Effects of Spousal Education on Mortality among Older Men and Women in China

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The effect of individual educational attainment on health and mortality has been extensively documented although the strength of this effect varies across social and cultural contexts {Elo, 2009 #2079;Hummer, 2011 #2073;Vathesatogkit, 2014 #2174}. Education was found to be inversely related to poor self-rated health and mortality risk, as well as levels of morbidity and disability. Much less is known about the effect of a spouse's education on one's own health and mortality risk, and the results are inconsistent {Jaffe, 2005 #2162;Jaffe, 2006 #2163;Brown, 2014 #2164;Spoerri, 2014 #2165;Torssander, 2009 #2167;Li, 2013 #2168;Monden, 2003 #2169;Kravdal, 2008 #2170}. Some studies showed that both men and women are affected by their spouses' education {Jaffe, 2006 #2163}{Kravdal, 2008 #2170}{Monden, 2003 #2169}, while others showed that only men are affected by their wives' education {Torssander, 2009 #2167}{Jaffe, 2005 #2162}, and still others showed that only women are more strongly affected by their husbands' education {Brown, 2014 #2164}.

Research on the effect of spousal education on health and mortality in developing countries is even more limited. One study from rural Bangladesh showed that wives' education has an independent negative effect on men's mortality, but husbands' education did not have an independent effect on women's mortality {Hurt, 2004 #2173}. A cross-sectional study of married couples in Shanghai, China revealed that while there is a positive association between spouses' education and self-rated health for both men and women, the association was stronger for women than for men which seems to suggest that women's health benefits more from husbands' education {Li, 2013 #2168}. No studies, however, have looked at the effects of spouses' education on mortality among older adults in China.

These conflicting findings call for additional research on this topic. This study uses a large national sample to examine the effects of spousal education on older adults' mortality risk in China. More specifically, it addresses three research questions: (1) Does a spouse's education have an effect on an older adult's mortality risk that is independent of the effect of his/her own education? (2) Does the effect of spousal education on mortality differ for men and women? (3) What are the underlying mechanisms for the effect of spousal education on mortality and its gender variations?

Methods

Data for this study come from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), which is conducted in the randomly selected half of the counties and cities of 22 provinces in mainland China (Zeng, Vaupel, Xiao, Zhang, & Liu, 2002). The survey attempted to interview all centenarians who agreed to participate. For each centenarian, one nearby octogenarian (aged 80-89) and one nearby nonagenarian (aged 90-99) of pre-designated age and

sex were selected for an interview. Age and sex were predefined so that the sample could have comparable numbers of male and female octogenarians and nonagenarians at each age from 80-99. The baseline survey was conducted in 1998 and five follow-up surveys with replacement of deceased elders were conducted every two or three years. Since 2002, the survey has been expanded to also include those aged 65 to 79 years. The interviews were carried out at the interviewee's home by an enumerator and a doctor, nurse, or medical school student who also performed a basic health examination. The baseline survey had a response rate of 88%, and 12-20% respondents were lost to follow up depending on the survey year.

Since our target population is older adults in general, including both the young old and the oldest old, we used data collected in 2002, 2005, 2008, and 2011 waves. We pooled data from the first three waves and created a person-wave dataset which allows us to incorporate time-varying covariates and produce more robust results than using data from the respondents in 2002 only. Our analysis excluded 556 respondents aged over 105 at their first interview because previous research showed that age reporting of the Chinese older adults was generally reliable up to age 105 (Zeng et al., 2002). Further excluding 7,531 cases lost to a subsequent follow-up survey, 449 cases missing on the date of death, 1388 cases missing on spousal education because the respondent has never married or didn't report the current or last spouse's education, and 14 cases missing on other variables, our analytical sample includes 38,260 observations (16,485 male vs. 21,775 female) from 25,888 respondents (10,839 male vs. 15,049 female).

Mortality.—The dates of death for the period 2002 through 2011 for the deceased respondents were collected from various sources including death certificates, next of kin, and neighborhood committees. All dates were validated, and the dates reported on death certificates were used when available; otherwise the next of kin's report was used, followed by neighborhood registries (Gu & Dupre, 2008). Survival time was calculated for the 15,331 respondents who died between 2002 and 2011. For the survivors, the survival time was the days from the first interview date since 2002 to the interview date in 2011. For those lost to follow-up, the survival time was the days from the first interview date to the date of their last interview if they had at least one follow-up interview during the period of 2002-2011.

Education.—The respondent's report of his/her own education and the respondent's report of his/her current or last spouse's education are included. Because the number of years of schooling is highly skewed, we recoded these variables into three categories: no schooling, primary school (1 to 6 years), and middle school and more (7 or more years). Based on the three recoded education levels, we also created a measure of the spouses' educational gap which has three categories indicating whether the spouse's education is lower than, at the same level as, or higher than the respondent's education.

Demographic covariates.—We control for age, gender, ethnicity (Han vs. non-Han), and residence (urban vs. rural) which can affect both educational attainment and mortality.

We first calculated descriptive statistics stratified by gender. Parametric hazard models with Weibull distribution were used to estimate the hazard ratios because the proportional hazards assumption in Cox regression was violated for education and many other covariates

(e.g., adequate access to medical services). Because preliminary analysis showed that education effects on mortality risk vary by gender, we estimated separate models for men and women. Descriptive statistics were weighted by the sampling weight at each wave to account for special design of the CLHLS (Zeng et al., 2002). The multivariate analyses were not weighted, however, as research has shown that including variables related to sample selection in the regression produces unbiased coefficients without weights (Winship & Radbill, 1994). We estimated four models for each gender, all of which control for demographics and survey year. In addition, the first model includes respondent's own education, the second model includes spouse's education, the third model includes both respondent's own and spouse's education, and the fourth model includes respondent's education and the education gap between the spouses.

Preliminary Results

The descriptive statistics showed that the proportion of men who died between two adjacent waves is higher than that of women (Table 1). There are significant gender differences in both respondent's own education and spouse's education: the proportions of men with primary school education and middle school or more educations are higher than those of women and the proportion of men with no education is much lower than that of women. In addition, women are slightly older and are more likely to live in rural areas than men.

Multivariate analysis shows gender differences in the effects of both respondent's own education and spouse's education on mortality. Controlling for demographics and survey year, men with primary school education or middle school or more education have lower mortality risk than men with no education (Model 1). The wife's education also has a significant effect on men's mortality with those with primary school educated wives having 10% lower mortality risk and those with middle school or more educated wives having 25% lower mortality compared to those with wives who had no education (Model 2). These effects were only slightly attenuated once both spouses' educational attainments are included in Model 3 with one exception that once controlling for wife's education, the difference in mortality risk between men with middle school or more education and men with no education is no longer significant (Model 3). In addition, spousal education gap also matters for men: compared to men whose education is at the same level as their wives, men's mortality risk is higher when their wives education is lower than their own, but their mortality risk is lower when their wives' education is higher than their own (Model 4).

Controlling for demographics and survey year, women with primary school education do not have different mortality risk than women without education, but women with middle school or more education have much lower mortality risk than women without education (Model 1). For women, only those with husbands who have middle school or more education have lower mortality risk than those with husbands who have no education; women's mortality risk do not differ between those whose husbands have primary school education and those whose husband have no education (Model 2). These educational differentials in women's mortality are attenuated once both spouses' educational attainments are included, especially between those whose husband have middle school or more education and those whose husbands have no

education (Model 3). Spousal educational gap does not seem to make much difference in women's mortality risk (Model 4).

Further Analysis

Our analysis of the ever married older Chinese adults clearly showed gender differences in the effects of spouses' education on older adults' mortality risk. However, additional analyses restricted to those who are current married showed that neither men's nor women's mortality risk is significantly affected by their spouses' education. This is puzzling and requires further investigation. In addition, we plan to examine the underlying mechanisms of the effects of spouses' education, which may include other socioeconomic attainments, social relationships and activity participation, and health behaviors.

Table 1. Descriptive statistics by gender, pooled CLHLS data.

	Men	Women	
	Mean/%(std)	Mean/%(std)	p of gender difference
Died between adjacent waves	13.7	12.3	**
Own education			**
No education	24.3	68.2	
Primary school	51.2	25.4	
Middle school or more	24.5	6.4	
Spouse education			**
No education	60.5	39.6	
Primary school	28.9	44.2	
Middle school or more	10.6	16.2	
Age	72.89(5.85)	73.33(6.46)	**
Han	93.7	93.5	
Urban	38.6	36.7	*
Observations	16485	21775	

Note: results are weighted. * $p < .05$, ** $p < .01$.

Table 2. Hazard ratios of own and spouse's educational attainments on mortality from 2002 to 2011 by gender.

	Men				Women			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Own education								
Primary school (cf. no education)	0.93**		0.94*	0.86**	0.99		1.00	0.98
Middle school or more (cf. no education)	0.90**		0.96	0.83**	0.71**		0.75**	0.70**
Spouse education								
Primary school (cf. no education)		0.90**	0.91*			0.99	0.99	
Middle school or more (cf. no education)		0.76**	0.77**			0.88**	0.93+	
Spousal education gap								
Spouse lower (cf. same level)				1.09*				1.01
Spouse higher (cf. same level)				0.87+				0.97
Age	1.08**	1.08**	1.08**	1.08**	1.08**	1.08**	1.08**	1.08**
Han	0.99	1.00	0.99	0.99	1.17**	1.17**	1.17**	1.17**
Urban	0.93**	0.94*	0.95+	0.94*	0.96+	0.96+	0.96+	0.96+
2005 wave (cf. 2002 wave)	0.79**	0.79**	0.79**	0.79**	0.77**	0.77**	0.77**	0.77**
2008 wave (cf. 2002 wave)	0.76**	0.75**	0.75**	0.75**	0.74**	0.74**	0.74**	0.74**
Chi-square	3794.05	3804.57	3809.55	3802.13	5844.68	5834.73	5847.58	5845.99
Df	7	7	9	9	7	7	9	9

+ $p < .1$, * $p < .05$, ** $p < .01$