Education and Depression
Among Middle-aged and Elderly Chinese Adults

Population aging is a serious issue in China. The sixth China national census showed that the population aged over 60 accounted for 13 percent of the total population in 2011 and was estimated to be 31 percent in 2049. Older adults have to face many changes that come later in life—retirement, the death of loved ones, increased isolation, and especially medical problems, all of which potentially lead to mental health issues, such as depression. Depression in old age is considered one of the most frequent causes of emotional suffering and lower quality of life (Geerlings et al, 2000). Depression is also consistently related to suicide among the elderly (Li, Xiao, & Xiao, 2009).

Middle-aged and older Chinese adults today have gone through some of the most turbulent times in China's recent history – the Sino-Japanese war, the civil war, the agricultural collectivization movement that resulted in widespread starvation and, more recently, the Cultural Revolution. The wars and political turmoil have caused disruptions to these adults' life and left many with little or no education. Our objective is to examine if education still serves the function of differentiating individuals' emotional health, measured by depression, for a population with low educational levels.

Although the prevalence of depression among older people has been explored in the United States and other countries, rigorous studies on this issue in China emerged only after the 1990s (Zhang, et. al., 2012). More research and is needed to understand the factors contributing to depression among the elderly in order to design prevention measures.

Literature Review

Education has been found to be one of the strongest demographic variables in predicting individuals' health status. It is an important risk factor in the occurrence of depression among the elderly. Older adults with a low level of education are at risk for depression (Chou & Chi, 2005). Although several explanations have been given, the education-depression relationship is still not well understood. This is especially true in developing countries like China where the elderly population has a low educational level.

One explanation for the education-depression relationship is based on the assumption that education represents the economic condition or financial capital of older adults. Income, health insurance, and job characteristics partly account for the relationship between education and depression (Lahelma et al., 2004; Culter et al., 2006). Because highly educated people work in better environments and have greater health care resources than do less educated people, they are less likely to be depressed (Herzog et al., 1998).

Another explanation is about the social connections elderly adults have with their family. The elderly who are married are less likely to experience depression than elderly adults who are single, separated, divorced, or widowed (Haynie et al., 2001). Loss of one's siblings and lack of children's support are also risk factors for depressive symptom in later life (Hybels et al., 2001).

The third explanation is from the perspective of the human capital theory that emphasizes cognitive ability and skills learned in school. Formal schooling imparts cognitive skills that are not only useful for work, but they are also necessary for continued learning as well as learning out of school. Years of schooling and learning

of cognitive skills help individuals to deal with difficult situations, to take charge of their health matters, and to become more engaged in cognitively stimulating activities, all of which likely prevent depression (Mirowsky & Ross, 1998, 2003; Culter et. al., 2006; Zhang et al., 2012).

Drawing on a nationally representative large database of middle-aged and old Chinese adults, we ask two research questions. First, what is the relationship between the Chinese elderly's education and the frequency with which they experience depressive symptoms? Second, what accounts for this education-depression relationship? In this study, we develop and examine hypotheses based on explanations of the elderly's financial capital, family connections, and cognitive functioning.

Data and Variables

We use data from the China Health and Retirement Longitudinal Study (CHARLS), a longitudinal survey of a sample of households with members aged 45 years or above. Modeling after the U.S. Health and Retirement Study (HRS), this is a high quality public micro-database with a focus on China's aging problems. The data were collected and maintained by the National School of Development at Peking University. Currently two CHARLS databases were released to the public: a pilot study in 2008 and a baseline study in 2011. This paper is based on the 2011 data that provided us with rich information about the demographics, health status, and socioeconomic conditions of adults in 450 communities in 150 counties and in 28 (out of 34) provinces in China. There are 10,257 main respondents in the full sample, of whom 1,101 have missing information on depressive symptom. After removing these and other missing data, our multivariate analysis is based on 9,000 main respondents.

The dependent variable, depression, is measured by the Chinese version of the 10-item Center for Epidemiologic Studies Depression Scale, known as CESD-10 (Zhao et al., 2012). Developed in western countries, CESD-10 captures depressive symptoms to identify high-risk individuals for epidemiological studies. The reliability and validity of CESD-10 were later established and applied to various populations in different countries (Cho & Kim, 1993). Specifically, CESD-10 contains self-reported items asking respondents how often they experienced the 10 specific symptoms during the past week. These symptoms include being bothered by things that usually did not bother them, having trouble keeping their minds on what they were doing, and so on. A 4-point ordinal scale was applied to each item: rarely or none of the time (less than 1 day); some or a little of the time (1-2 days); occasionally or a moderate amount of the time (3-4 days); and most or all of the time (5-7 days). Each participant obtained a total score ranging from 0 to 30 with higher scores indicating more frequent depressive symptoms.

The major independent variable is respondents' education, measured by five dummy variables: no education, elementary school, middle school, high school, and college or above. Other independent variables include age, gender, marital status, number of children living together, living standards, household status, and cognitive functioning.

Preliminary Results

As expected, the elderly Chinese population has very low levels of education. Of the 10,257 main respondents sampled in 2011, 46% had no schooling, 20% had an elementary education, 19% had completed middle school, 10% had a high school degree, and only 2% had college education. Despite such educational distribution that

concentrates in the lower tail, a little bit of education appears to matter significantly to the elderly's depressive symptoms. This is shown in the baseline regression in Model 1 that controls for age and gender. There is a significantly negative relation between education and depression. Compared to those without any schooling, older people who have an elementary education or above are less likely to suffer from depression. This result is consistent with previous research in the United States (Herzog et al., 1998).

Indicators of social relations are then added to investigate the family connections hypothesis for the education-depression relationship. Model 2 shows that, compared to the married elderly, those who are separated, divorced, widowed, or never married have more frequent depression symptoms. However, we do not find older people living without any children to have a higher frequency of depression than older people living with one or more children. It is possible that even though their children are not living with the elderly, they live close by. Thus the living arrangement may not reflect family connections. Including these social relations variables in the model does not change the education-depression relationship, suggesting that family connections based on our measures are not an appropriate explanation.

Model 3 adds to Model 2 the indicators of living standards and Hukou status to test the hypothesis of economic conditions. It shows that older people with higher living standards or with urban Hukou have a lower frequency of depression. These financial capital factors substantially account for the relation between education and depression. All education coefficients dropped by 25% (elementary) to 43% (college).

Our last model includes cognitive functioning as an indicator of human capital. Cognitive functioning is strongly and negatively associated with depression. Adding the cognitive variable further reduces the coefficient of elementary education to insignificance. Other education coefficients decreased by 46-63%. Further analysis separating the different components of cognitive functioning reveals that the effects of cognitive functioning come primarily from self-reported memory. Objective measures of memory are not important. Self-reported memory may be contaminated by the elderly's self-confidence. This is an area we will further investigate.

Due to the very low levels of female education, we separate gender group for additional analysis. The results remain largely the same. Our preliminary conclusion is that the education-depression relationship can be accounted for by elderly's financial and human capital but not social relations around the family.

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Table 1 Result from Multivariate Regression Model

Variable	Model 1 (Basic Model)		Model 2 (Model1 + Social Capital)		Model 3 (Model2 + Financial Capital)		Model 4 (Model 3 + Human Capital)	
Depression	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)	Coef.	(SE)
Elementary School	-0.13***	(0.02)	-0.12***	(0.02)	-0.09***	(0.02)	-0.01	(0.02)
Middle School	-0.24***	(0.02)	-0.23***	(0.02)	-0.16***	(0.02)	-0.06**	(0.02)
High School	-0.38***	(0.02)	-0.37***	(0.02)	-0.26***	(0.03)	-0.14***	(0.03)
College or above	-0.51***	(0.04)	-0.49***	(0.04)	-0.28***	(0.04)	-0.15**	(0.04)
Age	0.00***	(0.00)	0.00**	(0.00)	0.00***	(0.00)	0.00*	(0.00)
Female	0.15***	(0.01)	0.14***	(0.01)	0.15***	(0.01)	0.12***	(0.01)
Separated			0.13***	(0.03)	0.12***	(0.03)	0.11***	(0.03)
Divorced			0.17**	(0.05)	0.11*	(0.05)	0.11*	(0.05)
Widowed			0.13***	(0.02)	0.10***	(0.02)	0.08***	(0.02)
Single			0.25***	(0.05)	0.16**	(0.05)	0.13*	(0.05)
Live with one child			-0.02	(0.02)	-0.02	(0.01)	-0.02	(0.01)
Live with two or more children			0.03	(0.02)	0.01	(0.02)	0.01	(0.02)
Living Standards					-0.22***	(0.01)	-0.20***	(0.01)
Hukou Status					-0.13***	(0.02)	-0.09***	(0.02)
Cognitive Ability							-0.65***	(0.03)
Constant	0.72***	(0.05)	0.76***	(0.05)	1.16***	(0.05)	1.79***	(0.06)
R-squared	0.08				0.16		0.20	
Adj R-squared	0.08				0.16		0.20	

*** p<.001, **p<.01, *p<.05 (two-tailed tests)