Death of a sibling in early life and health of the survivor sibling in later adulthood
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INTRODUCTION

This study is to examine the long-term negative consequences of death of a sibling on health of the survivor siblings in later adulthood using a modern data with rich information on family environment, SES, and life course events. Using Wisconsin Longitudinal Study (WLS), I found that experiencing the death of a sibling before age 36 had direct and robust harming effects on many measures of physical health of men and women at age 50 after controlling for childhood family environment (SES, family configuration, and others), socioeconomic attainment in adulthood, and other important life events. Next, I will explore some possible explanations on the associations using information from a full sibship roster in WLS. I will dissect the effects of the death by the age and the cause of the death and then look into the associations between the sibling's death, early parental death (before age 50), family medical (parents and siblings) history, and childhood health of the respondents.

BACKGROUND

The relationships between a dead young child on the health and survival of other children were well documented in infant and child mortality literature. The explanation mostly focused on competition between siblings for nutrition and parental care but few researchers also proposed an explanation of selection effects. Death of a previous sibling had mixed effects on the health of the subsequent sibling. Data were mostly drawn from modern developing countries and few from historical European regions. While influences of other variables of sibship configuration, e.g., number of siblings, birth spacing, or birth order, on well-being and health in adulthood were well studied, the relationship between the death of a sibling and individual well-being (including socioeconomic status and health) of the survivors beyond childhood have been limited to studies of mortality using historical data or genealogical data. In medical studies, the medical history of the biological siblings is an important instrumental variable for familial risk. The Framingham study and other medical literature showed that those (mostly men) who had one or more siblings with cardiovascular disease were at a higher risk for the disease. And the effect was independent of the similar effect of the father. Similar results were also found in cancer research. For example, before the BRCA defect was identified in 1994, studies had found that women who had sisters or mothers had breast cancer were more likely to had breast cancer themselves. Psychological literature suggested that death of a sibling in childhood had traumatic psychological consequences on the survivor siblings. However, as for the findings in child mortality and health literature, the sample in psychological studies did not go beyond childhood.

DATA AND METHODS

The original WLS sample was consisted of 13,017 randomly selected Wisconsin high school seniors of class 1957. It was about 1/3 of Wisconsin high school seniors at that time. Besides individual and school data collected in 1957 and from parents in 1964, the study continued to collect data from the original respondents (hereafter, graduates) in 1975, 1992, and 2002. The response rate of the graduate sample has been very high, 87.09% for 1964, 90.09% for 1975, and 87.18% for 1992. In 1977, one sibling was randomly selected from the roster of all living siblings for each graduate, but only 2,134 siblings were eventually interviewed in the data. In 1994, the sibling sample was expanded to include the sibling interviewed in 1977, the selected but not interviewed 1977 sibling if the graduate respondent was interviewed in 1992-3, and a newly selected sibling if the selected but not interviewed 1977 sibling was no longer available. There were 4,677 sibling respondents who completed the phone interviews, 4,036 who completed phone interview and mail questionnaire, and 561 who completed the revised mail questionnaires due to funding limit. In 2003-4, the WLS re-interviewed 7,284 graduates by phone and mail; in 2004, 3,862 spouses of graduates were also interviewed; in 2005, 3,252 siblings were interviewed. Most childhood family information, including family incomes, farmer background, father's and mother's education, occupation, residential locations, and religion, were collected in 1957, but some, such as positive relationship with parents, abuses, family configuration and structure, and smokers and problem drinkers in the family, were collected in subsequent interviews from graduates, siblings, parents, and other sources, such as WI State tax record, social security, and schools. Health data were not collected until 1992/1994. Adult life events, such as educational history, occupation and job history, income, social participation, religion, marital history, fertility history, were obtained over time. The WLS also has a rich set of

variables on first-degree relative information (age, education, occupation, martial status, health, and others), aspiration, expectations, social comparisons, personality (since 1992), psychological well-being (since 1992), financial inter-transfers (since 1992), health insurance (since 1992), and retirement-related measures (since 1992). The variables are introduced below. I will analyze WLS graduates using multivariate regression analysis.

VARIABLES

The key independent variable was death of any biological siblings, which was measured by subtracting number of living siblings by number of siblings ever born. It was coded as dichotomous variable: 1 indicates death of any sibling and 0 indicates no death. In 2002/4, the WLS updated all siblings' living status, time of death and causes. In place of the sibling death, I will use 2 variables: any death occurred before or in childhood and any after age 18. The other set of variables to explain the associations are childhood health, medical history of parents and siblings, and parental death and health. They were all collected in 2002/4. The inclusion of childhood health can help to narrow down the influences before adulthood. The WLS has retrospective reports on childhood health. A self-rated health status in childhood, long absence of school and its reasons, and childhood diseases are collected in 2002/4 mail questionnaires. Medical history of parents and siblings are measured by variables indicating whether parents or siblings had cancer, stroke, heart attack, and diabetes. Parental health, death and age are reported in 1992/4 and 2002/4.

Basic measures of parental socioeconomic status are parental educations, father's (or mother's) occupation, family income, mother's employment status, union membership, and farmer background. The family income was constructed from 1975 report and the WI State Tax record; father's occupational status was measured by Duncan SEI score and constructed from 1975 report and Wisconsin tax record. Other childhood environment variables included living with problem drinkers before age 18, living with smokers, physical and verbal abuse, family violence and quality of relationship with parents. A set of family structure variables were also controlled: number of biological siblings, birth order of the respondent, parental ages at birth of the respondent and the oldest sibling, and whether growing up with both parents. The other control variables include socioeconomic attainment, marital history and timing, the quality of marriage, fertility outcomes and timing, and major disruption in employment.

The outcomes included being obese, ever smoking for more than 10 years, current smoking, heavy drinking and ever seeking for help in drinking. The definition of heavy drinker is for women who drink 30 drinks per month and men who drink 60 drinks per month. The physical health is measured by self-report health status, disability, number of physical symptoms, number of illness, and specific chronic diseases such as cardiovascular diseases and cancers.

FINDINGS AND FURTHER ANALYSIS

Multivariate regression analysis showed that death of a sibling before middle age had negative effects on many measures of health and well being at age 50. The death of a sibling was measured by subtracting the number of living siblings from that of total siblings ever born, reported in 1975 when the respondents were mostly 36 years old. The dichotomous indicator was coded as one for respondents with at least one sibling who had died before or at 1975. In the equation, I also controlled for parental education, father's occupation, family income, rural area, number of living siblings, birth order, father's age at first birth, mother's age at respondent's birth, parental encouragement for college, parental positive interaction with respondents, childhood abuse, growing up with smokers, growing up with problem drinkers, respondent's academic performance, and respondent's IQ at junior/senior year. Furthermore, I entered total years of schooling in 1975, occupational status in 1992, family income in 1992, marital status, age at first marriage, number of biological children, and age at first birth. The respondents who experienced the death of a sibling were more likely to be obese or overweight; they were more likely to report bad health; they had more diagnosed chronic diseases and more physical symptoms; they were more likely to have ever smoked more than 10 years; they did not do as well in high school; they also started the family earlier and had more biological children. However, their personality characteristics (Big 5), levels of psychological well-being, intelligence in high school and at age 50, socioeconomic status, and mental health DID NOT differ from the others.

I also found that, while the effects of sibling death were robust, the effects of number of living siblings were inconsistent. The number of living siblings had negative influences on socioeconomic attainment but mixed or no influences on health. To make sure that the effect of sibling death was not simply instrumental for excessive birth(s) of the parents, I also used the number of siblings ever born, in place of number of living

siblings and death of a sibling. The effects of number of siblings ever born were insignificant for most of outcomes. This further supports the harming effects of sibling death on health in later adulthood.

Few studies examined the impact of death of a sibling on health and well-being of the survivors in later adulthood using contemporary data, but some arguments may help to explain the direct and robust effects and worth further investigation. First, the relationship between sibling death and poor health of the other siblings in adulthood was an extension of its effect on health of the survivor sibling in childhood. Up to now, I did not specify the age of the death for both the respondent and the dead sibling and the cause of the death. Childhood health was not controlled in the equation either. It is useful and interesting to see when most of the death occurred and what the causes were. For example, if most of the deceased siblings died in the childhood, the direct harming effect of the death on the survivor siblings in later adulthood is more likely to be familial, either environmental or genetic. Furthermore, the significant death effects on high school grades but not on cognitive ability in high school or at midlife may indicate the indirect effect of childhood health on academic performance; thus the argument for childhood health may be valid.

As mentioned above, many national familial medical studies suggested that those whose siblings had chronic diseases were in a higher risk to have the disease than those whose siblings did not. Likely, the death of a sibling in childhood or in young adulthood has the same implication. Finally, the relationship between sibling death and poor health may be spurious because of lack of controlling for unmeasured heterogeneity. Death of a sibling may signal the health status of the parents or the physical and mental environment in childhood. Because the death did not have any direct impact on mental and psychological characteristics (i.e., personality, well-being, depression, and intelligence), the psychological pathway was excluded in the current paper.