The Importance of Spousal Education for Cardiovascular Health in the United States

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Abstract

Prior research consistently finds an inverse association between a person's own education and multiple health outcomes. However, most research into education and health approaches the problem at the individual level, failing to take into account the potentially independent influence exerted by the educational attainment of one's spouse. Research from other nations links spousal education to various health outcomes. In contrast, the results from a handful of studies in the United States are more ambiguous. The purpose of the proposed paper is to examine the association between spousal education and cardiovascular health in the United States. Using twelve years (1997-2008) of cross sectional data from the National Health Interview Survey, I will estimate a series of nested regression models to examine the link between spousal education the association between spousal education and cardiovascular health. The results potentially have important implications for the study of family, socioeconomic status, and health.

Background

Education is positively associated with a healthier lifestyle, less chronic disease, lower levels of psychological distress, and a lower risk of death (Mirowsky and Ross 2003). Previous studies also consistently find that being married is associated with better health and a lower risk of death (Waite 1995). Despite a great deal of evidence indicating that educational attainment and being married are both are both associated with better health, most studies fail to move beyond the individual-level and examine how the educational composition of the household is associated with the health of individual household members (Hujits, et al. 2009; Monden 2003)[1]. In particular, it is reasonable to assume that a spouse's education would independently influence the health of his or her partner. This is because the intimate attachments that spouses share inherently motivate them to pool their respective material and non-material resources in an attempt to improve their own and their partner's well-being (Becker 1991; see also Jacobson 2000; Monden, et al. 2003; Skalická and Kunst 2008) [2]. The fact that resource pooling transforms an individual's education into a household or family-level resource within the confines of marriage has profound implications for the way social scientists approach the study of health disparities.

Indeed, the results of several recent studies in Europe and Israel generally suggest that a spouse's education is associated with a range of health outcomes including self-rated health, smoking, obesity, cardiovascular disease, cancer morbidity, all-cause mortality, and cause-specific mortality (Bosma, et al. 1995; Egeland, et al. 2002; Hujits, et al. 2009; Jaffe, et al. 2005, 2006; Kravdal 2008; Martikainen 1995; Monden, et al. 2003; Skaliká and Kunst 2008; Thorssander and Erikson 2009)[1]. Moreover, a couple of studies report gender differences in the link between spousal education and some health outcomes (Jaffe, et al. 2005, 2006; Skalická and Kunst 2008). For example, in analyses of Israeli Census data linked to subsequent mortality records Jaffe, et al. (2005,2006) found that spousal education did little to protect women from all-cause (Jaffe, et al. 2005) and CVD mortality (Jaffe, et al. 2005, 2006). Jaffe, et al. (2006) also found that for married men, a wife's education was a more robust predictor of CVD mortality than one's own education. Skalická and Kunst (2008) also report an inverse association between spousal education and the risk of all-cause and cardiovascular disease mortality net of one's own education, income, occupation, and age among Norwegian men, but not women. Most importantly, these studies also imply that failing to incorporate spousal education in models predicting health outcomes among the married potentially overestimates the importance of an individual's own education.

In contrast, the evidence from the United States concerning spousal education and health is much more ambiguous. Some U.S. studies report no association between spousal education and all-cause mortality in the Panel Survey of Income Dynamics (PSID) (McDonough, et al. 1999; Zick and Smith 1994; Lillard and Waite 2004) or for self-rated health in data from the Americans' Changing Lives' (ACL) study (Stolzenberg 2001) after introducing controls for income. However, other studies in the U.S. have found that men married to women with higher levels of education relative to their own actually have an increased risk of adverse cardiovascular outcomes (Haynes, et al. 1983; Suarez and Barrett-Connor 1984) and psychosocial stress (Hornung and McCullough 1981; see also Vernon and Buffler 1988)[3]. It bears mentioning, however, that the claims made by studies linking educational discrepancies between spouses to poor health outcomes are exceedingly difficult to interpret due to the small, non-representative samples examined by these studies.

In sum, studies from Europe consistently suggest that education is a pooled or household resource within the confines of marriage which has important consequences for an individual's health and/or risk of death. However, fragmentary evidence from the United States suggests that this is not the case. Indeed, a handful of relatively recent studies from the U.S. suggest that a spouse's education dose not influence one's own health. Older studies from the United States do generally associate a spouse's education with the health of his/her partner, but they find that it operates in counterintuitive ways. These studies actually find, at least among low educated men married to highly educated women, that having an educated spouse is detrimental to your health. They hypothesize that this is due to the psychosocial stress brought about by inter-spousal status discrepancies or asymmetries.

The primary purpose of the proposed paper is to clarify the link between spousal education and cardiovascular health in the United States. The focus is on cardiovascular health for several important reasons. First, cardiovascular disease is an enormous public health problem in the

United States and, indeed, across the globe. For example, despite large reductions in morbidity and mortality attributable to cardiovascular disease over the last several decades, heart disease and stoke remain the first and second leading causes of death in the United States (American Heart Association 2010). Second, studies consistently find an inverse association between a person's own education and various cardiovascular outcomes (Clark, et al. 2009). Third, as I mention above, several older studies from the United States examine the link between spousal education and cardiovascular outcomes. Thus, will make the task of comparing the results of the proposed paper and extant research in the United States (and Europe) easier. These, are the primary reasons I choose to focus on cardiovascular health in the proposed paper.

Research Questions

I will address five interrelated questions drawn from prior studies. Is a spouse's education independently linked to one's own health? Does omitting information on spousal education overestimate the importance of an individual's own education on his/her health? How are discrepant levels of education between spouses associated with each partner's health? Is education a household resource within the context of marriage as the research from other nations suggests, or do status discrepancies between spouses actually increase the risk of death for those with lower levels education as older studies from the U.S. argue? Finally, are there gender differences in any of these associations? I will address these questions with a large, nationally representative sample of married men and women drawn from the U.S. National Health Interview Survey (NHIS)[4].

Analytical Approach

Data. I will pool twelve years (1997-2008) of NHIS data. The NHIS is a nationally representative cross-sectional survey of the U.S. non-institutionalized, civilian population ages eighteen and over begun in 1957. The U.S. National Center for Health Statistics (NCHS) randomly selects one adult from each household to answer supplementary questions beginning 1997. The NHIS core files contain around 100,000 respondents per year. The adult sample files contain around 30,000 respondents per year. Couple-level data were created using information on the NHIS household rosters, which make it possible to link the records of an NCHS-designated household reference person to the records of his/her spouse. Regrettably, this eliminates a relatively small number of married couples who live in multiple-family households. To ensure that the majority of the respondents have completed their education at the time of interview, the sample will be restricted to persons ages 25 and over. The final analytic sample will contain currently married persons ages 25 and older with complete information for the variables in the models.

Dependent variables. I will examine six dimensions of cardiovascular health: coronary heart disease (CHD), hypertension (HYP), angina pectoris (AP), myocardial infarction (MI), stroke (STK), and an index representing the count of these variables[5]. These variables come from a series of questions in the NHIS in which respondents were asked if a doctor has ever told them they had and/or experienced specific health events, diseases, and/or medical conditions. Thus, these variables measure the prevalence of various cardiovascular events/conditions in a given period. The cardiovascular health index simply indicates the total number of the CVD events/conditions outlined above that an individual reported. Thus, the values for CVD index potentially range from zero (e.g., no events/conditions reported) to five (all of the events/conditions reported). These measures are analogous to those included in some European and older U.S. studies examining the effect of spousal education on cardiovascular health. However, to the best my knowledge, the only studies in the U.S. that have examined the association between spousal education and cardiovascular outcomes were conducted several decades ago using small, often clinically-based, samples that were not nationally representative (Haynes, et al. 1983; Suarez and Barrett-Connor 1984; also see Vernon and Buffler 1988). These studies found evidence for the status inconsistency hypothesis (see above).

Independent variables. The measure of own and spousal educational attainment used in the analyses is measured by question asking respondents to provide the highest level of formal education completed. The NHIS also contains a continuous measure of education. I use the categorical measure of education because testing the assertions of status inconsistency theory requires the assessment of qualitative differentials in the educational credentials possessed by each spouse. The measure of education in the NHIS was recoded into the following categories: Less than high school, high school or its equivalent (i.e., a G.E.D.), some college and/or an Associate's degree, and a Bachelor's degree or higher.

Risk factor controls. The models will control for smoking history and body mass index (BMI), which are key risk factors for cardiovascular health. Importantly, BMI and smoking also exhibit a strong socioeconomic gradient and as such are included as in the models to evaluate their role as potential mediators of the association between education (own and spouse's) and cardiovascular health[6]. Self-reported smoking history will be measured by a categorical variable indicating that a person has never smoked, formerly smoked, or currently smokes. Persons how have never smoked will be the reference group. Notably, this is a somewhat crude measure of smoking history. A better measure would be what is commonly referred to as "pack years." This basically measures cumulative lifetime exposure to cigarette smoking by assessing the number of cigarettes smoked daily per year. Therefore, if possible, I will calculate pack years instead.

Body mass index values are commonly grouped into four categories that broadly reflect its U-shaped association with multiple health problems, including cardiovascular disease. These categories for BMI are underweight (≤18.49), healthy weight (18.50–24.99), overweight (≥25.00), and obese (≥30.00). I anticipate using a categorical measure of BMI based on the above categories, but I will also examine alternative specifications. Persons identified as healthy weight will be the reference category. BMI is a continuous variable in the NHIS. It is a proxy for a cluster of important behavioral and biological risk factors closely linked to cardiovascular health. BMI is primarily determined by health behaviors, particularly exercise and dietary habits. However, BMI also largely determines several biological risk factors important to the overall health of the cardiovascular system including high cholesterol, metabolic syndrome, and diabetes mellitus (Mokdad, et al. 2003).

Sociodemographic controls. The models will include controls for poverty status, age, race-ethnicity, and nativity status. The measure of economic resources included in the models is the ratio of family income to the poverty threshold. Respondents were asked to report their total family income in the previous calendar year. Analysts at NCHS combined this information with the official poverty thresholds published by U.S. Census Bureau in the year each cross-sectional survey was conducted to obtain a ratio of family income to poverty that takes into account the size and age structure of each respondents' family. The poverty ratio is a fourteen-level categorical variable, with values ranging from 50% of poverty to 500% of poverty[7]. Following the example provided by Schenker, et al. (2006), I plan to collapse the poverty ratio variable into the following categories: less than 100% poverty, 100% to 199% poverty, 200% to 399% poverty, and at or above 400% poverty. In all of the models, at or above 400% poverty will be the reference category.

The models are stratified by gender (see below) and control for other basic demographic characteristics including age, race-ethnicity, and nativity. Age is self-reported and measured in continuous years. Due to top-coding, the age range of the respondents included in the analyses is from 25 to an open category of 85 years and older. Self-reported race-ethnicity is collapsed into the following mutually exclusive categories: non-Hispanic white, non-Hispanic black, non-Hispanic-other race/ethnicity, or Hispanic (of any race). In all of the models, non-Hispanic whites will be the reference category. Nativity status is a dummy variable indicating whether or not a respondent was born in the United States. Persons born in the United States will be the reference category.

Statistical approach. I will evaluate my research questions via a series of nested models that progressively adjust for various mediators and/or controls. Although all of the models presented in the paper will be gender-specific, I will also formally examine gender differentials in the association between own/spouse's education and cardiovascular health via a series of pooled models interacting gender*own education, gender*spousal education, and gender*own education*spouse's education. The models will include all main effects, lower-order interaction terms, and controls for age, race-ethnicity, and nativity status. Initially, I will estimate a series of OLS regressions in the models for the chronic disease index. In recognition of the fact that the cardiovascular condition index is a count, and, thus, not a truly linear outcome, I will also run supplementary analyses using negative binomial regression. To facilitate interpretation, the raw coefficients from the negative binomial models will be exponentiated.[8] The models for coronary heart disease, hypertension, angina pectoris, myocardial infarction, and stroke will be analyzed with binary logistic regression. An overview of my general modeling strategy is presented below. For purposes of illustration, the outcome is a generic dichotomous indicator of cardiovascular disease (CVD) and is analyzed using logistic regression.

$$\log(\mathrm{CVD})_{\mathrm{m}} = \beta_{\mathrm{m}0} + \beta_{\mathrm{m}1} Own\ Ed + \beta_{\mathrm{m}2} Age + \beta_{\mathrm{m}3} Race + \beta_{\mathrm{m}4} Navitity \quad (1a)$$

$$\log(\mathrm{CVD})_{\mathrm{f}} = \beta_{\mathrm{f}0} + \beta_{\mathrm{f}1} Own\ Ed + \beta_{\mathrm{f}2} Age + \beta_{\mathrm{f}3} Race + \beta_{\mathrm{f}4} Navitity \quad (1b)$$

$$\log(\mathrm{CVD})_{\mathrm{m}} = \beta_{\mathrm{m0}} + \beta_{\mathrm{m1}} Own\ Ed + \beta_{\mathrm{f2}} Spouse\ Ed + \beta_{\mathrm{m3}} Age + \beta_{\mathrm{m4}} Race + \beta_{\mathrm{m5}} Navitity \quad (2a)$$

$$\log(\mathrm{CVD})_{\mathrm{f}} = \beta_{\mathrm{f0}} + \beta_{\mathrm{f1}} Own\ Ed + \beta_{\mathrm{m2}} Spouse\ Ed + \beta_{\mathrm{f3}} Age + \beta_{\mathrm{f4}} Race + \beta_{\mathrm{f5}} Navitity \quad (2b)$$

$$\log(\mathrm{CVD})_{\mathrm{m}} = \beta_{\mathrm{m0}} + \beta_{\mathrm{m1}} Own\ Ed + \beta_{\mathrm{f2}} Spouse\ Ed + \beta_{\mathrm{m3}} Poverty + \beta_{\mathrm{m4}} Age + \beta_{\mathrm{m5}} Race + \beta_{\mathrm{m6}} Navitity \quad (3a)$$

$$\log(\mathrm{CVD})_{\mathrm{f}} = \beta_{\mathrm{f0}} + \beta_{\mathrm{f1}} Own\ Ed + \beta_{\mathrm{m2}} Spouse\ Ed + \beta_{\mathrm{f3}} Poverty + \beta_{\mathrm{f4}} Age + \beta_{\mathrm{f5}} Race + \beta_{\mathrm{m6}} Navitity \quad (3b)$$

$$\log(\mathrm{CVD})_{\mathrm{m}} = \beta_{\mathrm{m0}} + \beta_{\mathrm{m1}} Own\ Ed + \beta_{\mathrm{f2}} Spouse\ Ed + \beta_{\mathrm{m3}} Poverty + \beta_{\mathrm{m4}} Smoking + \beta_{\mathrm{m5}} BMI + \beta_{\mathrm{m6}} Age + \beta_{\mathrm{m7}} Race + \beta_{\mathrm{m8}} Navitity \quad (4a)$$

$$\log(\mathrm{CVD})_{\mathrm{f}} = \beta_{\mathrm{f0}} + \beta_{\mathrm{f1}} Own\ Ed + \beta_{\mathrm{m2}} Spouse\ Ed + \beta_{\mathrm{f3}} Poverty + \beta_{\mathrm{f4}} Smoking + \beta_{\mathrm{f5}} BMI + \beta_{\mathrm{f6}} Age + \beta_{\mathrm{f7}} Race + \beta_{\mathrm{f8}} Navitity \quad (4b)$$

$$\log(\mathrm{CVD})_{\mathrm{m}} = \beta_{\mathrm{m0}} + \beta_{\mathrm{m1}} Own\ Ed + \beta_{\mathrm{f2}} Spouse\ Ed + \beta_{\mathrm{m,f3}} Own\ Ed * Spouse\ Ed + \beta_{\mathrm{m4}} Poverty + \beta_{\mathrm{m5}} Smoking + \beta_{\mathrm{m6}} BMI + \beta_{\mathrm{m7}} Age + \beta_{\mathrm{m8}} Race + \beta_{\mathrm{m9}} Navitity \quad (5a)$$

$$\log(\mathrm{CVD})_{\mathrm{f}} = \beta_{\mathrm{f0}} + \beta_{\mathrm{f1}} Own\ Ed + \beta_{\mathrm{m2}} Spouse\ Ed + \beta_{\mathrm{f,m3}} Own\ Ed * Spouse\ Ed + \beta_{\mathrm{f4}} Poverty + \beta_{\mathrm{f5}} Smoking + \beta_{\mathrm{f6}} BMI + \beta_{\mathrm{f7}} Age + \beta_{\mathrm{f8}} Race + \beta_{\mathrm{f9}} Navitity \quad (5b)$$

The first set of models (Models 1a and 1b) examine the baseline association between own education and CVD net of the controls. These models are estimated to establish the basic association between a person’s own education and his/her cardiovascular health. The second set of models (Models 2a and 2b) examine the additive effects of one’s own and one’s spouse’s education on CVD net of the controls. These models test the household resource perspective. If education is a pooled resource within the context of marriage, then a spouse’s education should add to the effect of one’s own education. Moreover, if omitting spousal education from the model overestimates the association between one’s own education and cardiovascular health, the magnitude of the association between one's own education and CVD should be substantially reduced upon entering a term for spousal education into the model. The third (Models 3a and 3b) set of models examines the extent to which economic resources mediates the association between own/spousal education and cardiovascular health net of the controls. The fourth (Models 4a and 4b) set of models examines the extent to which economic resources, smoking history, and body mass mediate the association between own/spousal education and cardiovascular health net of the controls. Finally, the fifth set of models (Models 5a and 5b) examine the interactive effect of one's own and one's spouse's education on cardiovascular health net of the main effects of one's own and one's spouse's education and the controls. These models test the status inconsistency perspective. If status discrepancies between spouses result in poorer health, then the presence of non-normative educational configurations between spouses that are out-of-sync with prevailing social norms should increase one's likelihood having a cardiovascular condition.

The analyses will be conducted using STATA version 11. The analyses will incorporate sample weights and adjust for the complexity of the sampling design using the *svy* option. Following the recommendations of Raftery (1995), I will evaluate model fit using the Bayesian Information Criterion (BIC). Lower values for the BIC indicate that the current model fits the data better than the previous model.

<u>Expected Results</u>

Given the dearth of extant research on this topic in the United States, it is difficult to predict how closely my results will actually match those from similar studies in the U.S. However, this being said, I do expect to find evidence for an association between spousal education and cardiovascular health. The results may differ across specific conditions/events though. Again, it is difficult to tell. This finding would be broadly consistent with the burgeoning literature on spousal education and health in other nations, but not necessarily the comparably small literature on this topic from the United States. Accordingly, I expect that the results will generally support the notion that education is a household resource within the context of marriage. This pattern is found consistently in recent studies from Europe.

Moreover, I also expect that the association will only be partially mediated by introducing controlling for the ratio of family income to the poverty in the third set of models. This would be important because this finding would be contrary to the results from some relatively recent U.S.

studies that found no association between spousal education and self-rated health (Stolzenberg 2001) and all-cause mortality (McDonough, et al. 1999; Zick and Smith 1994; Lillard and Waite 2004) after introducing controls for income. Once again, this would be consistent with studies from Europe that do include controls for income and/or occupation (for example, Kravdal 2008 and Thorssander and Erikson 2009). Similarly, I expect that controlling for smoking and BMI will also attenuate, but not completely diminish, the association between spousal education and cardiovascular health. However, at present, I am unaware of any recent studies from either the U.S. or elsewhere that actually controls for these variables. However, a Dutch study did find some evidence suggest that spousal education is a significant predictor of smoking (Monden, et al. 2002).

In the fifth set of models that interact own and spousal education, I do not expect to find that educational discrepancies will increase the likelihood of having a cardiovascular condition. Indeed, I am very certain about this finding. If this turns out to be the case, it would contradict the results of older U.S. studies on this topic. The studies that report status inconsistency effects have rather large methodological flaws (see above). Although there are several good reasons to believe that the associations between spousal education and cardiovascular health would be different among men and women, the results concerning gender differential in this association from prior studies in Europe and Israel are inconclusive. Therefore, I am unsure whether I will find any evidence of gender differentials in the models that interact gender with spousal education. In sum, I expect that my findings will generally be consistent with those from recent studies in Europe, but not necessarily those from the United States.

Finally, and perhaps most importantly, if the predictions outlined above are correct, then the results of these analyses would suggest that failing to include spousal education in models predicting health outcomes among the married potentially overestimates the effect that a person's own education has on his/her health. This would imply that studies of health disparities should be mindful that the household is a context in which the characteristics of other people may impinge on an individual's health.

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[1]Two important exceptions to this general statement are in order. First, a large literature finds that maternal education is associated with infant and child health outcomes (for example, Caldwell 1979; Meara 2001). Second, some studies show that an elderly parent’s health is associated with the educational attainment of their adult children (for an example, see Zimmer, et al. 2007).

[2] Becker (1991) argues that resource pooling occurs because of altruism within the family (this is usually referred to as the “common preferences” assumption). Jacobson (2000) also makes this assumption, but points-out that family members do not always necessarily behave altruistically. Prior research does indicate that resources (i.e., income) within the household are distributed differentially when women rather than men are in control of their disbursement (Lundberg and Pollak 1996). This is taken to suggest that the common preferences assumption does not hold.

[3] This is thought to be due to the effect of status inconsistency. Status discrepancies between spouses that are inconsistent with broader social norms are hypothesized to bring about role conflicts. The psychosocial stress triggered by these role conflicts is presumed to result in deleterious health outcomes and, ultimately, an increased risk of death. Notably, I define this process in gender neutral terms, but as originally conceived it only applied to lower status men married to higher status women. For a thorough review of the literature on status inconsistency and health, refer to Vernon and Buffler (1988).

[4] If time permits, I intend to supplement the NHIS analyses with analyses from the Health and Retirement Study (HRS, 1992-2008).

[5] A similar set of outcomes were used in a recent paper that examined the effect of marital biography on health (Hughes and Waite 2010). In this paper, the authors used the HRS.

[6] Though BMI and obesity share an inverse association with cardiovascular health, it will be somewhat difficult to interpret the role these variables actually play as mediators of the association between own/spousal education and cardiovascular health. The socioeconomic distribution of smoking, BMI, and their sequela – for example, high cholesterol which is an important CVD risk factor in its own right – has changed dramatically over the last several decades (Kanjilal, et al. 2006; Chang and Lauderdale 2009). This is due to a combination of demographic factors including cohort effects and, presumably, mortality selection. These concerns are especially true for cigarette smoking. Smoking was much more common among the highly educated prior to the publication of the U.S. Surgeon General's Report in 1964 which unequivocally linked cigarette smoking to higher rates of morbidity and mortality. In the wake of the report, attitudes toward smoking changed appreciably. A second, issue has to do with measurement. The NHIS is cross sectional and as such it is difficult, if not impossible, to precisely determine the nature of the relationship between these risk factors and cardiovascular health (e.g., a persons may lose weight or stop smoking in response to a cardiovascular event or diagnosis).

[7] If time permits, I will impute to account for the missing values for poverty. NCHS has produced a set of public-use data files (n=5) containing multiply imputed income and poverty data for the survey years included in the analysis (e.g., 1997-2008). The details of the methodological approach used to impute the income and poverty data is outlined elsewhere (Schenker, Raghunathan, Chiu, Makuc, Zhang, and Cohen 2006).

[8] For information on negative binomial regression, refer to Long (1997) and Powers and Xie (1999)