

Psychological Distress due to Poverty and Its Impact on the Health of the Aging Population in China

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Using two waves of the nationally representative Chinese Longitudinal Healthy Longevity Survey, we examine how psychological distress measured by frequent experience of fear and anxiety affects health outcomes. We find that poverty-induced psychological distress significantly increases the probability of death. For those who survived till follow-up, results show that psychological distress affects the onset and continuation of ADL limitations and cognitive impairment. Recognizing the psychological impact of poverty on health and factors that can reduce psychological distress, has important consequences for designing intervention programs for the growing aging population in China and in other developing countries.

INTRODUCTION

An important aspect of population aging across the globe is the effect of poverty on the well-being of the aging population (Barrientos, Gorman, & Heslop, 2003; Heslop & Gorman, 2002). Though a large body of literature discusses poverty among aging population in Western welfare economies, little research exists for developing countries with weak or limited welfare programs. Some of these studies focusing on the effects on health (Banerjee & Duflo, 2010; Lloyd-Sherlock, 2000; Zeng, Gu, & Land, 2007) highlight how financial deprivation directly impacts lifestyle and health care utilization. However, the causal link between poverty and health through its impact on the mental health of the individual is less well established. Scholars have shown that poverty is associated with psychological stress (Pearlin & Bierman, 2012; Schulz et al., 2012; Seeman, Epel, Gruenewald, Karlamangla, & McEwen, 2010). Others have found that psychological stress has physical effects on organs and tissues, manifesting in altered physical functioning, cognitive decline, cardio- and cerebrovascular diseases and weakened immune systems (Glaser & Kiecolt-Glaser, 2005; McEwen & Gianaros, 2011; Salovey, Rothman, Detweiler, & Steward, 2000). While these studies identify the associations between poverty and health or poverty and stress or stress and health, none specifically identifies a causal relation between poverty-induced psychological

conditions and health outcomes. The establishment of a causal link is important as it has implications for effective policy interventions. Thorny methodological challenges including endogeneity and reverse causality often restricted previous studies from going beyond establishing an association. Endogeneity can be present as there can be some third factor e.g. a loss of a source of income or public welfare, which can both cause psychological distress as well as adverse health outcome due to lack of resources to meet health needs. In addition, there can be reverse causality as worsening health outcome can increase psychological distress as well as push people into poverty. The closest in scope of this current research in the Asian context is a paper by Yeung and Xu (2012) who shows a significant association between subjective feeling of economic adequacy and mortality for elderly. However, they fall short in demonstrating the causal link.

The Chinese Context

In this study, we examine these relations in the context of aging in China. China has the largest aging population in the world with approximately 144 million persons aged 65 and above in 2015. Though China has made significant improvements in the well-being of its population in recent decades, in certain respects, it still represents a typical developing country with a weak or limited welfare program. Also, a significant proportion of the Chinese aging population is below or near poverty level. According to a recent national survey, 23 percent (approximately 42.4 million) of Chinese aged 60 and above are living below poverty in 2011 when measured in terms of consumption expenditure in the household¹ (CHARLS Research Team, 2013; Park, Shen, Strauss, & Zhao, 2012). Poverty measured in terms of household income rises sharply after attaining age 60 (29 percent) compared to those aged 45-59 (20 percent). Though this may be associated with withdrawal from the labor force, poverty measured in terms of consumption also follows a similar trend (20 percent for 60 and above compared to 15 percent for those aged 45-59). Another aspect of poverty among aging population in China is the higher poverty rates among women. According to the CHARLS report, the poverty rate is higher among women (24 percent) compared to men (22 percent). This is because women are more likely to withdraw from labor force compared to men as they age (Chang, MacPhail, & Dong, 2011; Cook & Dong, 2011). The 2005 one percent population sample² shows that while 14 percent of older men in cities and 50 percent of older men in villages were employed, the rates are lower at 5.7 percent in cities and 29 percent in villages for women. Consequently, as women on average outlive men, they are more likely to be in poverty as they enter widowhood.

An important aspect of poverty in China is the rural-urban divide in the incidence of poverty (Cai, Giles, O'Keefe, & Wang, 2012). The CHARLS report notes that the consumption poverty rate is much higher for those from rural areas (30 percent) than for those from urban (10 percent). Further among rural residents, those in the 61-70 age group, are more likely to experience repeated episodes of poverty than those in the lower age group and those surviving beyond age 80 (CHARLS Research Team, 2013). The origin of these disparities is usually attributed to the household registration system (the hukou system) initiated in the late 1950s. It was instituted by the Chinese government to restrict the population's geographic movement. However, such restriction resulted in uneven distribution of public benefits for its population. Some of these, benefits like pensions, health services and insurance and food rations, have important implications on rural urban differences in poverty at old ages (Cheng & Selden, 1994; Selden, 1999; Wu & Treiman, 2007).

An important consequence of the differences in public programs for the elderly can be seen in the differences in sources of income for the aging population in rural and urban areas. The 2005 one percent population sample shows that while a substantial proportion (58 percent) of urban population over 60 years of age relies on pension income, it accounts for less than five percent of the rural elderly. This because a large proportion of the aging population with earlier employment in state enterprises or military could access generous pension, there was little social insurance available for the rural residents until the very recent introduction of the Rural Social Pension Plan in 2009 (which is supposed to reach 100 percent coverage by 2020) with government contributions. The rural elderly rely mainly on family members (54 percent) and own labor (38 percent). The corresponding percentages are 30 percent and 9 percent

respectively for urban elderly (Giles, Wang, & Zhao, 2010). For the income poor, co-residence, transfers and dissaving play key role in keeping the elderly out of poverty (Park et al., 2012; Zimmer, 2005). However, this traditional source of support is facing significant challenges. China has experienced a dramatic decline in fertility due to the One-child policy. Consequently, there is far fewer working age population to take care of the rapidly growing aging population both physically and financially (Hesketh, Lu, & Xing, 2005; Y. Zhang & Goza, 2006).

Another consequence of rural-urban divide in public provisions is differences in healthcare access. Privatization of the health care delivery system since the 1980s has resulted in higher out-of-pocket medical expenditures over the years. The out-of-pocket cost of health care increased from 40 percent of total expenditure in 1997 to 49 percent in 2000 and 59 percent in 2006 (You & Kobayashi, 2011). Several studies find evidence of health expenditure induced poverty during this period (Liu, Rao, & Hsiao, 2003; Van Doorslaer et al., 2006). The effects are more strongly felt in rural areas as public healthcare providing are much better in urban areas (Duckett, 2012). The recent reforms in the New Community Medical System (NCMS) which was introduced between 2003 and 2008 made little difference in reducing out-of-pocket expenses (Lei & Lin, 2009; Wagstaff, Yip, Lindelow, & Hsiao, 2009). Studies find difficulty in NCMS enrollment among more vulnerable populations like aging (Brown & Theoharides, 2009), women 65+ (Jiang et al., 2011), and sicker individuals (Babiarz, Miller, Yi, Zhang, & Rozelle, 2012; Brown & Theoharides, 2009) as well as those in remote areas (Wagstaff & Yu, 2007).

DATA AND VARIABLES

We use data from two recent waves (2008 and 2011) of the nationally representative Chinese Longitudinal Healthy Longevity Survey (CLHLS) data to explore the effect of poverty-induced psychological distress at baseline on the health outcome in the next wave. The CLHLS is a nationally representative panel survey launched in 1998 and followed-up in 2000, 2002, 2005, 2008 and 2011. For the purpose of our study, we focus on individual's 65 and above. The 1998 and 2000 waves sampled only the oldest-old (80 and above). Young olds were added to the sample in later waves. Among the remaining waves, we used the two most recent waves as attrition rates are high among the aging population and only a small proportion remains in the sample across more than two waves. In addition, we specifically focus on the 2008 wave as the baseline, as that wave introduced several important instruments relevant for this study.

The data was collected from a multistage probability sample drawn from half of the counties and cities in 22 of China's 31 provinces, which makes up about 85 percent of the total population in China (Zeng, 2008). The survey collected data on health, disability, demographics, family, socioeconomic status, and behavioral risk factors for mortality and healthy longevity. In addition, there are modules on life satisfaction, self-rated health, participation in financial decision-making within the household, and self-rating of economic status with respect to others in the locality.

Due to unavailability of a clinical measure of stress, like the perceived stress scale (Cohen, Kamarck, & Mermelstein, 1983) as an alternative, we use a subjective indicator of psychological distress. The survey asked the respondents how frequently they felt fearful or anxious, from "never" to "most of the time". We identify respondents experiencing psychological distress if they reported they felt fearful or anxious "most of the time" (always/often/sometimes=1, never/seldom=0). For the health outcome measures, we identify ADL limitations as having any limitations in bathing, dressing, toilet, indoor transfer, continence or in eating without assistance. We identify cognitive impairment using a Mini-Mental State Examination (MMSE) score on orientation, registration, recall, and language of less than 18. We measure cognitive function using a Chinese-adapted version of the MMSE (Folstein, Folstein, & McHugh, 1975). The scale ranges from 0 to 30, with higher scores indicating better cognitive function. Cognitive functioning declines with age and the average MMSE score is usually lower for the older population. This is also affected by the level of literacy which is generally low for the study sample. So following Z. Zhang (2006), we set the cutoff point for cognitive impairment at 18.

ANALYTICAL STRATEGY

As mentioned earlier, two important methodological challenges for estimating the effect of poverty-induced psychological distress on health are the possibility of endogeneity and reverse causality. In addition, a large body of literature finds stress as the most important psychological factor affecting health outcome. However, our survey does not provide relevant instruments to clinically measure stress. Our subjective measure of anxiety and fear, though strongly related to stress, thus introduces errors in measurement of the underlying psychological condition. Errors in measurement are known to bias estimates in the same way as endogeneity and reverse causality. To address these challenges, we use an instrumental-variable (IV) specification. We use a specification following similar applications for a binary endogenous variable by Altonji, Elder, and Taber (2005), Bhattacharya, Goldman, and McCaffrey (2006) and Chiburis, Das, and Lokshin (2012). This strategy uses a bivariate probit model (Heckman, 1978)

$$PD_i = I(\beta X_i + \lambda Z_i + u_i > 0) \quad (1)$$

$$H_i = I(\alpha PD_i + \gamma X_i + \epsilon_i > 0) \quad (2)$$

where PD_i indicates the presence of psychological distress, H_i indicates a given health outcome, X_i s are the other controls, Z_i s are IVs and $I(.)$ is an indicator function taking the value 1 if its argument is true and 0 otherwise. Errors (u_i, ϵ_i) are jointly normally distributed with correlation ρ and independent of Z_i . Independence conditions and $\alpha \neq 0$ meet the conditions for IV discussed in (Imbens & Angrist, 1994).

This strategy needs instruments which are correlated with the endogenous variable (psychological distress) but are not expected to be correlated with the outcomes, except through its association with the endogenous variables. In addition, psychological distress may be due to a host of factors, the impact of poverty being just one of them. To identify the poverty-induced aspect of poverty we need some instruments which are related to poverty. But we cannot consider a direct measure of poverty as it is going to be also directly related to health outcomes.

One way poverty affects one's psychological well-being is through the sense of lack of control over one's life and the feeling of helplessness (Banerjee & Duflo, 2010). To capture these consequences of poverty within and outside the household, we use two measures – the ability to make financial decisions within the household and subjective socioeconomic status (SES) compared to others in the locality. The survey asked the respondents about their ability to make decisions on financial spending within the household. This is used to create a binary measure of low ability (“not making any financial decision/making decisions only on own spending” =1, “making decisions on some or all spending in the household” =0). The survey also asked the respondent to rate their economic status compared with others in their local area. This is used to create a binary measure of low subjective SES (“poor and very poor” =1, “very rich, rich and similar”=0). Our main assumption in the justification of this IV strategy is that these two variables can only affect the outcome through psychological distress, but not on their own. As a first step, we examine the factors that affect psychological distress among those who died between baseline (2008) and follow-up (2011) and those who survived in follow-up using equation (1) above to observe the differential effects of psychological distress among these two groups. This exercise also serves to validate our choice of instruments for poverty induced psychological distress. Subsequently, we consider the IV estimates of psychological distress on health outcomes starting with mortality. This is followed by the two adverse health outcomes - ADL limitations and cognitive impairment. For the adverse health outcomes, we estimate the above set of equations separately for those who did not have the adverse health outcome at baseline (to study onset) and for those who have the adverse health outcome at baseline (to study continuation).

All regression models control for demographic factors — age cohorts (aged 65 to 79, 80 to 94, and those aged 95 and above), sex, educational attainment, current marital status (married or not), proximity of living children (co-resident/ in the same village/ neighborhood or not), health-related lifestyle factors

— currently smoke/drink, currently exercise, eats vegetables almost every day, and rural residence at the time of baseline survey. As a measure of socioeconomic status, we use the respondents' education (no formal education, 1-4 years, and 5 years and above of schooling) as it was found to be more robust compared to other variables available in the survey like childhood poverty (whether went to bed hungry), father's occupation (agriculture or not), respondents primary lifetime occupation (agriculture or not).

The 2008 wave interviewed 16,563 elderly aged 65 and above, of which 4,286 were young elderly aged 65-79 and 12,277 oldest-old aged 80 and above. Among those whose information is available in 2008, 50 percent survived till the 2011 survey, while 33 percent die before the survey. We use listwise deletion to arrive at our analytical sample. Of the 16,563 individuals 65 and above, we could follow 13,919 across the two waves (including death at follow-up). Among those 11,674 have non-missing information for dependent and independent variables.

All regressions were estimated using STATA 13. The CLHLS survey provides weights for population estimates based on their probability sampling strategy³, however, we do not use them in the regression analysis. This is because in regression models, the weights introduce a substantial design effect into the data and it can potentially increase the standard errors (Gelman, 2007; Winship & Radbill, 1994). However, we control for the level of stratification e.g. age, sex, and rural/urban residence in the regression analysis, which accounts for the sampling design.

RESULTS

Descriptive Statistics

In Table 1, we present the descriptive statistics of the analytical sample. 30.6 percent of the sample are in the age group 65-79 while 23.1 percents are 95 and above, with remaining 46.3 percent between 80 and 94 in the baseline. As expected, those who are alive at follow-up are younger with 42.5 percent in the age group 65-79, while those who are not alive at follow-up older with 41.9 percent 95 years and above at baseline. 54.7 percent of the sample is female at baseline, though the percent is slightly higher (56.6 percent) among those who died by follow-up. 60.4 percent of the sample did not receive any formal education. This percentage is higher (69.7 percent) for those died in the follow-up. On the other hand, for those alive at follow-up, 20.4 percent had 1-4 years of education and 24.2 percent have 5 or more years of education. 34.1 percent of the baseline sample is still in a marriage, with a much higher percent for those alive at follow-up (42.7 percent) compared to those died by follow-up (18.5 percent). 62.6 percentage of the sample is from the rural areas with 16.4 percent from cities and 21.0 percent from towns. The proportion of those who died by follow-up is slightly higher in rural areas (65.4 percentage) and slightly lower for those in cities (14.2 percentage).

Among lifestyle variables, the proportion of current smokers, drinkers are slightly higher among those alive (20.5 percent and 19.9 percent respectively) at follow-up than the full baseline sample (18.8 percent and 18.6 percent). Daily consumption of fruits and vegetables are above average (63.0 percent) for those alive at follow-up (65.4 percent) while slightly lower for those who die by follow-up (58.5 percent). Finally, 80.1 percent of the elderly have children living nearby. This percent is higher for the survivors (83.2 percent) than for the deceased (78.4 percent).

For the key variables of interests, Table 1 shows that 28.6 percent of the sample reported that they experienced a frequent level of psychological distress and the percentage is higher among the deceased (32.5 percent) than the survivors (26.5 percent). 59.2 percent of the elderly have low financial decisions making power, with a much higher percent for the deceased (77.2 percent) compared to those alive (49.3 percent) ones. 17.7 percent are in low subjective SES, with a higher percentage of 19.0 for the deceased than those alive (17.1 percent).

For specific health outcomes, Table 2 shows that 15.2 percent of the elderly had ADL limitations at the baseline, with a 7.8 percent for the survivors and 28.4 percent for the deceased. Among those who survived till follow-up, 24.2 percent had ADL limitation. 16.8 percent of the respondents had cognitive impairment at the baseline, with 9.4 percent for the survivors and 30.3 percent for the deceased ones. However, for those who survived till the follow-up, 20.1 percent had cognitive impairment.

TABLE 1
DESCRIPTIVE STATISTICS OF SAMPLE AT BASELINE 2008

	Alive at follow-up	Died before follow-up	Total
Age			
65-79	42.50%	9.10%	30.60%
80-94	44.90%	49.00%	46.30%
95+	12.70%	41.90%	23.10%
Sex			
Male	46.30%	43.40%	45.30%
Female	53.70%	56.60%	54.70%
Education			
No Formal Education	55.30%	69.70%	60.40%
1-4 yrs	20.40%	15.80%	18.80%
5+ yrs	24.20%	14.60%	20.80%
Current Marital Status			
Not Married	57.30%	81.50%	65.90%
Married	42.70%	18.50%	34.10%
Residence			
City	17.60%	14.20%	16.40%
Town	21.30%	20.50%	21.00%
Rural	61.10%	65.40%	62.60%
Current Smoker			
No	79.50%	84.30%	81.20%
Yes	20.50%	15.70%	18.80%
Current Drinker			
No	80.10%	83.80%	81.40%
Yes	19.90%	16.20%	18.60%
Daily Consumption of Vegetables			
No	34.60%	41.50%	37.00%
Yes	65.40%	58.50%	63.00%
Children Nearby			
No	21.60%	16.80%	19.90%
Yes	78.40%	83.20%	80.10%
Anxious/Fearful			
Never/Seldom	73.50%	67.50%	71.40%
Always/Often/Sometimes	26.50%	32.50%	28.60%
Financial Decision-making			
High	50.70%	22.80%	40.80%
Low	49.30%	77.20%	59.20%
Subjective SES			
High	82.90%	81.00%	82.30%
Low	17.10%	19.00%	17.70%
N	7,591	4,083	11,674

TABLE 2
DESCRIPTIVE STATISTICS: OUTCOME

	Baseline		Total	Follow up
	Alive at Follow-up	Died before Follow-up		
Any ADL Limitation				
None	92.2%	71.6%	84.8%	75.8%
Any	7.8%	28.4%	15.2%	24.2%
MMSE Score				
18 +	90.6%	69.7%	83.2%	79.9%
Lt 18	9.4%	30.3%	16.8%	20.1%

TABLE 3
REGRESSION ESTIMATES OF FACTORS AFFECTING PSYCHOLOGICAL DISTRESS

Dep Var: Psychological Distress	Alive at Follow-up		Died at Follow-up	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Financial Decision-making: Low	0.163*** (0.05)	0.048*** (0.01)	0.216** (0.10)	0.073** (0.03)
Subjective SES: Low	0.442*** (0.06)	0.132*** (0.02)	0.372*** (0.11)	0.125*** (0.04)
Female	0.213*** (0.06)	0.063*** (0.02)	0.304*** (0.11)	0.102*** (0.04)
Education: 1-4 yrs	-0.013 (0.06)	-0.004 (0.02)	-0.048 (0.13)	-0.016 (0.04)
Education: 5+ yrs	-0.157** (0.06)	-0.046** (0.02)	0.133 (0.14)	0.046 (0.05)
Children Near	-0.139** (0.06)	-0.041** (0.02)	-0.288** (0.13)	-0.097** (0.04)
Current Smoker	-0.144** (0.06)	-0.043** (0.02)	-0.048 (0.12)	-0.016 (0.04)
Current Drinker	-0.185*** (0.06)	-0.055*** (0.02)	-0.178 (0.13)	-0.060 (0.04)
Daily Cons. of Vegetables	-0.150*** (0.05)	-0.045*** (0.01)	-0.135 (0.10)	-0.045 (0.03)
Observations	7,591	7,591	4,083	4,083

Regressions also controls for age cohorts, marital status and residence. Robust standard errors in parentheses (***) p<0.01, ** p<0.05, * p<0.1)

Regression Results

Tables 3 through 6 show the coefficient and marginal effects of the regression analysis (Please refer to Appendix Tables A1-A4 for detailed results). The marginal effects for a continuous variable in a probit model report the average change in the probability of success for a unit change of the variable among all observations in the sample. For categorical variables, they report the average change in the probability of success for a particular category compared to the base category. In Table 3, we report the different factors that are associated with psychological distress among those who died in the follow-up and those who survived. The results show that low financial decision-making ability and subjective SES have significant positive effects on psychological distress for both deceased and alive elders, though the marginal effect of

lower financials decision-making ability is stronger among those who died by follow-up. Low subjective SES is also positively associated with psychological distress as well but the effect is stronger for the survivors as shown in the marginal effects.

Among individual characteristics, being female is positively associated with psychological distress, with stronger effects for those who died by the follow-up. Those with 5+ years of education are significantly less likely to have psychological distress among the survivors, though the education gradient is absent for those who died between the surveys. Having a child nearby significantly reduces the probability of psychological distress for both groups. Among lifestyle variables, a regular diet of vegetables has the expected sign of psychological distress, but it is only significant among those are alive at follow-up. It is worth noting that our results do not show any significant difference by residence in the probability of psychological distress at baseline for those who are alive at follow-up or those who died before follow-up (Appendix Table A1). This is not unexpected as our specification accounts for the mechanisms through which residence affects psychological distress in the Chinese context.

TABLE 4
REGRESSION ESTIMATES OF PSYCHOLOGICAL DISTRESS AT
BASELINE AND DEATH AT FOLLOW-UP

	Coefficients		Marginal Effects	
	Psychological Distress	Death	Psychological Distress	Death
Financial Decision-making: Low	0.237*** (0.04)		0.072*** (0.01)	
Subjective SES: Low	0.436*** (0.05)		0.132*** (0.01)	
Psychological Distress		1.135*** (0.15)		0.229*** (0.03)
Observations	11,674			

Regressions also controls for age cohorts, gender, education, marital status, the presence of children nearby, lifestyle variables – smoking, drinking, vegetable consumption, and residence. Robust standard errors in parentheses (***) p<0.01, ** p<0.05, * p<0.1)

In Table 4 we report the results of the joint estimation of psychological distress at baseline with death at follow-up. Low financial decision-making ability and subjective SES have positive and significant effects on psychological distress. Low financial decision-making ability increases the probability of psychological distress by 7 percent points while low subjective SES increases the probability of psychological distress by 13 percent points. Psychological distress increases the probability of death by 23 percent points after controlling for confounders.

Subsequently, we look at the effect of psychological distress on two health outcomes among those who are alive at follow-up. Table 5 shows the joint estimates of psychological distress at baseline and ADL limitations for those alive at follow-up. The marginal effect of psychological distress on the onset of ADL limitations is approximately 11 percent points while it raises the probability of continuation for those already with ADL limitations by approximately 44 percent points. The effect of financial decision-making power on psychological distress is significant in both onset and continuation, but the effect of subjective well-being is significant only in the case of onset.

TABLE 5
REGRESSION ESTIMATES OF PSYCHOLOGICAL DISTRESS AT BASELINE AND
ACTIVITIES OF DAILY LIVING (ADL) LIMITATIONS FOR THOSE
ALIVE AT FOLLOW-UP

	Onset: No ADL Limitation at Baseline				Continuation: ADL Limitation at Baseline			
	Coefficients		Marginal Effects		Coefficients		Marginal Effects	
	Psycho. Distress	Any ADL Limitation	Psycho. Distress	Any ADL Limitation	Psycho. Distress	Any ADL Limitation	Psycho. Distress	Any ADL Limitation
Financial Decision-making: Low	0.164*** (0.05)		0.048*** (0.01)		0.350** (0.18)		0.124** (0.06)	
Subjective SES: Low	0.450*** (0.06)		0.132*** (0.02)		0.131 (0.15)		0.046 (0.05)	
Psychological Distress		0.622** (0.25)		0.106** (0.05)		1.405*** (0.15)		0.442*** (0.03)
Observations	7,006				585			

Regressions also controls for age cohorts, gender, education, marital status, the presence of children nearby, lifestyle variables – smoking, drinking, vegetable consumption, and residence. Robust standard errors in parentheses (***) p<0.01, ** p<0.05, * p<0.1)

Table 6 shows the joint estimates of psychological distress at baseline and cognitive impairment for those alive at follow-up. The effect of financial decision-making power and subjective SES on psychological distress is significant in both onset and continuation of cognitive impairment. The effect of psychological distress on the outcome is significant for the continuation of cognitive impairment where the marginal effect is approximately 46 percent points. However, psychological distress is not significantly associated with the onset of cognitive impairment in our sample.

TABLE 6
REGRESSION ESTIMATES OF PSYCHOLOGICAL DISTRESS AT BASELINE AND
COGNITIVE IMPAIRMENT FOR THOSE ALIVE AT FOLLOW-UP

	Onset: No Cognitive Impairment at Baseline				Continuation: Cognitive Impairment at Baseline			
	Coefficients		Marginal Effects		Coefficients		Marginal Effects	
	Psycho. Distress	Cognitive Impairment	Psycho. Distress	Cognitive Impairment	Psycho. Distress	Cognitive Impairment	Psycho. Distress	Cognitive Impairment
Financial Decision-making: Low	0.171*** (0.05)		0.051*** (0.02)		0.415*** (0.13)		0.146*** (0.04)	
Subjective SES: Low	0.432*** (0.06)		0.128*** (0.02)		0.419*** (0.14)		0.148*** (0.05)	
Psychological Distress		0.674 (0.56)		0.077 (0.08)		1.556*** (0.15)		0.456*** (0.02)
Observations	6,898				693			

Regressions also controls for age cohorts, gender, education, marital status, the presence of children nearby, lifestyle variables – smoking, drinking, vegetable consumption, and residence. Robust standard errors in parentheses (***) p<0.01, ** p<0.05, * p<0.1)

DISCUSSION

While there are several studies which examine the implication of poverty on psychological outcomes, or the effect of psychological outcomes on health or the relation between poverty and health outcomes, the causal relationship between poverty-induced psychological stress and health has not been established. However, this is an important area of policy interest in developing countries with a weak public welfare system. Our main contribution in this paper is that we use an IV strategy to establish the causal effect of poverty on health outcomes through its effect on the psychological well-being among aging population in China. We find that poverty-related psychological distress significantly increases the probability of death by 23 percent points. For those who survived till follow-up, our results show that psychological distress affects the onset and continuation of ADL limitations and continuation of cognitive impairment. These effects are present even after controlling for potential confounders and other sources of bias in estimates. The study finds that support from adult children as well as lifestyle factors like regular consumption of vegetables is significantly associated with lower psychological distress (Appendix Tables A2-A4). These two factors have important implications regarding public policies in addressing the poverty induced psychological distress on health outcomes.

The factors strongly associated with lower psychological distress points out to the need of expanding welfare program among the aging population to a wider population than currently available. Intergenerational support plays an important role in reducing poverty-related psychological distress at old ages. Also, women at old ages are more likely to be dependent on such support. Such links are threatened by the consequences of the One-child policy in the near future as the policy has already increased the old-age dependency ratio limiting the number of children to provide effective intergenerational support in the long run. As pointed out earlier, the need for intergenerational support among the aging population varies negatively with the availability of public pensions in China. And current pension programs for employees of the state are generally limited to the elderly population in the urban areas. Further, the significant effect of proper diets also highlights how better nutritional access can minimize the psychological burden of poverty and therefore reduce its impact on health outcomes. Yeung and Xu (2012) points out that access to fruits and vegetables all year round is often limited for the majority of the Chinese elderly, particularly in rural areas. This once again highlights the need for public intervention in food and nutritional provisions. Once again, the urban areas are much well provided through food rationing than the rural areas.

This study has a number of limitations. Our main operational variable is psychological distress, as we do not have indicators of clinical stress. Household surveys in developing countries usually do not have a wide range of psychological instruments. Our IV strategy aims to address this limitation, though future research can benefit from better instruments. The next important limitation is attrition. A significant part of those missing is due to death between the waves. Since the probability of death and onset or continuation of different health condition is in the same direction, our estimates for the marginal effect of psychological distress can be considered as conservative estimates. Finally, as the main goal of this research was to establish the causal relation of poverty-related stress on health outcomes, exploring the effect of the interactions of psychological distress and factors that can potentially reduce its impact, with gender and rural-urban residence is beyond the scope of this paper. However, as our results indicate, there is a need to explore this in future research.

There are several important implications of our findings. First, the evidence of a causal relationship between poverty induced psychological distress and health outcomes should motivate policy makers in China and similar developing countries to pay special attention to mental health of older people living in poverty. Mental health is usually not given the highest priority in resource-scarce developing countries, particularly among aging population. But the results of this study highlight the effect of the poverty-induced psychological stress on health and well-being of the aging population. Second, our study also establishes the importance of intergenerational support, as well as the importance of proper diet in addressing psychological distress. Public policy should pay special attention to address these needs through properly designed welfare programs. Finally, our study highlights the need for gathering better

quality psychological information in household surveys for developing countries, without which it is very difficult to have a clearer idea of need and support.

ENDNOTES

1. Poverty rate is usually measured as the share of the population whose household consumption expenditure or income is below the poverty line. The poverty line is the minimum threshold level of consumption or income necessary for survival (Coudouel, Hentschel, & Wodon, 2002).
2. State Statistics Bureau, 2006. China 2005 national 1% population survey data. China Statistics Press
3. Interested readers may refer to the following website for the sampling design and weighing methods https://sites.duke.edu/centerforaging/files/2015/12/weighting_method.pdf

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APPENDIX

TABLE A1
REGRESSION ESTIMATES OF FACTORS AFFECTING
PSYCHOLOGICAL DISTRESS

Dep Var: Psychological Distress	Alive at Follow-up		Died at Follow-up	
	Coeff.	Marg.Eff.	Coeff.	Marg.Eff.
Financial Decision-making: Low	0.163*** (0.05)	0.048*** (0.01)	0.216** (0.10)	0.073** (0.03)
Subjective SES: Low	0.442*** (0.06)	0.132*** (0.02)	0.372*** (0.11)	0.125*** (0.04)
Age: 80-94	-0.000 (0.04)	-0.000 (0.01)	0.114 (0.09)	0.039 (0.03)
Age: 95+	-0.254*** (0.08)	-0.069*** (0.02)	0.066 (0.11)	0.022 (0.04)
Female	0.213*** (0.06)	0.063*** (0.02)	0.304*** (0.11)	0.102*** (0.04)
Education: 1-4 yrs	-0.013 (0.06)	-0.004 (0.02)	-0.048 (0.13)	-0.016 (0.04)
Education: 5+ yrs	-0.157** (0.06)	-0.046** (0.02)	0.133 (0.14)	0.046 (0.05)
Currently Married	-0.092* (0.05)	-0.027* (0.01)	-0.056 (0.11)	-0.019 (0.04)
Children Near	-0.139** (0.06)	-0.041** (0.02)	-0.288** (0.13)	-0.097** (0.04)
Current Smoker	-0.144** (0.06)	-0.043** (0.02)	-0.048 (0.12)	-0.016 (0.04)
Current Drinker	-0.185*** (0.06)	-0.055*** (0.02)	-0.178 (0.13)	-0.060 (0.04)
Daily Consumption of Vegetables	-0.150*** (0.05)	-0.045*** (0.01)	-0.135 (0.10)	-0.045 (0.03)
Residence: Town	-0.054 (0.08)	-0.016 (0.02)	0.078 (0.18)	0.026 (0.06)
Residence: Rural	0.009 (0.07)	0.003 (0.02)	0.055 (0.15)	0.018 (0.05)
Constant	-0.557*** (0.11)		-0.590** (0.23)	
Observations	7,591	7,591	4,083	4,083

Robust standard errors in parentheses (***) p<0.01, ** p<0.05, * p<0.1)

TABLE A2
REGRESSION ESTIMATES OF PSYCHOLOGICAL DISTRESS AT BASELINE AND DEATH
AT FOLLOW-UP

	Coefficients		Marginal Effects	
	Psyco.		Psyco.	
	Distress	Death	Distress	Death
Financial Decision-making: Low	0.237*** (0.04)		0.072*** (0.01)	
Subjective SES: Low	0.436*** (0.05)		0.132*** (0.01)	
Age: 80-94	0.030 (0.04)	0.545*** (0.04)	0.009 (0.01)	0.129*** (0.01)
Age: 95+	-0.051 (0.06)	1.331*** (0.07)	-0.015 (0.02)	0.387*** (0.02)
Female	0.215*** (0.05)	-0.435*** (0.05)	0.065*** (0.02)	-0.088*** (0.01)
Education: 1-4 yrs	-0.024 (0.05)	-0.094 (0.06)	-0.007 (0.02)	-0.019 (0.01)
Education: 5+ yrs	-0.108* (0.06)	-0.122** (0.06)	-0.032* (0.02)	-0.025** (0.01)
Currently Married	-0.080* (0.04)	-0.140*** (0.05)	-0.024* (0.01)	-0.028*** (0.01)
Children Near	-0.165*** (0.05)	0.116** (0.05)	-0.050*** (0.02)	0.023** (0.01)
Current Smoker	-0.120** (0.06)	0.012 (0.06)	-0.036** (0.02)	0.002 (0.01)
Current Drinker	-0.186*** (0.06)	-0.145** (0.06)	-0.056*** (0.02)	-0.029** (0.01)
Daily Cons. of Veg.	-0.148*** (0.04)	-0.051 (0.05)	-0.045*** (0.01)	-0.010 (0.01)
Residence: Town	-0.033 (0.07)	-0.002 (0.08)	-0.010 (0.02)	-0.000 (0.01)
Residence: Rural	0.023 (0.06)	0.115* (0.07)	0.007 (0.02)	0.023* (0.01)
Psychological Distress		1.135*** (0.15)		0.229*** (0.03)
Constant	-0.590*** (0.10)	-1.246*** (0.11)		
Observations	11,674			

Robust standard errors in parentheses (***) p<0.01, ** p<0.05, * p<0.1)

TABLE A3
REGRESSION ESTIMATES OF PSYCHOLOGICAL DISTRESS AT BASELINE AND ADL
FOR THOSE ALIVE AT FOLLOW-UP

	Onset: No ADL Limitation at Baseline				Continuation: ADL Limitation at Baseline			
	Coefficients		Marginal Effects		Coefficients		Marginal Effects	
	Psyco.	Any ADL	Psyco.	Any ADL	Psyco.	Any ADL	Psyco.	Any ADL
	Distress	Limitation	Distress	Limitation	Distress	Limitation	Distress	Limitation
Financial Decision-making: Low	0.164*** (0.05)		0.048*** (0.01)		0.350** (0.18)		0.124** (0.06)	
Subjective SES: Low	0.450*** (0.06)		0.132*** (0.02)		0.131 (0.15)		0.046 (0.05)	
Age: 80-94	0.011 (0.05)	0.488*** (0.05)	0.003 (0.01)	0.102*** (0.01)	-0.86*** (0.23)	0.725*** (0.21)	-0.30*** (0.07)	0.222*** (0.06)
Age: 95+	-0.248*** (0.09)	1.052*** (0.08)	-0.06*** (0.02)	0.280*** (0.03)	-1.26*** (0.28)	1.265*** (0.26)	-0.42*** (0.07)	0.361*** (0.06)
Female	0.211*** (0.06)	-0.114 (0.07)	0.062*** (0.02)	-0.019 (0.01)	0.316 (0.25)	-0.331 (0.25)	0.112 (0.09)	-0.104 (0.08)
Education: 1-4 yrs	-0.022 (0.06)	-0.071 (0.07)	-0.007 (0.02)	-0.012 (0.01)	0.026 (0.29)	0.037 (0.28)	0.009 (0.10)	0.012 (0.09)
Education: 5+ yrs	-0.155** (0.06)	-0.071 (0.08)	-0.045** (0.02)	-0.012 (0.01)	-0.210 (0.27)	0.297 (0.24)	-0.075 (0.09)	0.093 (0.07)
Currently Married	-0.084* (0.05)	-0.048 (0.06)	-0.025* (0.01)	-0.008 (0.01)	-0.288 (0.24)	0.264 (0.22)	-0.102 (0.08)	0.083 (0.07)
Children Near	-0.134** (0.06)	0.072 (0.07)	-0.039** (0.02)	0.012 (0.01)	-0.111 (0.25)	-0.140 (0.22)	-0.039 (0.09)	-0.044 (0.07)
Current Smoker	-0.143** (0.06)	-0.021 (0.07)	-0.042** (0.02)	-0.004 (0.01)	0.165 (0.31)	-0.801*** (0.27)	0.058 (0.11)	-0.252*** (0.08)
Current Drinker	-0.170*** (0.06)	-0.217*** (0.07)	-0.05*** (0.02)	-0.037*** (0.01)	-0.108 (0.38)	0.064 (0.35)	-0.038 (0.13)	0.020 (0.11)
Daily Cons. of Veg.	-0.142*** (0.05)	-0.206*** (0.06)	-0.042*** (0.01)	-0.035*** (0.01)	-0.349 (0.23)	0.057 (0.21)	-0.124 (0.08)	0.018 (0.07)
Residence: Town	-0.060 (0.08)	-0.163* (0.09)	-0.017 (0.02)	-0.029* (0.02)	0.328 (0.31)	-0.672** (0.26)	0.118 (0.11)	-0.209*** (0.08)
Residence: Rural	0.016 (0.07)	-0.143* (0.08)	0.005 (0.02)	-0.026* (0.01)	0.209 (0.27)	-0.337 (0.24)	0.075 (0.10)	-0.105 (0.07)
Psychological Distress		0.622** (0.25)		0.106** (0.05)		1.405*** (0.15)		0.442*** (0.03)
Constant	-0.596*** (0.11)	-1.140*** (0.13)			0.245 (0.44)	-0.518 (0.43)		
Observations	7,006				585			

Robust standard errors in parentheses (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)

TABLE A4
REGRESSION ESTIMATES OF PSYCHOLOGICAL DISTRESS AT BASELINE AND
COGNITIVE IMPAIRMENT FOR THOSE ALIVE AT FOLLOW-UP

	Onset: No Cognitive Impairment at Baseline				Continuation: Cognitive Impairment at Baseline			
	Coefficients		Marginal Effects		Coefficients		Marginal Effects	
	Psyco.	Cognitive	Psyco.	Cognitive	Psyco.	Cognitive	Psyco.	Cognitive
	Distress	Impairment	Distress	Impairment	Distress	Impairment	Distress	Impairment
Financial Decision-making: Low	0.171*** (0.05)		0.051*** (0.02)		0.42*** (0.13)		0.15*** (0.04)	
Subjective SES: Low	0.432*** (0.06)		0.128*** (0.02)		0.42*** (0.14)		0.15*** (0.05)	
Age: 80-94	0.001 (0.05)	0.614*** (0.07)	0.000 (0.01)	0.093*** (0.01)	-0.334 (0.22)	0.084 (0.21)	-0.118 (0.08)	0.024 (0.06)
Age: 95+	-0.30*** (0.09)	1.345*** (0.09)	-0.08*** (0.02)	0.299*** (0.03)	-0.55** (0.27)	0.730*** (0.26)	-0.19** (0.09)	0.216*** (0.07)
Female	0.219*** (0.06)	-0.017 (0.09)	0.065*** (0.02)	-0.002 (0.01)	-0.194 (0.28)	0.399 (0.26)	-0.068 (0.10)	0.117 (0.08)
Education: 1-4 yrs	-0.005 (0.06)	-0.118 (0.08)	-0.001 (0.02)	-0.015 (0.01)	-0.278 (0.33)	-0.199 (0.30)	-0.097 (0.11)	-0.057 (0.08)
Education: 5+ yrs	-0.149** (0.06)	-0.389*** (0.10)	-0.043** (0.02)	-0.042*** (0.01)	-0.84** (0.33)	0.500 (0.31)	-0.3*** (0.09)	0.148 (0.09)
Currently Married	-0.080 (0.05)	-0.197*** (0.07)	-0.024 (0.01)	-0.023*** (0.01)	-0.43** (0.21)	0.151 (0.20)	-0.15** (0.07)	0.044 (0.06)
Children Near	-0.131** (0.06)	0.128 (0.08)	-0.039** (0.02)	0.015 (0.01)	-0.461 (0.28)	0.029 (0.29)	-0.163* (0.10)	0.009 (0.09)
Current Smoker	-0.139** (0.06)	-0.140 (0.10)	-0.041** (0.02)	-0.016 (0.01)	-0.101 (0.36)	0.182 (0.35)	-0.035 (0.13)	0.053 (0.10)
Current Drinker	-0.18*** (0.06)	-0.080 (0.09)	-0.05*** (0.02)	-0.009 (0.01)	-0.65** (0.31)	0.073 (0.33)	-0.23** (0.11)	0.021 (0.10)
Daily Cons. of Veg.	-0.15*** (0.05)	0.024 (0.07)	-0.045*** (0.01)	0.003 (0.01)	0.248 (0.20)	-0.269 (0.20)	0.088 (0.07)	-0.079 (0.06)
Residence: Town	-0.061 (0.08)	0.051 (0.11)	-0.018 (0.02)	0.006 (0.01)	0.077 (0.36)	-0.336 (0.36)	0.028 (0.13)	-0.098 (0.11)
Residence: Rural	0.005 (0.07)	0.025 (0.10)	0.001 (0.02)	0.003 (0.01)	-0.176 (0.30)	-0.071 (0.29)	-0.063 (0.11)	-0.021 (0.08)
Psychological Distress		0.674 (0.56)		0.077 (0.08)		1.556*** (0.15)		0.456*** (0.02)
Constant	-0.58*** (0.11)	-1.695*** (0.18)			0.449 (0.47)	-1.086** (0.44)		
Observations	6,898				693			

Robust standard errors in parentheses (***) $p < 0.01$, (**) $p < 0.05$, (*) $p < 0.1$)