



Cross-sectional schooling–health associations misrepresented causal schooling effects on adult health and health-related behaviors: Evidence from the Chinese Adults Twins Survey

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ABSTRACT

Adult health outcomes and health behaviors are often associated with schooling. However, such associations do not necessarily imply that schooling has causal effects on health with the signs or magnitudes found in the cross-sectional associations. Schooling may be proxying for unobserved factors related to genetics and family background that directly affect both health and schooling. Recently several studies have used within-monozygotic (MZ) twins methods to control for unobserved factors shared by identical twins. Within-MZ estimates for developed countries are generally smaller than suggested by cross-sectional associations, consistent with positive correlations between unobserved factors that determine schooling and those that determine health. This study contributes new estimates of cross-sectional associations and within-MZ causal effects using the Chinese Adults Twins Survey, the first study of its type for developing countries. The cross-sectional estimates suggest that schooling is significantly associated with adult health-related behaviors (smoking, drinking, exercising) but *not* with own or spouse health outcomes (general health, mental health, overweight, chronic diseases). However, within-MZ-twins estimators change the estimates for approximately half of these health indicators, in one case declining in absolute magnitudes and becoming insignificant and in the other cases increasing in absolute magnitudes. Within-MZ estimates indicate significant pro-health effects for at least one of the indicators for own health (better mental health), own health-related behaviors (less smoking) and spouse health (less overweight).

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1. Introduction

Positive associations between schooling and health are extensively documented. More-schooled individuals are more likely to have better health behaviors and outcomes (Cutler and Lleras-Muney, 2008, 2010; Albert and Davia, 2010; Zhang et al., 2010; Lange, 2011; Montez et al., 2011; Montez et al., 2012). However, these wide-spread positive schooling–health associations do not necessarily reflect beneficial effects of schooling on health. The health–schooling gradient may be in part due to unobserved endowments – such as innate physical and mental capabilities and

family and community background – that affect both schooling and health. For example, people with better health-related endowments may not only have better health outcomes but may also have had more energy to learn and thus obtain more schooling. To what degree health–schooling associations actually reflect the causal effects of schooling on health is an important question for understanding both schooling returns and health determinants.

A number of recent studies examine the causal effects of schooling on health in developed countries. One set of studies employs changes in schooling policies, usually increases in the minimum age or the legally permitted grade to leave school, as instrumental variables for schooling attainment to control for endogeneity. These studies provide LATE (local average treatment effect) estimates of the impact of schooling on health for individuals close to the minimum legal schooling levels. Another set of studies uses identical twins (monozygotic, i.e., MZ) to difference out the unobserved endowments shared by these twins. These

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studies obtain estimates of the impacts of the differences in schooling within a pair of identical twins on their health differences at various schooling levels, not only the minimum legal schooling levels.

The results from these studies vary. Some suggest that schooling has positive causal effects on health outcomes such as long-term illness, mortality, height and weight, and little effects on health-related behaviors such as smoking and drinking (Groot and Maassen van den Brink, 2007; Park and Kang, 2008; Fujiwara and Kawachi, 2009; Sillers, 2009; Kemptner et al., 2011; Lundborg, 2013). Others conclude that there are many fewer and much smaller causal effects than in the cross-sectional associations or that there are no causal effects of schooling on health. Some of these studies imply that more-schooled people have better health mainly because they have better endowments (Arendt, 2005; Albouy and Lequien, 2009; Braakmann, 2011; Behrman et al., 2011; Amin et al., 2013; Clark and Royer, 2013; Amin et al., 2015).

A smaller number of previous studies investigate the health effects of schooling within marriage and find positive associations of own schooling with spouse health status (Egeland et al., 2002; Lipowicz, 2003; Jaffe et al., 2005; Kravdal, 2008; Li et al., 2011). We are aware, however, of only one such study that uses within-MZ-twins estimates to control for unobserved endowments. This study, using US twins, finds a number of significant cross-sectional associations between own schooling and spouse health outcomes and health-related behaviors, but they all become insignificant in within-MZ-twins estimates (Amin et al., 2015).

For developing countries, there also are numerous studies of the associations between own schooling and adult health. However, to our knowledge, there are few studies of the causal effects of schooling on health and health-related behaviors controlling for schooling endogeneity, and no previous study that uses within-MZ-twins estimates for such a purpose. The few studies of which we are aware use randomized controlled trials (RCTs), instrumental variables (IV), or regression discontinuity designs (RDD) based on “natural policy experiments”. Jensen and Lleras-Muney (2012) analyze a Dominican Republic program that gives teenage boys randomized information about returns to schooling, which induces boys to stay in school longer and improves health-related behaviors by delaying the onset of heavy drinking and reducing smoking at age 18. Duflo et al., (2012) report that a randomized Kenyan school subsidy program increases schooling but has weak impacts on sexual behaviors and STD infections. Alsan and Cutler (2013), using distance from school as an IV, find that more secondary schooling for adolescent Ugandan girls increases sexual abstinence and therefore reduces exposure to sexually transmitted diseases. Behrman (2015) finds that abolishing school fees in the mid-1990s increases schooling for girls in Malawi and Uganda; she then uses an RDD to estimate that a one-grade increase in the schooling of girls leads to a reduction of six percentage points in the probability of testing positive for HIV as an adult in Malawi and a three percentage point reduction in Uganda.

In this study, using MZ twins data from urban China for the year 2002, we report both cross-sectional and within-MZ-twins estimates of the effects of one's own schooling on one's own health outcomes and health-related behaviors, as well as on spouse health outcomes. Cross-sectional estimates indicate that: (1) Own schooling has no significant associations with self-reported health status (SRH), mental health, being overweight and the number of chronic diseases; (2) own schooling is negatively associated with packs of cigarettes consumed and drinking alcohol and positively associated with exercising – and is thereby associated with improved health-related behaviors; (3) own schooling is not significantly associated with spouse global health status, the spouse being overweight, or the number of chronic diseases of the spouse.

However, within-MZ-twins causal estimates indicate that schooling has protective effects on some of one's own and spouse health outcomes and own health-related behaviors that differ from the cross-sectional associations: (1) Schooling improves significantly own mental health (and at the 0.10 level, own self-reported health and reduces the number of chronic diseases) in contrast to insignificant cross-sectional associations; (2) schooling reduces smoking as in the cross-sectional associations but no longer significantly affects drinking or exercise as in the cross-sectional estimates; and (3) schooling reduces the probability of the spouse being overweight in contrast to the cross-sectional insignificant association. The majority of the causal estimates are larger in absolute magnitudes than the cross-sectional associations.

2. Methods

2.1. Data

The Chinese Adults Twins Survey (CATS) was conducted by one author of this study, Zhang, and the Urban Survey Unit (USU) of the National Bureau of Statistics (NBS). CATS was undertaken in 2002 in five Chinese cities with current population of approximately 35 million inhabitants: Chengdu, Chongqing, Harbin, Hefei, and Wuhan. CATS covered substantial socioeconomic information, building on previous twins questionnaires used in the US and elsewhere. Adult twins between the ages of 18 and 65 were identified by local statistical bureaus through channels that included colleagues, friends, relatives, newspaper advertising, neighborhood notices, neighborhood management committees, and household records from local public security bureaus. These channels permitted an approximately equal probability for contacting all twins in these cities, so the sample was approximately representative. Questionnaires were completed through face-to-face interviews. The survey was conducted with considerable care. Zhang made several site checks and closely supervised and monitored data input processes.

CATS was the first Chinese, and probably Asian, adult socioeconomic twin dataset. Completed questionnaires were collected from 3002 individuals, of whom 2996 were twins and six were triplets. Among these individuals were 914 complete pairs of identical twins (1828 individuals) for which both twins responded that they had identical hair color, looks, gender, and age. The data were assessed to be of high quality and were used in a number of published studies (see Li et al., 2007, 2010, 2012; Huang et al., 2009; and Rosenzweig and Zhang, 2013). The descriptive statistics for key variables of CATS are similar to those in the Urban Household Survey (UHS) conducted in 2002 by the National Bureau of Statistics of China (Appendix Table A1).

2.1.1. Own and spouse health outcomes

(1) *Self-reported health (SRH)*: Respondents were asked to evaluate their own and their spouses' global health; “How is your current health status? 1 means very good, 2 means good, 3 means just so-so, and 4 and 5 mean poor and very poor, respectively.” Because only 4.6% of interviewees reported poor and very poor SRH, our variable is 0 (not in good health) if the answers were 3, 4, and 5 and 1 otherwise (in good health). (2) *Overweight*: Respondents were asked to report their own and their spouses' current heights in centimeters and weights in kilograms, which were used to calculate body mass indices (BMI). “Overweight” is 1 if BMI was ≥ 25.0 and 0 otherwise. (3) *Number of chronic diseases*: The interviewees were asked about their own and their spouses' chronic diseases: “Do you have the following symptoms?” The 12 symptoms/conditions included: hemicranias, allergy to pollen, skin rash, hearing damage, hypertension, neurasthenia, problems

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