Social Science & Medicine 80 (2013) 31–36

Contents lists available at SciVerse ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Short report

Sheepskin effects of education in the 10-year Framingham risk of coronary heart disease

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ARTICLE INFO

Article history:
Available online 10 January 2013

Keywords:
CHD risk
Education
Sheepskin effect

ABSTRACT

While the association between education and adult health is well documented, it is unclear whether quantity (i.e. years of schooling) or credentials (i.e. degrees) drive this association. Individuals with degrees may have better health than their non-credentialed counterparts given similar years of schooling, the so-called "sheepskin" effect. This paper contributes to this line of inquiry by examining associations of educational degree and years of schooling with the Framingham Risk Score, a measure of 10-year risk of coronary heart disease (CHD), using data from a unique birth cohort (the New England Family Study; participants mean age 42 years) with prospective information on childhood health and intelligence quotient (IQ). According to our results, years of schooling were inversely associated with 10-year CHD risk in the unadjusted model but not in the fully adjusted models that included degree attainment. By contrast, associations between degree attainment and 10-year CHD risk remained significant in the fully adjusted models that included years of schooling. College degree holders had 10-year CHD risk 19% (95% CI: −33%, −2%) lower than individuals with HS degrees or less in the fully adjusted models. Subanalyses evaluating sheepskin effects on the individual components of the 10-year CHD risk algorithm showed the expected education gradient was generally noted for each of the individual components, with decreasing prevalence of "high risk" values associated with higher degree credentials. Our results suggest educational credentials provide an additional benefit to risk of coronary heart disease beyond schooling.

Introduction

Research has consistently reported inverse relationships between educational attainment and risk of coronary heart disease (CHD) (Becker, 1964; Gonzalez, Rodriguez Artalejo, & Calero, 1998; Harper, Lynch, & Smith, 2011; Kaplan & Keil, 1993; Loucks et al., 2009). While highly educated individuals have lower rates of CHD than less educated individuals, it is unclear what specific aspects of education contribute most to this decrease in CHD risk. Two of the most commonly studied aspects of education are years of schooling and degree credential.

Although used interchangeably, years of schooling and degree credential differ conceptually. Years of schooling implies skills learned in school directly lead to increases in human capital that, and in turn, affect health (Spence, 1973). The additional benefit associated with degree attainment that is above and beyond the benefit conferred by years of schooling alone imply other pathways beyond skill accumulation may play a significant role in the association between education and health. This difference in a given outcome associated with a degree, after adjusting for years of schooling, is called a credential or "sheepskin effect". The economics literature has widely reported sheepskin effects for wages (Ferrer, 2002; Silles, 2008). However, research on whether there is a sheepskin effect on health is mixed. One study reported a linear relationship between years of schooling and blood pressure using data from the National Health Interview Survey. The authors interpreted this finding as evidence of no sheepskin effects for blood pressure because the association for years usually associated with a degree obtainment did not differ from years not usually associated with a degree (e.g. 12 years of schooling vs. 11 years of schooling; (Cutler & Lleras-Muney, 2008). In an earlier study using the New England Family Study of middle-aged participants from

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http://dx.doi.org/10.1016/j.socscimed.2012.12.026

the United States and information on both years of schooling and educational degree we found significant sheepskin effects on systolic and diastolic blood pressure (Liu et al., 2011).

The objectives of this study were to evaluate whether there is a sheepskin effect in the 10-year risk for CHD using the validated Framingham algorithm among middle-aged (mean age 42 years) study participants. Secondary analyses were used to evaluate whether there are sheepskin effects on previously unexplored individual modifiable CHD risk factor components of the Framingham CHD risk algorithm, including smoking, total cholesterol, HDL cholesterol and diabetes. A growing body of work suggests education has causal effects on several individual factors associated with cardiovascular risk such as smoking and obesity (Chandola, Clarke, Morris, & Blane, 2006; Cutler & Lleras-Muney, 2008; Etilé & Jones, 2011; Kenkel, Lillard, & Mathios, 2006; MacInnis, 2006), but it is unclear whether degree credentials drive such associations.

Methods

Sample

Data from this study were collected from one of the sub-samples that comprise the New England Family Study (NEFS). NEFS was established in 2001 to follow-up the 17,921 adult children of pregnant women who had participated in the National Collaborative Perinatal Project (NCPP) at the Providence, Rhode Island and Boston, Massachusetts sites between 1959 and 1966 (Broman, 1984; Niswander & Gordon, 1972). Each of the several research projects within NEFS typically follows different subsets of individuals. Data for the current analyses were sourced from EdHealth, a NEFS study specifically designed to assess pathways linking education and health. The EdHealth participants were selected with preference for racial/ethnic minorities, low or high educational attainment, and assessed during 2005–2007. There were 914 participants selected, of which 898 were eligible (e.g. living, not incarcerated), 618 participated (69% response rate) and 576 completed in person clinical assessments. We excluded 13 participants who reported a doctor-diagnosed myocardial infarction/angina/coronary heart disease at the time of the blood draw, and 155 participants missing information for estimation of the Framingham Risk Score (reasons for missing information include blood draw refusal, equipment error or difficulty with blood draw). The sample size for current analyses was 393 participants in 264 families, reflecting the presence of several sibling pairs. Approximately 65% of our respondents had no siblings in the study, 25% had one sibling in the study, and 2% had two or more siblings in the study.

Included study participants did not differ significantly from excluded participants for most variables, including years of education, degree attainment, race/ethnicity, childhood SES, childhood IQ, proportion with a childhood chronic disease, current smoking status or diabetes status ($p < 0.05$). However, excluded participants were older compared to included participants ($M = 43$ vs. 42 years old, $p < 0.01$) and a higher proportion of included participants were non-Hispanic white (80% vs. 72%, $p = 0.03$). The study protocol was approved by the institutional review board of the Harvard School of Public Health and Brown Medical School.

Primary exposure variable

Educational attainment was categorized as ≤high school (HS) degree/General Educational Development (GED), some post-secondary training, or college degree (i.e. bachelor's or higher degree). The category of "some post-secondary training" included participants who reported additional schooling after high school but no college degree (e.g. individuals who completed some college course work for credit, technical/trade/vocational school, or a certificate program). Given the small number of participants with less than a high school diploma ($n = 24$), we included those participants with participants having a high school degree/GED. Years of schooling were calculated by summing respondent's self-reported last completed grade in secondary school with self-reported years of schooling since high school (range = 6–39).

Primary outcome variable

The 10-year risk of coronary heart disease (i.e. CHD death and myocardial infarction) was calculated as a gender-specific percentage using the validated Framingham Risk Algorithm (Wilson et al., 1998). The Framingham Risk Score (FRS), a standard tool clinically used for measuring future coronary heart disease risk, incorporates common characteristics that contribute to cardiovascular disease (i.e. total and HDL cholesterol, systolic and diastolic blood pressure, diabetes, smoking status, age, and gender). Previous studies found the Framingham risk score to have good predictive validity with a c-statistic for prediction of CHD events of 0.74 in men and 0.77 in women (Wilson et al., 1998). Additionally, external validity tests suggest the Framingham risk score performs reasonably well in white and black participants and both genders (D'Agostino, Grundy, Sullivan, & Wilson, 2001).

Components of the 10-year CHD risk variables were assessed in the EdHealth study. Current smoking status was based on self-report to the question, "Do you smoke cigarettes now?" (yes or no). Diabetes status was assessed by self-report to the question, "Have you ever been told by a doctor or health professional that you have diabetes?" (yes or no). Lipids were measured in non-fasting plasma samples at CERLab (Harvard Medical School, Boston, MA) using a Hitachi 911 analyzer, and participating in the Centers for Disease Control and Prevention/National Heart, Lung, and Blood Institute Lipid Standardization Program. Total cholesterol was measured enzymatically (CV = 1.7%; Allain, Poon, Chan, Richmond, & Fu, 1974). HDL cholesterol was measured using a direct enzymatic colorimetric assay shown to meet the rigid requirements established by the Lipid Standardization Program (CV = 3.3%; Rifai et al., 1998). Systolic and diastolic blood pressure were measured for seated participants, after a 5 min rest, in their right arm resting at heart level, using automated blood pressure monitors (VSMedTech BpTru, Coquitlam, BC, Canada) that have demonstrated good validity and reliability, compared with the auscultation method (Mattu, Heran, & Wright, 2004). Five blood pressure readings were obtained in 1 min intervals. Systolic and diastolic blood pressure values were calculated as the mean of the lowest three systolic or diastolic blood pressure readings, excluding the first recorded blood pressure. For approximately 1% ($n = 4$) of the participants, the mean of the two lowest systolic or diastolic blood pressure readings were used due to missing data.

Potential confounders

To address confounding, we included variables that could be associated with the outcome and the exposure but are unlikely to be in the pathway linking education and older adult CHD risk (A; Case, Fertig, & Paxson, 2005; Case, Lobotsky, & Paxson, 2002) including race/ethnicity (Non-White vs. White), mother's educational attainment (More than HS degree vs. HS degree or less), cognitive aptitude (verbal IQ at age 7), childhood chronic health condition at age seven (yes or no) and family socioeconomic status (SES) at age seven. Childhood socioeconomic index is a composite index based on the occupation and education of the head of the household and combined income of all family members (range = 0–9.3) (Myrianthopoulos &