comparable for mothers and fathers. In addition, we take a brief look at possible mechanisms for these effects and find that children's education relates to many different causes of death, and the relationship is more pronounced for causes of death that are linked to behavioral factors and may be more preventable. Smoking and exercise behaviors appear to be, at least, among the mechanisms that explain the relationship between children's educational attainments and parents' mortality.

One significant challenge faced by this and similar studies is that it is difficult to investigate the influence of children on parents, for all that children's schooling is likely correlated with family characteristics related to parents' health and risk of death. This potential problem is difficult to address using conventional analytic methods. We attempt to deal with this by including extensive controls for parents' own characteristics and, especially, socioeconomic status in our models. Still, this approach remains limited, as we may continue to be missing important variables that may bias our results. In addition, even one's own socioeconomic status and one's children's education may be confounded, with parents who anticipate sending children

to college saving and investing more and accumulating more income; whereas, those parents who do not plan on sending children to college are therefore freer to earn less and spend more.

Although these findings should be taken with caution due to these limitations, there is at least some indication that educational context beyond that of the individual may matter for mortality, and, therefore, that future research should investigate not only whether, but *whose*, education matters -- and for which outcomes. Perhaps educated children not only improve parents' health and life chances, but they may also benefit parents' labor market outcomes by connecting them to important social networks. This paper attempts to address some important new research questions regarding potential health and other benefits derived by parents who invest in their children's education, benefits which may even exceed the gains from investing that same money in other assets or resources.

In sum, our research isolates a previously understudied mechanism through which socioeconomic differences in mortality come about, to wit: the differential educational attainments of offspring. It shows that, even in more developed societies, parents' motivations for helping their children need not be confined to an altruistic commitment to future generations. It also contributes to an understanding of the complex links between demographic and stratification processes.

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Table 1: Descriptive Statistics

			All (n=25,668)	Survived to 2006 (n=17,805)	Died by 2006 (n=7,863)
Respondents' Characteristics					
Birth Cohort	Cohort 1:	Born before 1905	0.01	0.00	0.01
	Cohort 2:	Born 1905-1909	0.03	0.00	0.05
	Cohort 3:	Born 1910-1914	0.06	0.02	0.10
	Cohort 4:	Born 1915-1919	0.08	0.05	0.16
	Cohort 5:	Born 1920-1924	0.11	0.08	0.18
	Cohort 6:	Born 1925-1929	0.11	0.11	0.17
	Cohort 7:	Born 1930-1934	0.13	0.14	0.10
	Cohort 8:	Born 1935-1939	0.14	0.16	0.10
	Cohort 9:	Born 1940-1944	0.17	0.21	0.07
	Cohort 10:	Born 1945-1949	0.14	0.19	0.05
	Cohort 11:	Born 1950+	0.03	0.04	0.02
Sex	Male		0.44	0.42	0.48
	Female		0.56	0.58	0.52
Race	White		0.83	0.83	0.82
	Black		0.09	0.09	0.83
	Hispanic		0.06	0.06	0.10
	Other		0.02	0.02	0.04
Respondent's Education	<HS		0.30	0.25	0.02
	HS		0.31	0.32	0.44
	Some College		0.20	0.22	0.28
	College+		0.19	0.21	0.16
Spouse's Education	No/Missing Spouse		0.30	0.24	0.11
	<HS		0.19	0.18	0.45
	HS		0.23	0.24	0.20
	Some College		0.15	0.16	0.19
	College+		0.14	0.17	0.09
Income and Assets	Family income (median, sd)		$26,015 ($71,019)	$32,729 ($78,026)	$16,061 ($48,661)
	Family wealth (median, sd)		$82,516 ($398,880)	$94,087 ($429,082)	$58,993 ($313,634))
Children's Characteristics	Any children aged 25+, dichotomous		0.81 (0.39)	0.81 (0.39)	16.13 (0.03)
	Number of daughters aged 25+ (mean, sd)		1.19 (1.27)	1.17 (1.25)	0.82 (0.39)
	Number of sons aged 25+ (mean, sd)		1.21 (1.26)	1.20 (1.25)	1.24 (1.32)
	Number of children aged 25+ (mean, sd)		2.40 (1.99)	2.37 (1.96)	1.24 (1.3)

Children's Education	Proportion < HS (mean, sd)	0.08 (0.21)	0.10 (0.24)	0.08 (0.22)
	HS degree (mean, sd)	0.36 (0.38)	0.4 (0.39)	0.37 (0.38)
	some college (mean, sd)	0.23 (0.31)	0.19 (0.29)	0.22 (0.31)
	college+ (mean, sd)	0.33 (0.39)	0.31 (0.38)	0.32 (0.39)
Sons' Education	Proportion < HS (mean, sd)	0.09 (0.25)	0.11 (0.28)	0.10 (0.26)
	HS degree (mean, sd)	0.38 (0.43)	0.4 0(0.43)	0.39 (0.43)
	some college (mean, sd)	0.22 (0.36)	0.18 (0.33)	0.21 (0.35)
	college+ (mean, sd)	0.31 (0.42)	0.31 (0.42)	0.31 (0.42)
Daughters' Education	Proportion < HS (mean, sd)	0.07 (0.22)	0.09 (0.26)	0.07 (0.23)
	HS degree (mean, sd)	0.36 (0.43)	0.41 (0.44)	0.37 (0.43)
	some college (mean, sd)	0.24 (0.37)	0.20 (0.35)	0.23 (0.37)
	college+ (mean, sd)	0.33 (0.43)	0.29 (0.41)	0.32 (0.43)

Table 2: Log Hazard Ratios from Cox Survival Model Predicting Time to Death as a Function of Children's, Own, and Spouse's Educational Attainment (n=25,668)

		Children Only	+ Respondent	+ Spouse	+ Income	+ Wealth
Children's SES	Any children (dummy)	-0.50**	-0.43**	-0.35**	-0.33**	-0.33**
		(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
	LT HS (ref: College+)	0.70**	0.56**	0.48**	0.43**	0.42**
		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
	HS (ref: College+)	0.46**	0.34**	0.28**	0.26**	0.25**
		(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
	some college (ref: College+)	0.16**	0.10+	0.07	0.06	0.05
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Respondent's SES	Resp <HS (ref: College)+		0.34**	0.26**	0.19**	0.16**
			(0.04)	(0.04)	(0.04)	(0.04)
	Resp HS Degree (ref: College+)		0.22**	0.17**	0.12**	0.10*
			(0.04)	(0.04)	(0.04)	(0.04)
	Resp Some College(ref: College+)		0.19**	0.16**	0.12**	0.11*
			(0.05)	(0.05)	(0.05)	(0.05)
Spouse's SES	No Spouse			0.42**	0.33**	0.30**
				(0.05)	(0.05)	(0.06)
	Spouse <HS (ref: College+)			0.27**	0.23**	0.20**
				(0.06)	(0.06)	(0.06)
	Spouse HS Degree(ref: College+)			0.19**	0.16**	0.14*
				(0.06)	(0.06)	(0.06)
	Spouse Some College(ref: College+)			0.09	0.07	0.05
				(0.06)	(0.06)	(0.06)
Family SES	Family Income, logged				-0.10**	-0.10**
					(0.01)	(0.01)
	Total Wealth (no IRA), logged					-1.59**
						(0.58)
	AIC	86300.5	86240.45	86147.7	86043.03	86029.4
	BIC	86339.5	86308.6	86254.7	86159.8	86155.9
	Log likelihood	-43146.3	-43113.2	-43062.8	-43009.5	-43001.7

Standard errors in parentheses
+ p<.10, * p<.05, ** p<.01
Models stratified by race, Florida, birth cohort, and Sex.
In all models categories of children's education differ significantly from one another, with the exception of the % of children with some college which does not differ significantly from % of children with college in models 2-4.

Table 3: Log Hazard Ratios from Cox Competing Risks Survival Models Predicting Time to Death as a Function of Children's Educational Attainment, by Cause of Death

	Cancer	Diabetes/ pneumonia	Cardiovascular	Chronic lower respiratory	Accidents and alcohol
Any children	-0.26**	-0.61**	-0.30**	-0.44*	-0.37
	(0.09)	(0.16)	(0.07)	(0.22)	(0.24)
< HS (ref: College+)	0.58**	0.80**	0.46**	0.83**	0.79*
	(0.13)	(0.24)	(0.10)	(0.31)	(0.36)
HS (ref: College+)	0.28**	0.35*	0.30**	0.44*	0.40+
	(0.09)	(0.17)	(0.06)	(0.22)	(0.24)
Some college (ref: College+)	0.10	-0.16	0.14+	-0.31	0.17
	(0.11)	(0.23)	(0.08)	(0.29)	(0.30)
Observations	1,782	460	3,016	291	249
AIC	20643.99	4786.08	32612.53	3268.72	2854.00
BIC	20760.80	4902.89	32729.34	3385.53	2970.81
Log likelihood	-10310.0	-2381.0	-16294.3	-1622.4	-1415.0

Standard errors in parentheses
+ p<.10, * p<.05, ** p<.01
Models stratified by Race, Florida, Birth cohort, and Sex.
Note: Results for 1,586 `other' and 479 `missing' causes of death are not displayed in this table.

Table 4: Log Hazard Ratios from Cox Competing Risks Survival Models Predicting Time to Death as a Function of Children's Educational Attainment, Net of Smoking and Exercise (N=24,259)

		Original Model	Net of Ever Smoked	Net of Smoking Now	Net of Not Engaged in Vigorous Exercise	Net of Smoking and Exercise Behaviors
Children's Education	Any children	-0.30**	-0.28**	-0.28**	-0.27**	-0.25**
		(0.05)	(0.05)	(0.04)	(0.04)	(0.05)
	< HS (ref: College+)	0.43**	0.41**	0.38**	0.36**	0.31**
		(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
	HS (ref: College+)	0.25**	0.24**	0.23**	0.22**	0.20**
		(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
	some college (ref: College+)	0.03	0.03	0.03	0.03	0.02
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Respondent's Education	<HS (ref: College+)	0.20**	0.18**	0.17**	0.17**	0.14**
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
	HS Degree(ref: College+)	0.13**	0.11*	0.11*	0.11*	0.09+
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
	Some College(ref: College+)	0.13*	0.11*	0.11*	0.13**	0.11*
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Spouse's Education	No/Missing Spouse	0.35**	0.33**	0.30**	0.33**	0.28**
		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
	<HS (ref: College+)	0.21**	0.22**	0.19**	0.19**	0.19**
		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
	HS Degree(ref: College+)	0.17**	0.17**	0.16**	0.16**	0.15**
		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
	Some College (ref: College+)	0.07	0.06	0.06	0.06	0.05
		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Family Income	Family Income, logged	-0.11**	-0.11**	-0.10**	-0.09**	-0.09**
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
	AIC	72010.22	71785.14	71793.62	71431.97	71133.23
	BIC	72126.16	71910.75	71919.22	71557.58	71278.16
	Log likelihood	-35993.1	-35879.6	-35883.8	-35703.0	-35551.6

Standard errors in parentheses
+ p<.10, * p<.05, ** p<.01
Models stratified by Race, Florida, Birth cohort, and Sex.
Note: Table is for a subsample of 24,259 respondents with data on exercise and smoking behaviors.

APPENDIX A: HRS Child Data Descriptive Tables

Table A1: # Ineligible Children Based on Child Roster Data, by Wave 1992-2006

Wave[1]	# of Children[1]	# Dead[2]	# <25 years old	Eligible Children
Wave 1	24,697	0	6,081	18,616
Wave 2	38,862	59	4,254	34,549
Wave 3	37,192	210	3,005	33,977
Wave 4	44,961	293	3,858	40,810
Wave 5	42,137	251	2,860	39,026
Wave 6	39,029	32	2,132	36,865
Wave 7	41,575	6	3,842	37,727
Wave 8	38,994	4	2,788	36,202

[1]Includes all HRS and AHEAD Cohorts.

[2]Children includes biological and stepchildren of family and nonfamily respondent.
[3]There are a handful of cases where a dead child's spouse adopts his/her ID number and a dead child reappears in a future wave. These children are dropped in this step as well.

Table A2: Total # of Children After Drops Across All Waves

Reason	Count
Initial Count	66,035
Death	65,864
Less than 25 years old	61,010

Table A3: Count of Missing Child Data, All Waves (n=61,010 eligible children)

Missing in ALL waves	Count	% of Total Eligible Children
Sex	146	0.24%
Year of Birth	1,136	1.86%
Education	2,439	4.00%
Any of the above[1]	2,442	4.00%

[1] These observations are dropped from the final analytical sample for a total number of children of 58,568.

Table A4: Inconsistent Child Data, All Waves (n=61,010 eligible children)

Inconsistencies among waves	Count	% of Total Eligible Children
Inconsistent Sex	399	0.65%
Inconsistent year of birth	0	0.00%
Education decreases by a year or more in at least one wave[1]	3,293	5.40%
Education decreases by a category in at least one wave[2]	1,983	3.25%

[1] After pulling education from years in which it is available

[2] Where education is categorized as (1) Less than HS (2) HS (3) Some college (4) College+

Table A5: Families with and without (eligible) children, By Waves (n=61,010 eligible children)

	Total Respondents by Wave	Respondents with: No children	Children			
			Complete Roster for All Children			Incomplete[2] Roster
			Eligible Children	Ineligible Children[1]		
				all children <25	all children dead	
Wave 1	12,652	2,290	9,129	1,048	0	185
Wave 2	19,642	3,259	15,433	766	15	169
Wave 3	17,991	2,496	14,693	556	59	187
Wave 4	21,384	3,002	17,317	710	64	291
Wave 5	19,579	2,476	16,284	515	62	242
Wave 6	18,167	2,389	15,218	378	9	173
Wave 7	16,799	2,020	14,338	276	0	165
Wave 8	15,434	1,899	13,205	193	0	137

[1] Ineligible children are coded as 0 (no children)
[2] These children are dropped from the analyses.