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Depressive Symptoms and SES among the Mid-Aged and Elderly in China: Evidence from the China Health and Retirement Longitudinal Study National Baseline

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Abstract

We examine the prevalence of depressive symptoms among the mid-aged and elderly in China and examine relationships between depression and current SES factors such as gender, age, education and income (per capita expenditures). In addition, we explore associations of depressive symptoms with measures of early childhood health, recent family deaths and current chronic health conditions. We use data from the China Health and Retirement Longitudinal Study (CHARLS) national baseline, fielded in 2011/12, which contains the ten question version of the Center for Epidemiologic Studies-Depression scale (CES-D) for 17,343 respondents aged 45 and older. We fill a major gap by using the CHARLS data to explore the general patterns of depression and risk factors among the Chinese elderly nationwide, which has never been possible before. We find that depressive symptoms are significantly associated with own education and per capita expenditure, and the associations are robust to the inclusion of highly disaggregated community fixed effects and to the addition of several other risk factors. Factors such as good general health during childhood are negatively associated with later depression. There exist strong gender differences, with females having higher depression scores. Being a recent widow or widower is associated with more depressive symptoms, as is having a series of chronic health problems, notably having moderate or severe pain, disability or problems with measures of physical

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functioning. Adding the chronic health problems to the specification greatly reduces the SES associations with depressive symptoms, suggesting that part of the pathways behind these associations are through these chronic health factors.

Keywords

China depressive symptoms-SES correlations; Chinese mid-aged and elderly

1. Introduction

This paper reports measures of depressive symptoms among the mid-aged and elderly Chinese population using a nationally representative population survey, and then explores the socio-economic correlates of depressive symptoms for this population. Mental health is now recognized as a major health issue in many countries, and depression is one important component of mental health. Depression among adults can severely limit their ability to function in daily life and according to the World Health Organization (WHO) is a leading cause of disability in the world (WHO, 2012).

Depressive symptoms of the Chinese older population first captured the attention of researchers in the 1980s. Studies (Chen et al., 1994; Fan et al., 1994; Mong and Xiang 1997) generally found low prevalence of depression and a meta-analysis of studies between 1980s and 1990s (Chen et al. 1999) reported a prevalence of only 3.86%, much lower than that in Western Europe, of 12%. This was mainly explained by filial culture and high levels of social support. For example, there was apparently good social support for Chinese older people at the time of the studies: 65.30% of older people lived with two and sometimes three generations and 17.80% with the next generation, while 11.08% of couples lived together without their children. Only 3.65% lived alone even though they had children, and 2.17% were alone (Li et al., 2014). There were also other explanations such as stigma imposed on mental illnesses in the traditional Chinese culture or lack of standardized diagnostic criteria (Parker et al., 2001). Since the 1990s, a large number of studies concerning depression in Chinese older adults have emerged. Although showing higher rates of depressive symptoms, the results vary greatly, ranging from 6.3% to 53.6%. The studies are based on surveys from different regions and with different measures of depressive symptoms and so are not in general comparable with each other or with earlier studies (Zhang et al. 2011; Yu et al. 2011).

The first objective of this study is to have a nationwide view of the depressive symptoms of the Chinese elderly using a newly collected nationally representative data set of the population aged 45 and older and their spouses, the China Health and Retirement Longitudinal Study (CHARLS). With the 10 question version of the Center for Epidemiologic Study depression (CES-D) battery, we find that in 2011/12 a high fraction of Chinese people 45 and older, both men and women, are suffering from high levels of depressive symptoms, with some 30% of men and 43% of women having CES-D scores 10 and over (out of 30 as a maximum). The fraction of those 60 and older with high depressive symptoms is even larger, and is much larger than other East Asian countries such as

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Indonesia (Witoelar, Strauss and Sikoki, 2012). Our results are consistent with the claim that depressive symptoms in China have been rising over the past 30 years.

The second objective is to explore the correlates of depressive symptoms, which has attracted attention from researchers and policy makers due to the increasing evidence of depressive symptoms. Exploring the correlates of depressive symptoms is important in that it provides a basis for improving the situation through changing underlying risk factors. In western countries and even in east Asian societies like Japan and Korea, a significant relationship has been well-established in the social science literature (Dohrenwend and Dohrenwend, 1969; Yu and Williams, 1999; Cho et al., 1998; Inaba et al., 2005; Lopez et al. 2006; Nishimura 2011), however, the exact nature of this relationship may vary across countries, especially for China which has experienced a different path of industrialization and modernization and has been experiencing rapid health, nutrition and demographic transitions. Some researchers argue that the acceleration of the Chinese pace of life, the shrinking of the family structure and the weakening of family functions resulting from rapid industrialization and urbanization have reduced the protection of traditional culture against geriatric depression (Li et al., 2014). Chinese family values such as connectedness and traditional 'filial piety', which were thought to be the reasons for low depressive symptoms, are argued to have been weakened because of the drastic socioeconomic transition (Lim et al., 2011). Existing Chinese studies on correlations of depressive symptoms find age, retirement, physical disability and illness, poor social support (e.g. a bad relationship with children), financial problems, life events and low education level to be correlated with higher levels of depressive symptoms (Chen et al., 1999; Lim et al., 2010; Strauss et al., 2010). However, the significance and magnitudes vary across regions (e.g. Pan et al., 2008) so it is not possible to picture the whole country with a consistent conclusion from the current literature.

In this paper, we examine the level of depressive symptoms in the Chinese middle aged and elderly population and explore their associations with two important indicators of socio-economic status (SES): education and the log of per capita expenditure (log *pce*), our preferred measure of household resources. We extend the current literature that examines the relationships between SES and depressive symptoms, by using a newly collected nationally representative sample that is very rich in covariates and that focuses on the mid-aged and older population.

We also differ from prior studies by being careful about our modeling specifications. While we cannot infer causality from these estimates, neither can past studies for China, we begin with a specification that omits commonly used risk variables that are more likely to be endogenous in an economic model. These include childhood health variables, recent family deaths and a series of chronic health conditions. This way we argue we better capture the "full" associations with the underlying SES variables. We then systematically add these additional covariates, one set at a time, in order to examine how the coefficients on the SES variables change, as well as what the coefficients are of the added covariates. These results can tell us something important about the degree of depressive symptom differentials by education and per capita expenditure (*pce*), and how those differentials are affected by the addition of other risk factors.

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We find significant and negative correlations of depressive symptoms with own education and with per capita expenditure and the associations are robust to the inclusion of highly disaggregated community fixed effects. The "effect" of attaining primary or junior high school education is larger than for a one (or two) standard deviation change in log *pce*. Factors such as good general health during childhood are negatively associated with later depressive symptoms, although adding these into the regressions does little to affect the size of the schooling and log *pce* coefficients. There exist strong gender differences, with females having higher depressive symptom scores. Being a recent widow or widower is associated with more depressive symptoms, as is having a recent child death for women. Chronic health problems such as moderate or severe pain and having disabilities as measured by problems performing ADLs or IADLs are positively and significantly related to higher levels of depressive symptoms. Indeed when we add these covariates, the magnitudes and significance of the education variables shrinks towards zero and become not significant; while the log *pce* coefficients get smaller as well (although still significant). Hence it appears that part of the pathway behind the SES gradient of depressive symptoms is working through chronic health problems.

2. Analytical Framework

The analytical framework that we use to specify our regressions and interpret the results follows a standard static household production model applied to health outcomes (for example Grossman, 1972; Strauss and Thomas, 1995, 2008). Health, including mental health, is produced by health inputs and behaviors, and by health endowments. Households maximize a household utility function subject to constraints, including the health production function, a budget and a time constraint. Exogenous factors affecting household decisions, and therefore health outcomes, include exogenous non-labor income and prices, including prices of time (wages) and of health inputs, the underlying disease environment and public health infrastructure, and demographic factors such as gender and age. Education may have multiple influences: it raises the opportunity cost of time, which will have an associated income effect; it will improve allocative ability (the ability with which health and behavior choices are made); and it may affect preferences for health.

Generally it is expected that higher education is associated with better health, although this may not always be the case (for example higher education for men in China is associated with more overweight, Lei et al., 2014). Many studies of SES-depressive symptom associations find that persons with higher schooling tend to suffer less from depressive symptoms, similar to what is found for other health outcomes (see the surveys in Lorant et al., 2003 and Muntaner et al., 2004). Much of this literature is for western, industrialized countries.

Recent literature has begun to examine these relationships in Asia and in lower income countries. A number of studies of lower income countries and countries in Asia have found similar relationships (e.g. Lee and Smith, 2011 for Korea; Witoelar, Strauss and Sikoki, 2012 for Indonesia; and 11 studies in 6 lower and middle income countries surveyed by Patel and Kleinman, 2003). Other studies, such as Inaba et al. (2005), have found no relationships between schooling and depressive symptoms in Japan. A small number of

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studies in lower income countries, such as Das et al. (2007), have failed to find relationships between depressive symptoms and schooling, but the preponderance of the evidence seems to demonstrate relationships that are similar to those found in the United States and other industrialized countries.

Despite this evidence, the education coefficients should not necessarily be interpreted as causal because there may exist unobserved factors that are associated both with levels of schooling and mental health. One example is mental health of the respondent when the respondent was a child (a variable not generally observed in population surveys). Respondents who had depressive symptoms as a child may get less schooling, as well as be more likely to exhibit depressive symptoms later as an adult. While there do exist some good studies that get at a causal estimate of education on health (for example, Lleras-Muney, 2005; Cutler and Lleras-Muney, 2010), this study is unable to. As mentioned, prior studies for China on the correlates of depressive symptoms are equally affected by the potential endogeneity of schooling. Nevertheless we are able to examine education gradients of depressive symptoms, which is of considerable interest by itself.

Measuring income raises many well-known difficulties. Income has much measurement error and varies greatly over years and over the life-cycle. A different measure of longer run household resources, preferred by many economists, is expenditure. This is a better measure of long-run resources than is current income, particularly so in low-income rural settings, where incomes can vary so much year to year because of variation in weather, pests, plant diseases, and so on. Expenditure varies much less over time than does income because households try to smooth their consumption. Expenditure includes the value of food production which is self-consumed, which ought to be included in income, but may not be in all measures of income. Expenditure also tends to be measured with less error than income (Deaton 1997; Lee 2009). One problem with expenditure is that there may well be reverse causation from mental health to expenditure through mental health having a causal effect on income (for surveys of studies that do account for reverse causation between income and health see Strauss and Thomas, 1995, 1998, 2008; Smith, 1999; or Lee and Smith, 2009). In this paper we are unable to account for the potential endogeneity of expenditure. Nevertheless it is of substantial interest to see how steep the mental health gradient is with respect to a well-measured resource variable.

3. Data and Measurement

We use the CHARLS national baseline data, which was designed after the Health and Retirement Study (HRS) in the US as a broad-purposed social science and health survey of the elderly in China. The baseline survey was conducted between June 2011 and March 2012. It is a nationally representative sample of people aged 45 and over, and their spouses, living in households in China; see Zhao et al., 2013, 2014, for details of the CHARLS data (data and documentation are available at http://charls.ccer.edu.cn). Ethical approval for collecting data on human subjects was received at Peking University by their institutional review board (IRB). This approval is updated annually. In this paper, we use data on all respondents 45 year of age and older (spouses who are under 45 years old are dropped),

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some 17,343 respondents. All analyses, both descriptive tables and regressions, are weighted using individual sample weights, adjusted for non-response.

The CES-D 10 questions are reported in Appendix Table 1. CHARLS uses the Chinese translation provided at the Center for Epidemiologic Studies website. The answers for CES-D are on a four-scale metric, from rarely, to some days (1–2 days), to occasionally (3–4 days) to most of the time (5–7 days). We score these answers using the metric suggested by Radloff (1977). Numbers from 0 for rarely to 3 for most of the time are used for negative questions such as “do you feel sad”. For positive questions such as “do you feel happy”, the scoring is reversed from 0 for most of the time to 3 for rarely. Boey (1999) reports a validation exercise of the 10 question CES-D among elderly respondents in China. Table 1 reports a standard validation exercise using the CHARLS data. The Chronbach’s α is 0.815 (Boey, 1999, reports a Chronbach α of 0.78–0.79), which indicates a reasonable level of internal consistency.

Appendix Table 2 shows weighted means and standard deviations of the variables we use in the regressions. Average age for both men and women is just under 60 years. Some 45% of men and 43% of women are aged 60 and above. In our baseline regressions we use age dummy variables, grouped into five year increments, with 45–49 being the omitted group. Of course given that the data are from a cross-section, age patterns cannot be distinguished from birth cohort or period effects. We also use dummy variables for level of schooling completed, with no schooling being omitted. Note what we call “can read or write” indicates some primary school, but not completed. Just under 40% of women have no schooling, while only 12% of men in our sample have no schooling. Some 46% of men have junior high school or greater, while only 27% of women do. Having little or no schooling is very much a function of age, with older respondents being more likely to have had no schooling.For household resources, as discussed above, we use log of household per capita expenditure (log *pce*) for the household. Because income impacts may be highly nonlinear, even when *pce* is in logs, we use a linear spline around the median log *pce*. Allowing for nonlinearities turns out to be very important in our results.

In our first specification we include rural and county dummies. About half of the sample resides in rural areas. In our second specification we use community dummies that refer to the communities in the urban areas and administrative villages in the rural areas. The communities are small areas that are likely to be more homogeneous than cities or counties, or certainly than provinces. The idea here is that each community has factors that will affect health outcomes that are not captured by county dummies. These factors may include wages, health care and other prices, inherent healthiness of the area, public health infrastructure and other factors. F-tests for all combinations of dummy variables are reported as well.

In our following specifications, we add variables that are arguably increasingly endogenous in that they reflect in part choices made now and in the past by respondents or their parents. First we add two variables proxying childhood health. There is now a large literature regarding early life origins of later life health (e.g. Barker, 1994; Gluckman and Hanson, 2005; Zhang et al. 2010). The coefficients of current SES may represent in part omitted factors such as influences from childhood health, so we include these both to examine those

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coefficients directly and to see how the coefficients change of current SES covariates. The first childhood health covariate is derived from a general health measure of child health before age 16, on scale of excellent, very good, good, fair, and poor. This is the same variable used in HRS and was used by Smith et al. (2012) to examine childhood health-later life health correlations using the CHARLS pilot survey. We create a dummy variable for poor childhood health. The fractions of men and women reporting poor health during childhood is small, 6% of men and 8% of women. As will be seen below, however, this variable turns out to be a powerful one.As a second measure of childhood health we use the lower leg length of the respondent. Lower leg length is highly correlated with attained height of adults, including in Chinese populations (e.g. Zhang et al., 1998). Adult height, in turn, is highly related to childhood nutrition and health events (e.g. Martorell and Habicht, 1986). We use lower leg length instead of total height because the older respondents have begun to shrink, which turns out to be highly correlated with a respondent’s SES, and for a measure of childhood health, we want a measure of pre-shrinkage height. Lower leg length does not shrink with age, hence is a much better proxy for pre-shrinkage height (see Huang et al., 2013, for details).

In our next specification we add indicators of immediate family deaths within the past two years of the survey. These include, separately, deaths of a spouse, of a mother or father, or of a child. The fractions reporting these events are quite small, however because of our large sample, this still represents a large enough number of respondents to be meaningful. Recent deaths are likely to be correlated with greater depressive symptoms.

In our final specification, we add several current health measures. Among these are indicator variables measuring a recent accident or injury, a fall in the past two years, whether the respondent has reported having difficulty or cannot perform any of a series of physical functioning, whether the respondent reports moderate or severe pain, and whether the respondent is disabled, as measured by whether they report any difficulty or cannot perform any activities of daily living (ADLs) or instrumental activities of daily living (IADLs). In addition we add two measures of cognition: an index of episodic memory as measured by an average of immediate and delayed recall of 10 simple nouns, and a measure of mental intactness taken from a subset of the Telephone Interview of Cognition Status (TICS). Both cognition measures are used in HRS as well. For all these health measures except for accidental injury, women report more problems than do men, as is normal in health surveys. Cognition measures are higher for men.

3. Results

Figure 1 shows the distribution of the CES-D scores of men and women. As can be seen, women have a higher mean score (8.9 vs. 7.1) and a thicker right hand tail than men. Although with different samples, a few studies do not find significant gender difference in depressive symptoms (e.g. Zhang and Li, 2011), most comparable studies do find a significant female disadvantage. For example, Li et al. (2014) provide a detailed meta-analysis on 81 studies regarding depressive symptoms of the Chinese elderly. They find that Chinese women have significantly higher depressive symptom than men and attribute it to higher risk of onset, longer life-expectancy, higher widowhood rate, lower social status,

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economic income and degree of education. Zhang and Li's study use data from only major Chinese cities. Their sample includes women 5 years younger than men (60 and over for men and 55 and over for women) and they also use the full 20 question version of CES-D. Given these differences, however, it is not clear exactly why they do not find higher levels of depressive symptoms for women.

Table 2 provides the age-gender distribution of CES-D scores. Depressive symptoms are higher for women and increase markedly with age. These are standard results, but we show that they hold nationally for China. Depressive symptoms are also a good deal higher in rural than in urban areas. Using 10 and above as a cutoff point for high depressive symptoms (see Andreasen et al., 1994, for justification of this cutoff), we find that a large fraction of Chinese elderly aged 45 and over have CES-D scores 10 and over, 30% of men and 43% for women. As one can see, for seniors aged 60 and over these fractions are higher, just under 35% for men and nearly half for women.

These results show a severe problem of depressive symptoms among the Chinese elderly in 2011/12. As discussed in the Introduction, early studies from the 1980s in China showed small levels of depressive symptoms, although one must be careful in making comparisons since those studies did not necessarily use the same measures of depressive symptoms and they were not in general nationally representative. Still, our results are consistent with the story that problems with depressive symptoms have increased in China over the past 30 years. The exact reasons for this change we cannot pinpoint from our results. In contrast, in Indonesia, the Indonesia Family Life Survey, wave 4, shows that only 5% of men and 9.4% of women aged 60 and over have CES-D 10 scores at 10 and over (Witoelar et al., 2012).

We use OLS regressions, treating the depressive symptom score as continuous. All standard errors are clustered at the community level. Table 3 shows our baseline initial regression models. As discussed, our base specification includes as covariates a series of age dummies, dummies for education level completed, and a linear spline in log of *per capita* expenditure. In addition, contextual variables are added in the form of location dummies, at either county or community level. All regressions are stratified by gender.

Similar to Strauss et al. (2010), who used the CHARLS Pilot from only 2 provinces, Gansu and Zhejiang, we find in Table 3 that the schooling level dummies are jointly strongly associated with the CES-D depressive symptoms score for both men and women. The association is negative and monotonic for men and women with primary schooling or greater. Men with junior high school or greater schooling have on average 1.66 points less on the CES-D scale than their illiterate counterparts. The mean for men in the sample is 7.1; relative to this level better educated men have a 23% lower depressive symptom score. For women with junior high school or more, their CES-D scores average 1.73 points lower than their illiterate counterparts. This is relative to a mean for women of 8.9, or some 19% lower.

Depressive symptoms are also strongly correlated with the log of household *pce* for men and women. The relationship appears to be highly nonlinear, negative for respondents with *pce* below the sample median and very flat for respondents whose *pce* is above the median (note the coefficients for log *pce* above the median represent the change in the slope from the

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interval for log *pce* below the median). The *pce* coefficients are similar for men and women. A one standard deviation increase in *pce* is associated with a decline in CES-D score of .044 for men and .049 for women. Despite its high statistical significance, this association is weak in magnitude compared to the education effects. Even a two standard deviation increase in *pce* does not compare in magnitude to moving to completing primary school, never mind completing junior high school or more.

Older respondents have higher depressive scores and the age gradient is steeper for women than for men. When we test for SES interactions with an age dummy (being younger than 60 years) the interactions are not jointly significant (results available upon request).

Depressive symptom scores are significantly related to location dummies. Rural residents, controlling for county location, have a depressive symptom score about half a point more than urban residents. This is a larger impact than for log *pce*, but smaller than schooling. We also test for SES interactions with a rural dummy, but as is true for age interactions we do not find any jointly significant associations (results also available upon request).

In Table 4 we add our measures of childhood health: poor childhood health and lower leg length. Having self-reported poor childhood health is negatively and significantly associated with higher CES-D scores for both men and women, and the association is similar for men and women. Leg length is significantly and negatively associated with depressive symptom scores for men. For women, however, the sign is positive although the significance is weaker (only at 10%). The magnitudes of these coefficients are quite small compared to the associations with general child health, with schooling or rural residence. A two standard deviation increase in leg length would only be associated with a .0015 decline in CES-D scores for men, a trivial amount.

As one would expect, there is some decline in the respondent schooling coefficients comparing the estimates in Table 4 against Table 3. The decline is not large in magnitude, but is larger for women, a drop of about 12%. Still, the respondent schooling coefficients remain jointly significant at very low p-values and the magnitudes of the coefficients are still sizable. In contrast, the log *pce* coefficients barely change, while the rural coefficient increases for women, but declines slightly for men.

In Table 5 we add the recent family death variables. Having had a spouse die within the previous two years is strongly and positively associated with higher depressive symptom scores. These coefficients dwarf those for the SES variables, even going from no schooling to junior high school or more has a lower coefficient than being a widow/widower. Compared to our baseline specification, the schooling coefficients are not much changed, nor are the log *pce* coefficients.

Having a recent child death is positively and significantly (at 10%) related to higher CES-D scores for women. As for being a recent widow, the coefficient magnitudes are large. For men the coefficients are positive as well, but not as large as for women, and also not significant. The recent parental death coefficients are positive but not significant for men. The coefficients for women, however, are negative and sometimes significant. As the mean parental age of the sample is about 80, already much larger than the average longevity of the

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Chinese population, their death is somewhat expected, so we do not see a significant shock to their children. Furthermore, because women are more likely to be the caregivers that observe their parents suffering before death, the death may be a relief for them, resulting in a negative coefficient.

Table 6 adds some current health controls. Each is individually significant at under 1% for men and all but accidental injury are significant at under 1% for women. In terms of size of coefficients, the largest associations are with having moderate or severe pain, being disabled (any ADL or IADL problem) and having problems with physical functioning. In results not reported, when we exclude the pain control, the coefficients on physical functioning and disability are larger, so that part of their association with depressive symptoms is through pain, but not all. The pain coefficient is even larger than the recent widowed coefficient, adding on average 3.2 points to the CES-D scale for men and 3.8 for women. Falling down within the past two years is also associated positively with depressive symptoms, as is having had an accident/injury for men. Better episodic memory and mental intactness are associated with fewer depressive symptoms.

Now the schooling completion coefficients decline radically and become insignificant for both men and women. But this is because there are strong correlations between higher schooling and having better current health, as shown for the CHARLS data by Lei et al. (2014). Similarly, the coefficients on log *pce* have been substantially reduced, as have the coefficients on the rural dummy and on childhood health. These current health variables are apparently pathways for the influence of these other variables.

4. Discussion and Conclusions

This paper has presented estimates of depressive symptom scores for a nationally representative sample of mid-aged and elderly population in China using the CES-D 10 questions. We find that in 2011/12 a high fraction of Chinese people 45 and older, both men and women, are suffering from high levels of depressive symptoms, with 30% of men and 43% of women having a CES-D score of 10 and over. The fraction of those 60 and older is even larger, much larger than other East Asian countries such as Indonesia. This result is consistent with recent literature on China arguing the problems of depressive symptoms have increased since the 1990s. The gender difference in depressive symptoms is consistent with other studies on depressive symptoms of Chinese elderly (as reviewed in Li et al., 2014), with statements about international evidence by the World Health Organization (WHO, 2012) and with the gender patterns of other outcomes such as physical health and cognition (Strauss et al., 2010; Lei et al., 2012; Lei et al., 2014).

After validating the CES-D measure for this sample, we proceed to explore the associations of depressive symptoms with different measures of SES, including schooling levels, household *per capita* expenditure and rural residence. We examine the age/cohort patterns of depressive symptoms and how the SES correlations change when we add covariates measuring recent family deaths and several current health variables.

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We find that the positive age/cohort gradient in depressive symptoms is steeper for women than for men, a phenomenon worth further investigation in the future. Depressive symptoms among the elderly in China are negatively related to better SES, in particular both schooling level and log *pce*. Rural residents also have higher CES-D scores. While these relationships are not necessary causal, they do show that there exists a strong SES gradient in depressive symptoms in China. This result is consistent with what other studies in China have found for depressive symptoms, but now replicated on a national sample and for the mid-aged and elderly population. This result is also consistent with findings of strong socio-economic and urban-rural gradients for other health measures including general, physical, and cognitive (Lei et al., 2014). As we know, China is now experiencing high economic inequality, much of that between urban and rural areas. These negative correlations between depressive symptoms and better SES, including urban-rural dichotomies, indicates that health inequalities based on economic inequalities are an issue in China as well. How to approach these problems is outside the scope of this paper, but our findings highlight the policy challenges facing China as it faces its health and demographic transitions.

Poor childhood health is associated with higher levels of depressive symptoms, as is being a recent widow or widower, and a recent child death for women. The coefficients on these variables are large in magnitude, more so even than the education coefficients. These results illustrate the importance of family support even in current China. Given that future cohorts of Chinese elderly will have fewer children to support them because of the past decline in fertility, this will become more an issue with time.

Current health measures also have strong correlations with depressive symptoms. Reporting moderate to severe pain is associated with higher depressive symptom scores, as is being disabled or having problems with measures of physical functioning. Also recent falls and accidental injuries are associated with higher CES-D scores. The magnitudes of these coefficients is also large, similar to the coefficient on recent death of a spouse. In addition, worse cognitive functioning is associated with higher levels of depressive symptoms. These results are consistent with many of the earlier studies in China, referenced in the introduction of the paper. What we can also say, is that controlling for these current health measures greatly weakens the associations with SES factors, driving the education coefficients to near zero and shrinking the log *pce* coefficients, suggesting that a large part of the pathways through which SES matters is through these current health measures. This suggests that in forecasting future magnitudes of the depressive symptom problem in China, much will depend on what happens to measures of physical health such as disability and pain.

Future waves of CHARLS will be very useful to allow examination of changes in depressive symptoms among the Chinese elderly and how they relate to changes and initial values of SES and other factors considered in this paper. It may also be very helpful in seeking a causal explanation which the current literature is not able to deal with.

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References

Andreasen EM, Malmgren JA, Carter WB, Patrick DL. Screening for depression in well older adults: Evaluation of a short form of the CES-D. American Journal of Preventive Medicine. 1994; 10(2): 77–84. [PubMed: 8037935]

Barker, D. Mothers, babies and health in later life. London: BMJ Publishing Group; 1994.

Boey KW. Cross-validation of a short form of the CES-D in Chinese elderly. International Journal of Geriatric Psychiatry. 1999; 14(8):608–617. [PubMed: 10489651]

Chen MS, Pan JX, Yu Y, Gao ZX. An epidemiological survey of depression in old people in rural areas of Shanghai. Chinese Journal of Gerontology. 1994; 14:270–271.

Chen R, Copeland JRM, Wei L. A meta analysis of epidemiological - studies in depression of older people in the People's Republic of China. International journal of geriatric psychiatry. 1999; 14.10:821–830. [PubMed: 10521881]

Cutler D, A L-M. Understanding differences in health behaviors by Education. Journal of Health Economics. 2010; 29(1):1–28. [PubMed: 19963292]

Das J, Do Q-T, Friedman J, McKenzie D, Scott K. Mental health and poverty in developing countries. Social Science and Medicine. 2007; 65(3):467–480. [PubMed: 17462803]

Deaton, A. The analysis of household surveys: A microeconometric approach. Baltimore: Johns Hopkins University Press; 1997.

Fan ZG, Chen JM, Lu GH, Zhou HJ. An epidemiological survey of depression in the elderly in urban areas of Huzhou. Chinese Journal of Gerontology. 1994; 13:73–75.

Gluckman, P.; Hanson, M. The fetal matrix: Evolution, development and disease. Cambridge: Cambridge University Press; 2005.

Grossman M. On the concept of health capital and the demand for health. Journal of Political Economy. 1972; 80(2):223–255.

Huang W, Lei X, Ridder G, Strauss J, Zhao Y. Health, Height, Height Shrinkage and SES at Older Ages: Evidence from China. American Economic Journal: Applied Economics. 2013; 5(2):86–121.

Inaba A, Thoits P, Ueno K, Gove W, Evenson R, Sloan M. Depression in the United States and Japan: Gender, marital status, and SES patterns. Social Science and Medicine. 2005; 61:2280–2292. [PubMed: 16115712]

Lee J, Smith JP. Work, retirement and depression. Journal of Population Ageing. 2009; 2:57–71. [PubMed: 23687521]

Lee J, Smith JP. Explanations for education gradients in depression: The case of Korea. Research on Aging. 2011; 33(5):551–575. [PubMed: 23645947]

Lee N. Measurement error and its impact on estimates of income and consumption dynamics. mimeo. Department of Economics: Chinese University of Hong Kong. 2009

Lei X, Sun X, Strauss J, Zhao Y, Yang G, Hu P, Hu Y, Yin X. Health Outcomes and Socio-economic Status among the Mid-aged and Elderly in China: Evidence from the CHARLS Baseline Data. Journal of the Economics of Ageing. 2014; 3:29–43.

Lei X, Hu Y, McArdle J, Smith J, Zhao Y. Gender Differences in Cognition among Older Adults in China. Journal of Human Resources. 2012; 41:951–971. [PubMed: 24347682]

Li D, Xu Y, Nie H, Zhang Y, Wu Y. A meta-analysis of the prevalence of depressive symptoms in Chinese older adults. Archives of gerontology and geriatrics. 2014; 58.1:1–9. [PubMed: 24001674]

Lim LL, Chang W, Yu X, Chiu H, Chang M-Y, Kua E-H. Depression in Chinese elderly populations. Asia-Pacific Psychiatry. 2011; 3.2:46–53.

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Lleras-Muney A. The relationship between education and adult mortality in the US. Review of Economic Studies. 2005; 72(1):189–221.

Lopez, A.; Mathers, C.; Ezzati, M.; Jamison, D.; Murray, C. Measuring the global burden of disease and risk factors, 1990–2001. In: Lopez, A.; Mathers, C.; Ezzati, M.; Jamison, D.; Murray, C., editors. Global burden of disease and risk factors. Oxford: Oxford University Press; 2006.

Lorant V, Deliege D, Eaton W, Robert A, Philippot P, Ansseau M. Socioeconomic inequalities in depression: A meta-analysis. American Journal of Epidemiology. 2003; 157(2):98–112. [PubMed: 12522017]

Martorell, R.; Habicht, JP. Growth in early childhood in developing countries. In: Falkner, F.; Tanner, JM., editors. Human Growth: A Comprehensive Treatise. Vol. 3. New York: Plenum Press; 1986. p. 241-262.

Mong S, Xiang MJ. Survey of depressive symptoms and structure analysis of CES-D in old people in urban districts of Beijing. Journal of China Psychological Health. 1997; 11:55–58.

Muntaner C, Eaton W, Miech R, O'Campo P. Socioeconomic position and major mental disorders. Epidemiologic Reviews. 2004; 26:53–62. [PubMed: 15234947]

Patel V, Kleinman A. Poverty and common mental disorders in developing countries. Bulletin of the World Health Organization. 2003; 81(8):609–615. [PubMed: 14576893]

Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. Applied Psychological Measurement. 1977; 1:385–401.

Smith JP. Healthy bodies and thick wallets: the dual relation between health and economic status. Journal of Economic Perspectives. 1999; 13(2):145–167.

Smith JP, Shen Y, Strauss J, Yang Z, Zhao Y. The Effects of Childhood Health on Adult Health and SES in China. Economic Development and Cultural Change. 2012; 61(1):127–156. [PubMed: 23539191]

Strauss, J.; Thomas, D. Human resources: empirical modeling of household and family decisions. In: Behrman, JR.; Srinivasan, TN., editors. Handbook of Development Economics. Vol. 3 A. Amsterdam: North Holland Press; 1995.

Strauss J, Thomas D. Health, nutrition and economic development. Journal of Economic Literature. 1998; 36(3):766–817.

Strauss, J.; Thomas, D. Health over the life course. In: Schultz, TP.; Strauss, J., editors. Handbook of Development Economics. Vol. 4. Amsterdam: North Holland Press; 2008.

Strauss J, Lei X, Park A, Shen Y, Smith JP, Yang Z, Zhao Y. Health Outcomes and Socio-economic Status among the Elderly in China: Evidence from the CHARLS Pilot. Journal of Population Ageing. 2010; 3:111–142. [PubMed: 23539329]

Witoelar, F.; Strauss, J.; Sikoki, B. Socio-economic success and health in later life: Evidence from the Indonesia Family Life Survey. In: Majmundar, M.; Smith, JP., editors. Aging in Asia: Findings from New and Emerging Data Initiatives, Committee on Policy Research and Data Needs to Meet the Challenge of Aging in Asia, National Research Council. Washington D.C.: National Academies Press; 2012. 2012.

World Health Organization. Global Burden of Mental Disorders and the Need for a Comprehensive, Coordinated Response from the Health and Social Sectors at the Country Level. Document A65/10. 2012. March 2012.

Yu J, Li J, Cuijpers P, Wu S, Wu Z. Prevalence and correlates of depressive symptoms in Chinese older adults: a population-based study. International Journal of Geriatric Psychiatry. 2012; 27:305–312. [PubMed: 21538538]

Zhang H, Hsu-Hage BH, Wahlqvist ML. The use of knee height to estimate maximum stature in elderly Chinese. Journal of Nutrition, Health and Aging. 1998; 2(2):84–87.

Zhang BS, Li J. Gender and marital status differences in depressive symptoms among elderly adults: The roles of family support and friend support. Aging and Mental Health. 2011; 15:844–854. [PubMed: 21562986]

Zhang L, Xu Y, Nie HW. Prevalence of depression among Chinese elderly people in 2000–2010: A meta-analysis. Chinese Journal of Gerontology. 2011; 31(17):3349–3352.

Zhang Z, Gu D, Hayward M. Childhood Nutritional Deprivation and Cognitive Impairment among Older Chinese People. Social Science and Medicine. 2010; 71:941–949. [PubMed: 20591545]

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Zhao, Y.; Strauss, J.; Yang, G.; Giles, J.; Hu, P.; Hu, Y.; Lei, X.; Park, A.; Smith, JP.; Wang, Y. China health and retirement longitudinal study – 2011–2012 national baseline user's guide. China Center for Economic Research, Peking University; 2013.

Zhao Y, Hu Y, Smith JP, Strauss J, Yang G. Cohort profile: The China Health and Retirement Longitudinal Study. International Journal of Epidemiology. 2014; 43(1):61–68. [PubMed: 23243115]

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Research Highlights

- Find high levels of depressive symptoms among elderly in China with national survey
- Women have higher levels of depressive symptoms than men
- Higher levels of schooling and per capita expenditure associated with less symptoms
- Recent deaths of spouse and children are associated with higher levels of symptoms
- SES-depressive symptom correlations partly through chronic health problems

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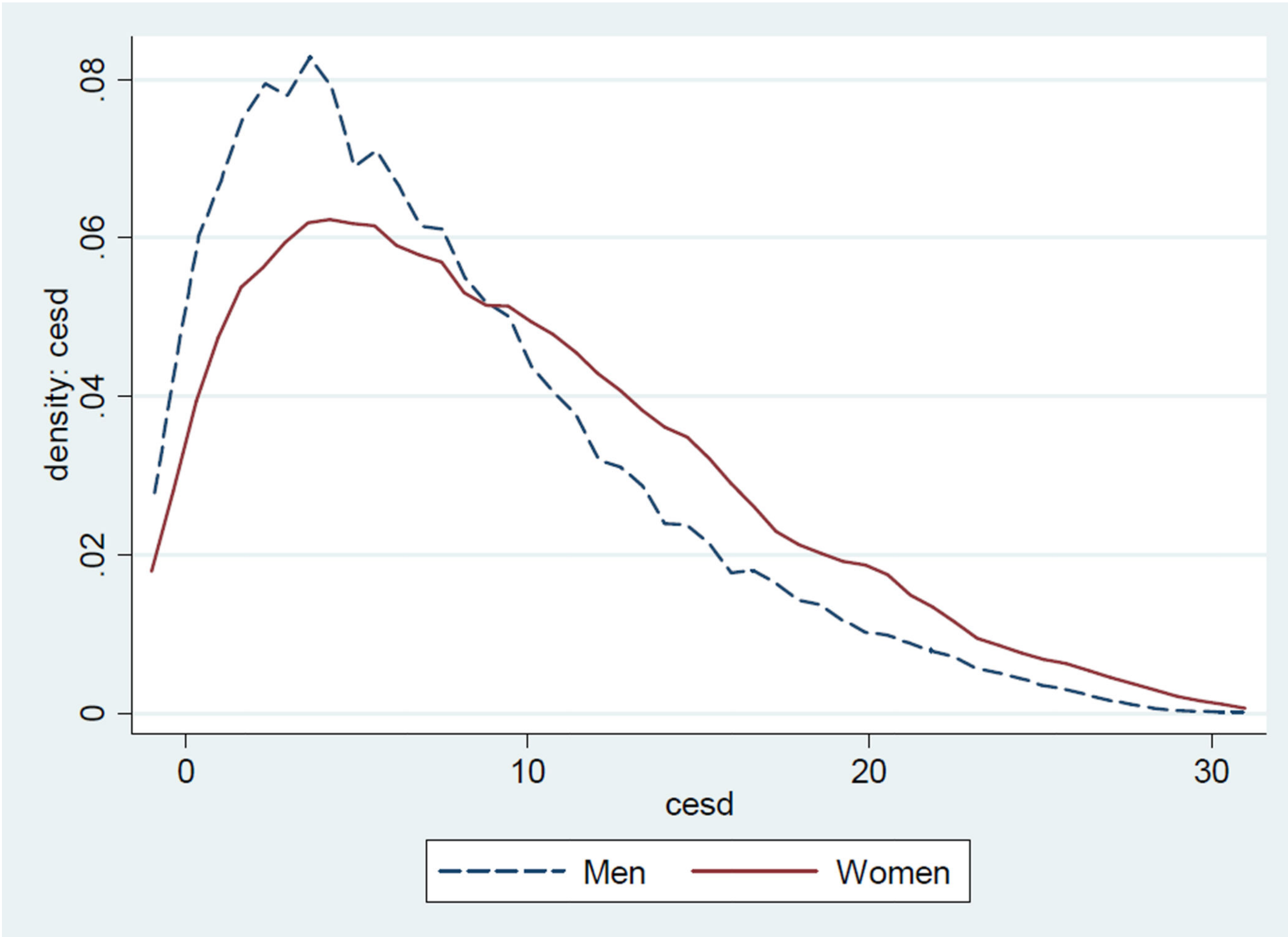

Figure 1.
The distribution of CESD-scores by gender

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Table 1

Internal consistency of CES-D scale

Item	N	Item-test correlation	Item-rest correlation	Average interitem correlation	Alpha	
Bothered	14927	0.6711	0.5651	0.2962	0.7911	0.7911
Mind	14927	0.6255	0.5098	0.3039	0.7971	0.7974
Depress	14927	0.7375	0.6478	0.2849	0.7819	0.7815
Effort	14927	0.6845	0.5817	0.2939	0.7893	0.789
Hopeful	14927	0.4442	0.2993	0.3348	0.8191	0.819
Fearful	14927	0.566	0.439	0.314	0.8047	0.8046
Sleep_rest~s	14927	0.5263	0.3927	0.3208	0.8096	0.8103
Happy	14927	0.6103	0.4915	0.3065	0.7991	0.7996
Lonely	14927	0.6245	0.5085	0.3041	0.7973	0.7973
Get_going	14927	0.6377	0.5245	0.3018	0.7955	0.7954
Test scale				0.3061	0.8152	0.8152

Source: CHARLS national baseline data

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Table 2

Distribution of CES-D Scores by Age and Gender

	Men									Women								
	Urban			Rural			Total			Urban			Rural			Total		
	Mean	N	CES-D >=10 (%)	Mean	N	CES-D >=10 (%)	Mean	N	CES-D >=10 (%)	Mean	N	CES-D >=10 (%)	Mean	N	CES-D >=10 (%)	Mean	N	CES-D >=10 (%)
45–49	5.0 (0.3)	535	20	7.1 (0.2)	750	27	6.0 (0.2)	1285	24	6.6 (0.4)	736	27	8.7 (0.2)	1004	41	7.6 (0.2)	1740	35
50–54	6.1 (0.3)	419	23	7.3 (0.2)	631	31	6.7 (0.2)	1050	28	7.1 (0.3)	500	31	9.6 (0.3)	682	46	8.3 (0.2)	11 82	40
55–59	5.9 (0.3)	583	21	7.8 (0.2)	901	33	6.9 (0.2)	1484	28	7.4 (0.3)	642	34	10.2 (0.2)	949	50	8.9 (0.2)	15 91	43
60–64	6.7 (0.3)	504	27	8.4 (0.2)	790	37	7.6 (0.2)	1294	33	8.6 (0.4)	522	41	10.8 (0.3)	748	53	9.8 (0.2)	12 70	48
65–69	6.1 (0.3)	300	24	9.0 (0.3)	539	40	7.8 (0.2)	839	35	8.8 (0.5)	299	41	11.1 (0.3)	502	55	10.0 (0.3)	80 1	50
70–74	6.2 (0.6)	249	30	8.6 (0.3)	390	39	7.4 (0.4)	639	35	7.8 (0.5)	262	35	11.1 (0/4)	307	57	9.3 (0.3)	56 9	47
75+	6.7 (0.4)	239	23	9.6 (0.4)	346	44	8.1 (0.3)	585	35	9.6 (0.5)	262	45	11.9 (0/4)	334	60	10.8 (0.3)	59 6	54
Total (45+)	6.0 (0.1)	2829	23	8.1 (0.1)	4347	35	7.1 (0.1)	7176	30	7.7 (0.2)	3223	35	10.2 (0.1)	4526	49	8.9 (0.1)	77 49	43

Notes: Weighted at individual level with household and response adjustment. Sample are respondents not younger than 45.Standard errors in parentheses. Source: CHARLS national baseline.

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Table 3

Regressions for CES-D

	Men		Women	
	(1)	(2)	(1)	(2)
Aged 50–54	0.661*** (0.251)	0.596** (0.254)	0.680** (0.268)	0.727*** (0.270)
Aged 55–59	0.569** (0.275)	0.435 (0.310)	0.551* (0.286)	0.749*** (0.284)
Aged 60–64	0.821*** (0.262)	0.698** (0.281)	1.162*** (0.306)	1.274*** (0.296)
Aged 65–69	0.942*** (0.297)	0.814*** (0.300)	1.422*** (0.352)	1.448*** (0.367)
Aged 70–74	0.692** (0.353)	0.497 (0.332)	0.756** (0.369)	0.708* (0.413)
Aged 75 and over	1.221*** (0.352)	1.002*** (0.342)	1.794*** (0.400)	1.682*** (0.422)
Can read and write	−0.065 (0.298)	0.110 (0.319)	0.103 (0.263)	−0.119 (0.298)
Finished primary	−0.786*** (0.279)	−0.779** (0.323)	−0.541* (0.284)	−0.577** (0.265)
Junior high and above	−1.740*** (0.279)	−1.657*** (0.305)	−1.799*** (0.292)	−1.727*** (0.352)
logPCE (< median)	−0.871*** (0.134)	−0.931*** (0.161)	−1.048*** (0.151)	−0.980*** (0.174)
logPCE (> median, marginal)	0.845*** (0.195)	0.996*** (0.215)	1.089*** (0.211)	1.042*** (0.248)
Rural	0.473** (0.216)		0.418* (0.229)	
County Dummies	YES	NO	YES	NO
Community Dummies	NO	YES	NO	YES
F-test for all age dummies (p-value)	2.92*** (0.008)	2.25** (0.038)	5.24*** (0.000)	4.84*** (0.000)
F-test for all education dummies (p-value)	19.29*** (0.000)	17.34*** (0.000)	15.58*** (0.000)	9.56*** (0.000)
F-test for all logPCE splines (p-value)	23.42*** (0.000)	17.30*** (0.000)	25.42*** (0.000)	16.89*** (0.000)
F-test for all location dummies (p-value)	5.51*** (0.000)	2.61*** (0.000)	6.06*** (0.000)	3.25*** (0.000)
Observations	7132	7132	7708	7708

Standard error in parentheses, all clustered at community level.

* p<.1

** p<.05

*** p<.01.

logPCE (>median, marginal) represents the change in the slope from the interval for logPCE below the median.
Weighted at individual level with household and response adjustment

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Table 4

Regressions for CES-D with childhood health and leg length

	Men		Women	
	(1)	**(2)**	**(1)**	**(2)**
Aged 50–54	0.724*** (0.279)	0.641** (0.271)	0.781*** (0.281)	0.771** (0.298)
Aged 55–59	0.392 (0.271)	0.402 (0.336)	0.503 (0.307)	0.571* (0.315)
Aged 60–64	0.545** (0.275)	0.480 (0.301)	1.155*** (0.303)	1.202*** (0.297)
Aged 65–69	0.840*** (0.319)	0.771** (0.337)	1.413*** (0.366)	1.397*** (0.405)
Aged 70–74	0.624 (0.392)	0.507 (0.352)	1.039*** (0.375)	1.004** (0.400)
Aged 75 and over	0.895** (0.362)	0.683* (0.353)	1.856*** (0.437)	1.716*** (0.466)
Can read and write	−0.115 (0.312)	−0.056 (0.339)	0.163 (0.266)	0.032 (0.296)
Finished primary	−0.738** (0.309)	−0.750** (0.359)	−0.340 (0.298)	−0.387 (0.294)
Junior high and above	−1.817*** (0.301)	−1.653*** (0.343)	−1.597*** (0.305)	−1.525*** (0.373)
logPCE (< median)	−0.833*** (0.143)	−0.921*** (0.166)	−1.007*** (0.161)	−0.985*** (0.189)
logPCE (> median, marginal)	0.960*** (0.218)	1.154*** (0.239)	1.054*** (0.229)	1.071*** (0.271)
Rural	0.466* (0.240)		0.697*** (0.252)	
Poor childhood health	1.645*** (0.525)	1.766*** (0.614)	1.517*** (0.396)	1.703*** (0.347)
Leg length	−0.012*** (0.004)	−0.013*** (0.004)	0.005* (0.003)	0.005* (0.003)
F-test for all age dummies (p-value)	1.91* (0.076)	1.43 (0.201)	5.15*** (0.000)	4.32*** (0.000)
F-test for all education dummies (p-value)	21.11*** (0.000)	12.58*** (0.000)	12.50*** (0.000)	7.29*** (0.000)
F-test for all logPCE splines (p-value)	17.28*** (0.000)	15.40*** (0.000)	20.48*** (0.000)	14.63*** (0.000)
F-test for all location dummies (p-value)	5.01*** (0.000)	2.31*** (0.000)	5.89*** (0.000)	2.97*** (0.000)

See notes under Table 3.

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Table 5

Regressions for CES-D with recent family deaths

	Men		**Women**	
	(1)	**(2)**	**(1)**	**(2)**
Aged 50–54	0.723*** (0.278)	0.639** (0.271)	0.760*** (0.281)	0.752** (0.295)
Aged 55–59	0.382 (0.270)	0.392 (0.336)	0.456 (0.305)	0.532* (0.313)
Aged 60–64	0.546** (0.275)	0.484 (0.300)	1.080*** (0.304)	1.136*** (0.296)
Aged 65–69	0.813** (0.320)	0.737** (0.339)	1.355*** (0.367)	1.344*** (0.405)
Aged 70–74	0.629 (0.393)	0.516 (0.352)	0.899** (0.378)	0.881** (0.406)
Aged 75 and over	0.823** (0.366)	0.602* (0.358)	1.644*** (0.442)	1.526*** (0.475)
Can read and write	−0.124 (0.312)	−0.063 (0.339)	0.188 (0.265)	0.059 (0.293)
Finished primary	−0.748** (0.309)	−0.760** (0.359)	−0.359 (0.296)	−0.399 (0.297)
Junior high and above	−1.818*** (0.302)	−1.656*** (0.343)	−1.568*** (0.304)	−1.509*** (0.370)
logPCE (< median)	−0.831*** (0.143)	−0.917*** (0.166)	−1.023*** (0.161)	−0.996*** (0.188)
logPCE (> median, marginal)	0.955*** (0.218)	1.146*** (0.238)	1.077*** (0.229)	1.082*** (0.271)
Rural	0.470** (0.240)		0.750*** (0.250)	
Poor childhood health	1.646*** (0.525)	1.765*** (0.614)	1.523*** (0.396)	1.709*** (0.347)
Leg length	−0.012*** (0.004)	−0.013*** (0.004)	0.005* (0.003)	0.005* (0.003)
Recent widowed	2.078* (1.114)	2.549** (1.174)	2.731*** (0.755)	2.450*** (0.853)
Recent father death	0.530 (0.747)	0.579 (0.802)	−1.060 (0.677)	−1.397** (0.709)
Recent mother death	0.397 (0.571)	0.683 (0.585)	−1.075* (0.627)	−0.536 (0.605)
Recent child death	1.715 (1.385)	1.771 (1.576)	3.452* (1.789)	3.445* (1.870)
F-test for all age dummies (p-value)	1.78* (0.100)	1.33 (0.241)	4.35*** (0.000)	3.78*** (0.001)
F-test for all education dummies (p-value)	20.92*** (0.000)	12.46*** (0.000)	12.36*** (0.000)	7.31*** (0.000)
F-test for all logPCE splines (p-value)	17.18*** (0.000)	15.33*** (0.000)	21.21*** (0.000)	15.01*** (0.000)
F-test for all recent events (p-value)	1.56 (0.181)	2.12* (0.078)	5.54*** (0.000)	3.94*** (0.004)
F-test for all location dummies (p-value)	5.03*** (0.000)	2.33*** (0.000)	5.91*** (0.000)	2.96*** (0.000)

See notes under Table 3.

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Table 6

Regressions for CES-D with mental and physical health

	Men		Women	
	(1)	**(2)**	**(1)**	**(2)**
Aged 50–54	0.307 (0.260)	0.232 (0.269)	0.101 (0.253)	−0.109 (0.269)
Aged 55–59	−0.064 (0.275)	−0.028 (0.372)	−0.031 (0.234)	−0.165 (0.272)
Aged 60–64	−0.040 (0.268)	−0.070 (0.309)	0.174 (0.270)	0.107 (0.284)
Aged 65–69	−0.099 (0.324)	−0.253 (0.345)	0.071 (0.359)	0.035 (0.451)
Aged 70–74	−0.735* (0.392)	−0.754** (0.314)	−0.821** (0.374)	−0.893** (0.413)
Aged 75 and over	−1.377*** (0.374)	−1.565*** (0.395)	−0.083 (0.434)	−0.250 (0.468)
Can read and write	0.189 (0.299)	0.219 (0.305)	0.390 (0.258)	0.282 (0.276)
Finished primary	−0.109 (0.298)	−0.108 (0.318)	0.179 (0.280)	0.197 (0.308)
Junior high and above	−0.571* (0.301)	−0.405 (0.336)	−0.206 (0.281)	−0.101 (0.297)
logPCE (< median)	−0.382*** (0.134)	−0.501*** (0.151)	−0.808*** (0.155)	−0.899*** (0.174)
logPCE (> median, marginal)	0.258 (0.196)	0.475** (0.208)	0.964*** (0.221)	1.067*** (0.250)
Rural	0.137 (0.223)		0.194 (0.245)	
Poor childhood health	0.959** (0.418)	1.138** (0.514)	1.407*** (0.345)	1.586*** (0.400)
Leg length	−0.008*** (0.002)	−0.008*** (0.003)	−0.036 (0.027)	−0.037 (0.029)
Recent widowed	2.087* (1.106)	2.541** (1.218)	2.707*** (0.731)	2.771*** (0.782)
Recent father death	−0.408 (0.663)	−0.552 (0.664)	−0.531 (0.669)	−1.021 (0.670)
Recent mother death	0.677 (0.494)	0.819 (0.529)	−0.461 (0.638)	0.107 (0.557)
Recent child death	2.330 (1.451)	2.178 (1.544)	2.457** (1.198)	2.454* (1.278)
Accident injury	0.822*** (0.274)	0.942*** (0.313)	−0.226 (0.319)	−0.135 (0.344)
Fall down last 2 years	1.271*** (0.246)	1.106*** (0.250)	1.264*** (0.228)	1.372*** (0.248)
Physical function difficulty	1.746*** (0.189)	1.705*** (0.196)	1.992*** (0.188)	1.989*** (0.209)
Any disability	1.910*** (0.221)	2.044*** (0.231)	2.034*** (0.228)	2.120*** (0.272)
Moderate or severe pain	3.274*** (0.255)	3.151*** (0.303)	3.865*** (0.218)	3.838*** (0.221)
Mental intactness	−0.168*** (0.044)	−0.181*** (0.049)	−0.171*** (0.043)	−0.174*** (0.046)

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	Men		**Women**	
	(1)	**(2)**	**(1)**	**(2)**
Episodic memory	−0.305*** (0.047)	−0.316*** (0.054)	−0.200*** (0.049)	−0.205*** (0.056)
F-test for all age dummies (p-value)	4.55*** (0.000)	4.86*** (0.000)	1.27 (0.267)	1.16 (0.327)
F-test for all education dummies (p-value)	3.84*** (0.009)	1.72 (0.161)	1.92 (0.124)	0.77 (0.513)
F-test for all logPCE splines (p-value)	5.90*** (0.003)	6.14*** (0.002)	13.68*** (0.000)	13.40*** (0.000)
F-test for all recent events (p-value)	2.15* (0.072)	2.69** (0.031)	4.72*** (0.001)	4.68*** (0.001)
F-test for all physical and mental health (p-value)	110.52*** (0.000)	109.41*** (0.000)	137.35*** (0.000)	120.21*** (0.000)
F-test for all location dummies (p-value)	3.67*** (0.000)	1.83*** (0.000)	3.48*** (0.000)	2.17*** (0.000)

See notes under Table 3.

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Appendix Table 1

CES-D questions, English and Mandarin

DC009 I was bothered by things that don't usually bother me. 我因一些小事而烦恼。
DC010. I had trouble keeping my mind on what I was doing. 我在做事时很难集中精力。
DC011. I felt depressed. 我感到情绪低落。
DC012. I felt everything I did was an effort. 我觉得做任何事都很费劲。
DC013. I felt hopeful about the future. 我对未来充满希望。
DC014. I felt fearful. 我感到害怕。
DC015. My sleep was restless. 我的睡眠不好。
DC016. I was happy. 我很愉快。
DC017. I felt lonely. 我感到孤独。
DC018. I could not get "going."我觉得我无法继续我的生活。

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Appendix Table 2

Summary statistics of independent variables

	Men			Women		
	Mean	SE	N	Mean	SE	N
Age	59.8	0.165	8426	59.64	0.226	8890
Aged 45–49	0.2	0.007	8426	0.22	0.008	8890
Aged 50–54	0.15	0.006	8426	0.15	0.005	8890
Aged 55–59	0.2	0.007	8426	0.2	0.006	8890
Aged 60–64	0.16	0.006	8426	0.15	0.005	8890
Aged 65–69	0.11	0.006	8426	0.09	0.004	8890
Aged 70–74	0.09	0.004	8426	0.08	0.004	8890
Aged 75+	0.1	0.005	8426	0.12	0.005	8890
Illiterate	0.12	0.007	8415	0.39	0.013	8872
Can read or write	0.17	0.008	8415	0.16	0.007	8872
Finished primary	0.25	0.008	8415	0.17	0.007	8872
Junior high or above	0.46	0.016	8415	0.27	0.013	8872
logPCE	9.07	0.046	8320	9.11	0.045	8765
Rural	0.51	0.028	8437	0.49	0.026	8902
Recent widowed	0.0073	0.00113	8425	0.0121	0.00143	8884
Recent father death	0.0162	0.00295	8410	0.0148	0.00283	8877
Recent mother death	0.0199	0.00366	8410	0.018	0.00338	8877
Recent child death	0.0041	0.00085	8410	0.0054	0.00093	8877
Poor childhood health	0.06	0.003	8219	0.08	0.005	8679
Leg length	49.86	0.14	6406	46.37	0.108	7069
Accident injury	0.13	0.006	7580	0.07	0.004	8327
Fall down last 2 years	0.13	0.007	7577	0.16	0.007	8325
Physical function difficulty	0.53	0.011	7726	0.69	0.011	7729
Disability (Any ADL or IADL)	0.23	0.009	8360	0.31	0.011	8811
Moderate or severe body pain	0.18	0.007	8349	0.27	0.009	8788
Mental intactness	8.92	0.056	7215	7.95	0.078	7743
Episodic memory	3.42	0.047	7219	3.27	0.051	7842

Notes: Sample include respondents not younger than 45.

All weighted at individual level with household and non-response adjustment except leg length. Leg length is weighted using biomarker individual level weights with household and biomarker non-response adjustment.
Source: CHARLS national baseline.