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Health outcomes and socio-economic status among the mid-aged and elderly in China: Evidence from the CHARLS national baseline data

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Abstract

Using a very rich set of health indicators that include both self-reported measures and biomarkers from the CHARLS national baseline data, we document health conditions of the Chinese mid-aged and elderly, examine correlations between these health outcomes and socio-economic status and compare these associations by gender, hukou status and region. As expected, we find that Chinese mid-aged and elderly are facing challenges from chronic diseases including hypertension. Overnutrition has become a bigger problem than undernutrition, particularly for women, reflected in a higher rate of overweight compared to underweight. Disability rates are also high, especially for female, rural and inland respondents, who also report suffering from more pain than male, urban and coastal ones. In general, education and PCE tend to be positively correlated with better health outcomes, as it is in other countries. For PCE the relationship is very nonlinear. At low levels of PCE, there exists a positive correlation with better health outcomes, while for higher levels of PCE the relationship flattens out. Unmeasured community influences turn out to be highly important, much more so than one usually finds in other countries. We also find a large degree of under-diagnosis of hypertension, a major health problems that afflicts the aged, although less large than in some other developing countries. This implies that the current health system is still not well prepared to address the rapid aging of the Chinese population.

Keywords

Health status; Health-SES correlations; Chinese elderly

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Introduction

We are concerned in this paper with measuring health outcomes among the mid-aged and elderly in China, and examining the relationships between different dimensions of health status and measures of current socio-economic status (SES). China has undergone a health revolution over the past 50 years, with life expectancy having risen from 46 in the 1950s to just over 74 in 2009 (Wagstaff et al., 2009; World Health Organization, 2012). Driving this change, the mortality rates for those under 5 fell dramatically from 225 per 1000 live births in 1960 to 48 in 1990 and 18 in 2010 (Wagstaff et al., 2009; UNICEF, 2012). Most of this decline was due to an increasing control over infectious disease and undernutrition. As a result, infectious diseases have been progressively replaced by chronic diseases as the major source of ill-health and mortality (Hossain, 1997; Lopez et al., 2006).

As China has been passing through its health transition, it has also been undergoing a nutrition transition, which has both positive and negative aspects (Popkin et al., 1993, 1995a; Popkin, 1999, 2002). Among the principle dimensions of this transition has been a dramatic rise in body mass index (BMI) among adults and a large change in diet towards more ‘fatty foods’ (Popkin et al., 1995b). For instance Luo (2003), using the China Health and Nutrition Survey (CHNS), documents an increase in overweight adults over 20 years from 1989 to 1997, for women from 11% to 21% and from 6% to 17% for men.¹ At the same time, Luo shows that the fraction of elderly adults who are undernourished (a BMI under 18.5) has fallen, particularly so for those over 60 years old, from 19% to 13% for women and 20% to 12% for men from 1991 to 1997.

Related to these health and nutrition transitions has been China’s demographic transition. China’s elderly population will increase from under 10% of the total population in 2000 to 30% in 2050 (Kinsella and He, 2009). The number of workers per pensioner has already fallen from over 12 in 1980 to 2 in 2005 (Kinsella and He, 2009). This sharp demographic transition is likely to place stress on China’s health system, which has been focused on disease at younger ages and on infectious, as opposed to chronic, diseases.

In this paper, we use the China Health and Retirement Longitudinal Study national baseline data (CHARLS) to document health conditions among the mid-aged and elderly (aged 45 and over) in China, focusing on the difference between men and women, respondents with urban and rural residence permits (hukou) as well as those living in inland and coastal areas. We use a very rich set of health indicators that include both self-reported measures and biomarkers. We also examine correlations between these health outcomes and two important indicators of socio-economic status (SES): education and log of per capita expenditure (log PCE), our preferred measure of household resources. While there exists a very large literature that examines the relationships between SES and health measures, little has been done on Chinese data to see whether correlations reported in many other countries are replicated in China, particularly so for the aged.² While we cannot in general infer causality

¹Overweight is defined using World Health Organization standard of having a BMI 25 or above.

²Some studies have shown health-SES gradients for children, for example, Chen and Li (2009), Chen et al. (2010), Zhang (2013) and Zhu et al. (2013). Much less work has been done on adults and particularly the elderly, see Strauss et al. (2010) for an exception.

from these estimates, they tell us something important about the degree of health differentials by education and per capita expenditure (PCE).

In general, education and PCE tend to be positively correlated with better health outcomes, as it is in other countries. The PCE association is quite nonlinear, positive at lower levels of PCE and flattening out for higher levels. These health-SES associations are not significantly different for the elderly, defined as those 60 years and older, from mid-aged Chinese, aged 45–59. Some significant differences in SES gradients exist between respondents with urban versus rural hukou and between those living in coastal versus inland areas, however no clear pattern is apparent. Unmeasured community influences turn out to be highly important, much more so than one usually finds in other countries. While it is not yet clear which aspects of communities matter and why they matter, we set up an agenda for future research on this topic. We also find a large degree of under-diagnosis of hypertension, a major health problem that afflicts the aged. This implies that the current health system is not well prepared to address the rapid ageing of the Chinese population.

This paper is divided into five sections. The next section briefly introduces the topic. Section “Data and empirical specifications” describes the data while our main empirical findings are presented in section “Results”. The final section highlights our main conclusions.

Health-SES correlations

Across most country settings, no matter which measures of SES are used (income, wealth or education), the evidence of this association between health and SES being large and pervasive is abundant (Marmot, 1999; Smith, 1999; Strauss and Thomas, 1998).

Mainly due to the absence of high quality data, far less research has been conducted on the magnitude and underlying reasons for the SES-health gradient in China for adults. China is about to age very rapidly and has at the same time been experiencing high but very unequal rates of economic growth. The extent to which this recent economic growth has improved the overall health of the Chinese population depends in part on understanding in the Chinese context the influence of economic well-being on health. Similarly, the degree to which growing inequalities in levels of economic resources in China are producing similarly large inequalities in health requires better understanding.

Part of the reason for a lack of any substantial research on this topic in the Chinese context is that until recently data in China were simply not up to the task or were largely unavailable to scholars either inside or outside China. Fortunately, this situation is changing. The investigators on this research project have been involved in a key ongoing data collection effort—the China Health and Retirement Longitudinal Study (CHARLS)—that aims to remedy this situation.

This paper documents in detail the nature of the SES-health gradient in China for the mid-aged and elderly population, aged 45 and over from the CHARLS national baseline, fielded in 2011. The analysis spans many salient measures of health status—including general health status, functional measures of disability (ADLs and IADLs), body pain, body mass index (BMI), hypertension, and survival expectations. In addition to standard measures of

economic status widely used in other country settings, notably schooling, we examine a measure of income, household consumption, which is arguably a much better index of economic wellbeing in a country at the level of economic development that China now is, especially in more rural regions.

This analysis builds on the work of Strauss et al. (2010). They use the first wave Pilot data from CHARLS, that cover only the two provinces of Gansu and Zhejiang. While representative of those two provinces, they are not nationally representative, as is the CHARLS national baseline that we use here. Furthermore, in part because the pilot only covers two provinces and has a much smaller sample, Strauss et al. (2010) were not able to examine how sensitive the health-SES gradient was to respondents with rural versus urban hukou and between different regions in China-coastal versus inland. The main results for the national baseline are broadly consistent with the earlier results from the Pilot CHARLS data, if anything the health-SES gradients are somewhat stronger in the national sample.

The salient nature of the SES-health gradient is not difficult to document. In most countries, at each age those in higher income or wealth groups are in much better health. These differences are quantitatively large. In the US the fraction reporting excellent health among the highest income quartile is 40 percentage points higher than those in the lowest quartile (Smith, 1999). The health-income gradient widens until around age 50 after which it gradually contracts. Similar gradients of this magnitude appear in many other countries, so that the US is not unique. While there is a broad consensus about the ‘facts’, the interpretation of underlying forces creating a strong SES-health gradient and how their relative importance varies across countries at different levels of economic development are controversial.

A basic question in any country is whether differences in health by SES indicators such as education, income, and wealth largely reflect impacts from SES to health, or vice versa. Medical scientists often conclude that the dominant pathway is that variation in SES produces large health disparities for example, Marmot (1999). This view, that the principal direction of causation flows almost exclusively from SES to health, has been challenged (Lleras-Muney, 2005; Cutler and Lleras-Muney, 2010a; Smith, 1999; Strauss, 1986, 1993; Strauss and Thomas, 1995, 1998, 2008; Thomas and Strauss, 1997; Thomas, 2010). The best evidence is in fact that causation goes in both directions, from SES to health and from health to SES.

The major problems besetting many analyses of health-SES gradients is a combination of omitted variables and in some cases reverse causality. Many omitted variables determine both health measures and SES. A good example, the subject of much recent research, is health when very young, which appears to affect health in older ages, but also SES outcomes such as education and incomes as adults (see for example, Barker, 1994; Gluckman and Hanson, 2005; Hoddinott et al., 2008; and Maluccio et al., 2009). With most aging surveys no or limited information is available on respondent health in utero or as a young child. Good health as a child is in general positively correlated with health as older adults (e.g., Smith et al., 2012; Case and Paxson, 2010). Hence if measures of early childhood health are omitted, an upwards bias will be likely be imparted to measured SES such as respondent

education, in regressions of health measures on SES; so the SES gradients will appear to be too steep. Other likely omitted variables, such as preferences for health will likely lead to the same direction of bias. For resource-related variables, notably income, wealth or in our case household per capita expenditures, there may well exist reverse causality from health, both with a lag and contemporaneously (see Strauss, 1986; Thomas and Strauss, 1997; or Thomas et al., 2011 for evidence of contemporaneous relationships and Hoddinott et al., 2008 for evidence on lagged relationships). Since better health seems to result in higher earnings, the coefficients on any resource related variable is also likely to be biased upwards, particularly for those respondents still working (in CHARLS this is more likely to be the younger respondents, those with rural hukou and men). On the other hand, recent careful non-experimental studies such as Lleras-Muney (2005) have established that the influence of education on health status is in part causal.

With these caveats, it is still of much interest to examine the health-SES gradients. As discussed, these correlations will also indicate the degree of socio-economic inequalities in health outcomes and their relationships to inequality in SES, education and resources in particular. Income inequality is now of much policy interest, particularly in China. Health inequality is likely to be of policy interest as well in China, as it is in industrial countries (Deaton, 2013). This paper can be viewed as an initial step in estimating health-SES gradients in China. As panel data in CHARLS accumulates, estimates that better address causality will become possible.

Data and empirical specifications

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.

The CHARLS baseline data represent some major advantages over existing Chinese data. First, CHARLS is nationally representative, which many other related surveys in China are not. Second, many Chinese datasets are not publicly available, though they may be available to some with special connections. One example is the Survey of the Aged Population, which started as a cross-sectional survey and now has a small panel component. The 2002 Nutrition and Health Survey is a specialized health survey of the entire population patterned after the United States' National Health and Nutrition Examination Survey (NHANES), and is another example. Even if they were made public, both have only very scant economic information (e.g., no consumption, poor income and wealth data) with which to examine SES-health relationships, a problem with other data sets. The Chinese Longitudinal Healthy Longevity Survey (CLHLS) is publicly available, but not nationally representative and is far different from an HRS-style survey, particularly in its lack of economic variables such as consumption and wealth and in its few biomarkers collected in the earlier waves. Likewise the World Health Organization's Study on Global Ageing and Adult Health (SAGE), a series of global surveys on the aged, including one for China, is rather light on socio-economic information on income, wealth, retirement and family support. Finally, the China Health and

Nutrition Survey (CHNS) may be the best known household survey on China to the outside world, and has been the workhorse for many scholars. However there are important differences from an HRS survey. CHNS, with only nine provinces, is not nationally representative. It is not an ageing survey, so its sample of elderly is small. Income is also not measured well in CHNS and there are no total consumption data (only food consumption). Moreover, CHARLS has richer health data, particularly on biomarkers. Very important for this study, CHARLS has available numeric codes for primary sampling units so that community-fixed effects regressions may be run while CHNS does not. Hence for our purposes, CHARLS represents a major improvement for the study of health-SES relationships of the elderly in China, and it is publicly available.³ Details on the sampling of the CHARLS national baseline can be found in Zhao et al. (2013).

In each sampled household, we interviewed one person aged 45 and over (randomly chosen if there were more than one), plus their spouse, no matter their age. Some 10,257 households were interviewed, containing 17,587 respondents aged 45 and over and their spouses. The response rate was 80.5% of those households that were chosen to be sampled. This is much better than that of HRS-type surveys in the US and Europe, which now tends to be in the 60% or even 50% range, and compares favorably with other surveys done in Asia.

In this paper, we use data on all respondents 45 year of age and older,⁴ 17,343 respondents. Tables and figures are weighted using individual sample weights, adjusted for household and individual non-response.⁵ All figures are nonparametric and drawn using LOW-ESS. Regressions are run unweighted.

The data collected on self-reported health outcomes, and on biomarkers are used extensively. Specifically, our health measures include a general health measure; a measures of disability (specifically activities of daily living [ADLs] and instrumental activities of daily living [IADLs]) and body pain; body mass index (BMI), underweight and overweight; hypertension and under-diagnosis of hypertension; and survival expectations to age 75 (for those aged 65 and under).⁶ A high or low body mass index (BMI) is associated with higher risk of subsequent mortality (Waller, 1984). Measures of functioning such as ADLs and IADLs have been found to be important health indicators of the elderly. Pain has a high impact on physical, psychological and social health (Elliott et al., 1999; Smith et al., 2001; Verhaak et al., 1998) and studies show an association between the report of widespread pain and subsequent death from cancer in the medium and long term (e.g., Macfarlane et al., 2001). The survival expectations of a persons have been shown to be highly predictive of subsequent mortality (Banks et al., 2009), as have measures of general health.

The SES measures in our regressions include a linear spline in log of household per capita expenditure.⁷ and dummies for education levels. As noted, we use log of household per

³See <http://charls.ccer.edu.cn>.

⁴Spouses who are under 45 years old are dropped from this analysis.

⁵The non-response adjustment is different for self-reported data than for biomarkers because the non-response for biomarkers is larger. See Zhao et al. (2013) for details.

⁶Heights were measured using a lightweight SECA aluminum height board, the SECA 214 portable stadiometer. Weights were measured using a portable digital scale, the Beaver Tech HTS7270. Blood pressure was taken with a digital meter, the Omron HEM 712c meter.

capita expenditure (logPCE) as a measure for the household resource. 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. Per capita 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. Per capita expenditure also tends to be measured with less error than income (Deaton, 1997; Lee, 2009). Because income impacts may be highly nonlinear, even when PCE is in logs, we use a linear spline around the median logPCE.

Education may proxy for many factors. Since we are controlling for an income measure, education will capture factors over and above income. These will include allocative efficiency effects, which may represent better-educated people having better information and their better understanding of what health inputs to choose to ensure good health (Schultz, 1984). Of course education will also be correlated with preferences towards health perhaps in part due to more forward-looking behavior (Fuchs, 1982). Since past health (which would be endogenous) is correlated with current health and is an omitted variable in our analysis, it may be that past health “caused” in part education attainment, so that causation is going in both directions with cross-sectional data.

We also include community, age and month of interview dummies in all the regressions. Community factors have been shown in the literature to play an important role in determining the health-SES gradient (e.g., Strauss et al., 2010). These factors may include health care and other prices, inherent healthiness of the area, public health infrastructure and other factors. We use the primary sampling unit (PSU) as our definition of community. These PSUs are small areas that are likely to be more homogeneous than cities or counties, or certainly than provinces.⁸ In addition to life-cycle progression, age dummies may also capture birth year cohort effects. With only a cross-section, we cannot distinguish the two.^{9,10} As the survey field work spans from July 2011 to March 2012, we control for interview month dummies to deal with potential biases driven by seasonal differences.

All our regressions are separately run by gender, hukou and region to examine heterogeneous effects.¹¹ Tests of pooling are reported for each set of stratifications.¹² While gender differences in health-SES gradients are commonly examined in other countries, disaggregation by hukou and region may be especially important in China. Hukou is the legal residence in China and people with an urban hukou enjoy a lot of benefits (e.g., health

⁷A linear spline allows different slopes to the left and right of the knot point with the two lines being joined at the knot point. The first coefficient reported is the slope to the left of the knot point and the second coefficient is the change in the slope between the two knot points.

⁸In a few cases there was no variation in the dependent variable among observations within the PSU. In these cases we refined the PSU to be a more aggregate area.

⁹Cohort effects would arise because younger birth cohorts have more schooling and also faced better health conditions when they were babies and in the fetus, compared to older cohorts. There is an accumulation of evidence now that better health conditions when young are associated with better health in older age (for instance Barker, 1994; Gluckman and Hanson, 2005; Strauss and Thomas, 2008, for an economist's perspective).

¹⁰To save space, we do not report the coefficients of each age category, month of interview and of each community, but F-tests are reported to show the joint significance of each of these groups of dummies: age, month of interview and community.

¹¹We also investigate whether the SES variables vary in their coefficients by age group, distinguishing older (age 60 and above) from younger (age 45–59). In general we do not find significant SES interactions with age.

¹²The pooling tests test the joint significance of interactions with a group dummy (female, for example) and the education and age dummies, and the logPCE spline variables.

care, social welfare, education) compared to those with a rural hukou. These benefits may in turn affect the associations between health and SES status. Similarly, coastal areas are more economically developed due to more encouraging policy and better geographic environment than inland areas. Therefore, it is important to examine the health-SES gradients along these dimensions.

Throughout this paper, we use ordinary least squares for continuous dependent variables and the linear probability model (LP) for binary dependent variables. LP model estimates are consistent for estimating average partial effects of the regressors, which is our main interest. Robust standard errors of the regression coefficients are computed, that also allow for clustering at the community levels. By using robust standard errors for the linear probability regressions, we ensure that these standard error estimates are consistent (Wooldridge, 2002).

Weighted means and standard errors for the variables used in the regressions are shown in Table A (see Appendix), for the six subsamples (men and women, rural and urban hukou, inland and coastal areas), respectively. Mean respondent age is approximately 60 years, while most respondents are between 45 and 64. Education tends to be low, especially for women and for those with rural hukou. 39 percent of the women and 33% of rural people have no schooling while the numbers for men and for those with urban hukou are only 12% and 9%, respectively. Between inland and coastal areas the fractions with no schooling are approximately equal. On the other hand, the fractions of men and urban people that did complete primary and junior high school and above are much higher than those for women and for rural people. LogPCE is higher for those with urban hukou, and those in coastal areas than for their counterparts.

Results

General health

We first examine self-reported general health. CHARLS followed the HRS example and asked respondents to assess their general health using two different scales: (1) excellent, very good, good, fair, poor, and (2) very good, good, fair, poor, very poor. Here we use the second scale and code it with a dummy variable indicating whether respondents report poor or very poor health. Table 1 displays the distribution of general health by age and sex group. About 23.1% of men and 29.7% of women report that they are in poor or very poor health. The fraction of women reporting poor health is larger than for men, as is common; our other health measures, both self-reports and biomarkers also indicate worse health for women, again commonly observed. For both men and women, the proportion reporting poor or very poor health increases with age. The fraction of respondents reporting fair health is quite high, about 48%. This is one reason why we do not combine fair and poor health as is often done in US studies. Apparently “fair” translates in Chinese to a word which is very commonly answered.

Table 2 presents SES regressions for reported general health. The fraction in poor or very poor health is negatively correlated with education and the effect is stronger for male, rural and coastal respondents than for female, urban and inland respondents.¹³ Stronger education associations for urban and coastal respondents is consistent with schooling being a

complement with better infrastructure and more generous social safety nets (such as health insurance) that are enjoyed by respondents with urban hukou and who live in coastal areas. Self-reported poor or very poor health is also negatively correlated with logPCE with a very non-linear relationship for all the groups but one (urban people).¹⁴ Higher PCE is associated with a lower likelihood of reporting poor health, until the median PCE, at which point the slope becomes close to zero.¹⁵ The fact that the coefficients for low PCE are a little more negative in inland areas and for rural hukou holders is consistent with this non-linearity. Having a rural hukou matters for both men and women and for residents of inland areas. The gender difference in health is only significant among people with rural hukou, with rural women more likely to have poor or very poor health than rural men. Meanwhile, urban men and urban women are more equal regarding general health. The gender difference exists in both inland and coastal areas, and the magnitude is slightly larger in inland areas. The age dummies are strongly significant for all the four groups, indicating either or both age and birth cohort effects. The community fixed effects are also strongly jointly significant. It is also interesting to notice that the inequality of health remains even after we control for community dummies and the pattern is consistent throughout the paper.

Disability and body pain

To make our study comparable with the other studies (e.g., Cutler et al., 2006; Schoeni et al., 2005), we define disability as the presence of any impairment in any of the activities of daily living (ADLs) or instrumental activities of daily living (IADLs). CHARLS includes information on 6 ADL measures: dressing, bathing, eating, walking, toileting, urination and defecations and 5 IADL measures: doing housework, shopping, cooking, managing money and taking medicine. In aggregate, 22.8% of men 45 and over and 30.8% of women suffer from disability (see from Appendix Table A). These disability prevalence rates are comparable to a study of the 2002 HRS population by Cutler and Lleras-Muney (2010b). They find a disability rate of 34% for men and women pooled (HRS surveys people aged 50 and over, plus their spouses). In the CHARLS data the comparable rate for those aged 50 and older is 32.5% (27.4% for men and 37.5% for women). The CHARLS rates are slightly lower than a study of 1348 men and women aged over 60 who were part of the Alumni Health Study in the U.S. and who had been participating in a longitudinal study of risk factors for physical disability since 1986 (Murtagh and Hubert, 2004). Over the lifetime of this study (1986–1999), they find the disability rates of 52% for women and 37% for men (our numbers for the same age groups are 45.4% and 34.6%, respectively). However, CHARLS rates are larger than results in a US study of men and women aged 65 and older using Phase 1 of the National Health Interview Disability Supplement of 1994 and 1995 (NHIS-D), in which 9.5% report ADL disability and 22.7% IADL disability (Cutler et al., 2006) (our numbers for the same age groups are 30.0% and 36.2% for ADL and IADL disability, respectively). The three graphs in the top panel of Fig. 1 present the age pattern of

¹³Pooling tests reported in Table 2 show that the urban-rural hukou coefficient differences are not jointly significant, while those between inland and coastal areas are, at 5%.

¹⁴Note the coefficients of logPCE for those above the median reported are marginal effects in addition to the coefficients for those below the median.

¹⁵We also try other thresholds such as 25 percentile and 75 percentile and the results are quite similar, a strong negative relationship below the threshold, flattening out at higher levels. Differences in R^2 s between specifications using the 25th, 50th and 75th percentiles as knot points are trivially small. If anything the R^2 s are very slightly higher for the knot point at the median.

disability by sex, hukou and region. Overall, the fraction of disability increases with age for all the six groups, from around 10% for those aged 45 to about 50% for those aged 80. This again may reflect a combination effect of age and birth cohort, since older Chinese face far worse health and living conditions when they were very young. From this figure, we also see large differences in disability rates between men and women, rural and urban people as well as inland and coastal ones at all ages. On average, the disadvantage of women versus men and that of inland people versus coastal people are close to 10 percentage points while that of rural people versus urban people is even larger. Another related dimension is measure of body pain. Pain has a high impact on physical, psychological and social health (Elliott et al., 1999; Smith et al., 2001; Verhaak et al., 1998) and studies show an association between the report of widespread pain and subsequent death from cancer in the medium and long term (e.g., Macfarlane et al., 2001). CHARLS respondents were asked about whether they were often troubled with any body pain and if so the level of pain (mild, moderate, or severe). On the whole, 18% of men and 27% of women suffer from moderate or severe body pain (shown in Appendix Table A). The bottom panel of Fig. 1 clearly shows the age pattern of moderate or severe pain across the three groups. Fraction of moderate and severe pain increases with age (and older birth cohorts), but the slope is much smaller than that of disability, meaning that people of all ages suffer from pain. Again here, we see disadvantage of women versus men, rural versus urban, and inland versus coastal areas. The youngest women (aged 45) have similar fractions of moderate and severe pain to the oldest men (aged 80), likewise for the youngest rural people and inland people to the oldest urban people and coastal people.

Regressions for any ADL or IADL disability are shown in Table 3. There is an obvious negative gradient in education and logPCE among all the groups. The logPCE effect is again nonlinear for both men and women, being negatively correlated with reported pain for logPCE below the median and flattening out to near zero for those above the median. Unlike for general health, there do not appear to be large gradient differences across the groups, except perhaps for logPCE which shows a steeper gradient for men and for urban respondents. Rural residence positively matters for both men and women, while women are disadvantaged in all the four groups (rural, urban, inland and coastal). The community fixed effects are strongly jointly significant, as is true for our other regressions.

Table 4 reports the analysis of moderate or severe pain for men and women. For education, only higher levels of education, at junior high school and above, is associated with reporting less moderate or severe pain, and the education variables are jointly significant for all the groups but men. The same nonlinear relationship we saw for logPCE in the previous results are repeated here. Higher logPCE is strongly negatively associated with moderate or severe pain, at levels of logPCE below the median, and then the curve flattens. Tests of pooling fail to reject significant joint SES differences for any of these groups. Both men and women with rural hukou report more moderate or serious pain than their urban counterparts. Women of each group are more likely to suffer from moderate or severe pain. The community fixed effects continue to show strong joint significance.

BMI

BMI is measured as weight (in kilograms) divided by height squared (in meters). Extreme values of BMI may be related to hypertension, diabetes, and in general to higher adult mortality (Waller, 1984). Across countries, the BMI distribution is shifted to the right for countries with higher incomes. Strauss and Thomas (2008) demonstrate in five developing countries that for men, BMI rises with more education. In the US, the relationship is reversed. For women the story is quite different. Again, the US excepting, for low levels of schooling for women, BMI rises with education, but at higher levels, it falls. It may be that at higher levels of female schooling, women recognize the health benefits of reducing their BMI. Why this is not the case for men is a key question for future research.

Fig. 2 shows the distribution of BMI by gender, hukou and region. The distribution for women is shifted to the right of men. We also show the densities for urban and rural hukou holders and for respondents living in coastal versus inland areas. The urban hukou density is shifted to the right compared to respondents with rural hukou and the same is true, to a lesser extent, for respondents in coastal areas versus inland. Fig. 3 further shows the age pattern of being underweight, overweight and obese by sex, hukou and region separately. As shown, the fraction overweight is much higher than fraction underweight and obese for all the groups, indicating that while malnutrition is less of a problem than before in China, overnutrition has become more so. Meanwhile, the overweight prevalence is higher for female, urban, coastal respondents than that of male, rural and inland ones. The fact that a higher fraction of women are overweight compared to men is a common result found in many other countries (see Strauss and Thomas, 2008). As urban and coastal areas represent more developed areas, the pattern shown here is also consistent with the observation by Strauss and Thomas (2008) that BMI is higher in areas with higher incomes. Women are not only more prone to be overweight but also obese. Note too that underweight is still a problem, and particularly so for the older population, those 75 years and over, for whom approximately 17% are underweight. Once again, this may represent birth cohort effects, at least in part. The regressions place emphasis on the extreme values of BMI—underweight and overweight.

Table 5 gives the analysis of underweight, again by gender, hukou and region, respectively. Education has no association with being underweight. LogPCE is again negatively correlated with underweight for both genders for those whose logPCE is below the median, and again the relationship disappears for those whose logPCE is above the median. Rural hukou matters only for men and for people living in inland areas. Rural men are more likely to be underweight than urban men and rural inland people are more likely to be underweight than urban inland people.

Regressions for overweight are presented in Table 6. Education has no association with being overweight for all the other groups but men. Men with junior high school and above show a higher probability of overweight and the education dummies are jointly significant at 5%. The fact that education has no association with being overweight for women, but has a positive association for men, while not showing the inverse-U shape for women described in Strauss and Thomas (2008), is still consistent in part. The effect of logPCE is positively correlated with being overweight for people whose logPCE is under the median level and

flattens out for those above the median again with an exception of the urban group. Thus the logPCE relationship is quite different and much stronger than for education. This may largely reflect historical experiences in China with famine, and associated effects on respondent preferences. Consistent with the results for underweight, hukou matters only for men and for inland people, among whom having a rural hukou associates with lower probability of being overweight.

Hypertension and Its under-diagnosis

Along with BMI, blood pressure is an indicator of risk of coronary heart disease. Respondents were measured three times for blood pressure in the survey. We take the mean of systolic and diastolic measurements separately and then form a variable for being hypertensive if the mean systolic is 140 or greater or the mean diastolic is 90 or greater. These are the conventional international cutoffs for high blood pressure, or hypertension. Also persons who report that they have been diagnosed with hypertension by a doctor are classified as hypertensive, including those who take medications for hypertension.¹⁶ Since we combine biomarker measurements and self-reported hypertension, our sample here exclude respondents that did not participate in the physical examination, but in the descriptive tables sample weights include an adjustment for non-response. On the whole, 41% of men and 45% of women aged 45 and above in China are hypertensive (Appendix Table A). The hypertension rate increases with age for both genders, but especially so for women over age 64 (Fig. 4). Women are more likely to be hypertensive than men starting at age 55 and the fraction being hypertensive reaches up to 70% for women older than 75. Consistent with the pattern of BMI, people with urban hukou and those in coastal areas tend to have a higher hypertension rate than those with rural hukou and those living in inland areas.

An important policy issue that emerges from the health transition that China has been going through is that chronic diseases tend to be under-diagnosed, at least during this transition period. Other countries that are undergoing the health transition seem to be experiencing a similar phenomenon (e.g., Witoelar et al., 2012; Lee et al., 2012; and Parker et al., 2010; for evidence on Indonesia, India and Mexico, respectively). Hypertension turns out to be a good example of the degree of under-diagnosis of disease among the elderly in China. We calculate the proportion of hypertensive people who report not being diagnosed, shown in Appendix Table A. Among those who have hypertension, 43% of men and 41% of women are under-diagnosed. This seems large, although estimates for Indonesia and India are much higher. In Indonesia undiagnosed rates are 74% for men and 62% for women (Witoelar et al., 2012), for India they are 67% for men and 62% for women (Lee et al., 2012), for Mexico they are also high (Parker et al., 2010). One interpretation is that the health system in China is not yet set up to focus on chronic conditions of the elderly, perhaps because the emphasis is on infectious disease and on children and mothers. Additional research will be required to examine this issue more properly. As seen in Fig. 4, the under-diagnosis rate of the youngest

¹⁶Because of the way the questionnaire is designed, those who report taking medicines are a subset of those who report a positive doctor diagnosis.

and the oldest groups is higher and the middle group is lower. Rural people tend to have higher rate of under-diagnosis, especially for the elderly above 60.

In addition to undiagnosed disease, another key health issue is good adherence to treatment when the disease is diagnosed (Goldman and Smith, 2002). Appendix Table A also shows that 78% of men and 82% of women, who have hypertension by our definition, and report having been diagnosed, are taking medications. Thus, conditional on being diagnosed a preponderance of respondents is taking medications. However, those who are undiagnosed are not. The bottom panel of Fig. 4 also shows the age patterns of treatment for different groups. While there is no big gender difference, rural and inland people seem to be less likely to get treatment once they are hypertensive.

Table 7 displays the regressions predicting being hypertensive. SES gradients exist only for men and for respondents with urban hukou and then only for schooling. Men and urban people finishing primary school are more likely to have hypertension, but this positive association disappears for respondents with junior high school or more schooling. In rural and in inland areas, women are more hypertensive than men, and the gender difference is not significant in urban and coastal areas. Having an urban hukou is positively associated with hypertension in coastal areas, but not elsewhere. As always, the age and community fixed effects are jointly significant.

In Table 8, using the sample of people who have measured or self-reported diagnosis of hypertension, we regress a dummy of not being diagnosed on the same set of covariates used in the other regressions for all the six subsamples, respectively. Education is jointly significantly associated with under-diagnosis only for those with rural hukou. For this group having more schooling is associated with a lower probability of being under-diagnosed, perhaps because better educated respondents are more likely to go to health practitioners. The effect of logPCE is not significant for any of the groups. Women are more likely to have their hypertension diagnosed, this association is significant for all groups except for those with urban hukou. Having a rural hukou is significantly, positively associated with a higher rate of under-diagnosis for both men and women, and respondents in coastal and inland areas. This speaks to the worse health infrastructure and less generous health insurance for those with rural hukou. Consistent with this interpretation, the community fixed effects are jointly significant except for the urban subsample. While the SES differentials are not so large, some do exist, particularly with respect to education. This is a health policy area where improvements seem possible, although more research is needed to fill in more details.

Survival expectations

In CHARLS, as in the HRS, we ask respondents about the chances that they expect to live to a particular age. Respondents answer the question on a five point scale, from 1 “almost impossible”, to 5 “almost certain”.¹⁷ Experience with HRS and other ageing surveys have shown that answers to this question are highly correlated with survival to subsequent waves (for example, see Banks et al., 2009). The future age about which each respondent is asked

¹⁷We do not ask probabilities directly since our pretest experience, and experience in other low- income countries indicated a real difficulty for respondents to understand probabilities.

depends on their current age. Older respondents are asked about survival to older ages. This raises an issue in that answers across respondents who were asked about different ages may not therefore correspond. Here we take respondents under age 65, all of whom were asked about survival to age 75, so that this issue does not arise. We construct our dependent variable to indicate whether the respondent thinks it is not very likely, or almost impossible, to reach age 75, the two lowest scores.

Regressions are reported in Table 9. Higher education is associated with a higher level of confidence of reaching age 75 for all the six groups. For men, education of junior high school and above leads to better expectations. For women, there is a distinct education gradient in survival expectations, starting with “can read or write” (some primary school). For rural and inland people, obtaining a primary school education and above makes a difference, while for urban people, the cutoff point is higher (junior high) and that for coastal areas is lower (can read and write). Expectations also improve with higher logPCE for all the groups, but yet again, flatten out for those above median logPCE. Women in all groups, except for those with an urban hukou, report being less likely to live to 75. Having a rural hukou is associated with a lower probability of survival to 75 for women and those living inland. Presumably these SES gradients result from the fact that real health variables which may be related to likely future mortality have SES gradients, as we have seen. Then one puzzle is for women’s expectations; we do not have an answer for that finding.

Conclusions

This paper has presented estimates of the health-SES gradient of the mid-aged and elderly in China using multiple measures of health and of SES. China has undergone a significant health and nutrition transition such that under-nutrition is much less of a problem for the elderly than it had been in the past and overnutrition has become much more of an issue. In China, where the CHARLS baseline was fielded, good health conditions of the elderly, such as better general health, less disability, less body pain, and positive survival expectations are all correlated positively with education for both genders while being overweight and hypertension is correlated only for men; with better education being associated with better health outcomes except for hypertension. Evidence for correlation between being underweight and education is not found in this paper. The correlations of health measures with income, as measured by log of per capita expenditure, are strongly significant for all health outcomes for both genders except for hypertension and for women, disability. In virtually all of our cases, logPCE is positively correlated with better health measures, for respondents with logPCE less than the sample median, and is flat for those above the median. These relationships are not significantly different between the mid-aged 45–59 and the elderly 60 and above.

We find some evidence for differential SES gradients between respondents with rural and urban hukou and respondents living in coastal versus inland areas, however the patterns of coefficient differences are not uniform. We cannot say, for example, that better educated respondents with urban hukou always have a stronger health-SES gradient compared to those with rural hukou.

As found in most studies, women are found to have poorer health outcomes than men, both for self-reported and measured health outcomes. One of the most important findings in this analysis is the apparent importance of community factors. In general respondents in rural areas have worse health outcomes than those in urban areas, both for men and women and within the coastal and inland areas. Moreover, community fixed effects are almost always significant. What exactly lies behind this is not yet clear and needs to be the subject of future research. See Smith et al. (2013) for a start, using the CHARLS data. From economic theory there are a number of factors that should be part of the story. Prices of health inputs and of other commodities is surely one such factor, as should be the availability and quality of health care services. Public health infrastructure should be another such factor, as should the inherent healthiness of a community due to factors like water, sanitation and air quality. Different and changing food or diet preferences are also no doubt related to these findings. Given the strength of the relationships, however, it may well be that there are other community influences that are important, including factors that related to social interaction and stress, that are particularly important in China. However at this point, all of these hypotheses represent speculation.

The other important finding in this research is the large-scale under-diagnosis of hypertension, which is correlated negatively with education in rural areas. It is lower for women, higher for respondents with rural hukou and is most strongly correlated with community location for all the people except for women with urban hukou. This represents a major health system gap and one which is probably more serious for other, less prevalent, chronic conditions of the elderly. This problem is certainly not unique to China and seems to exist in other countries that are still in the midst of the health transition from infectious to chronic diseases. Health systems in such health transition countries apparently take time to re-orient their systems to diagnose and treat chronic diseases of the ageing and aged. This is an important step that the health systems in China will need to work out in the future.

Appendix A

Table A.

Means and standard deviations of variables, by sex, hukou and region.

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
<i>Demographics</i>						
Age	59.8	59.64	59.37	60.5	60.02	59.25
(Standard error)	−0.245	−0.296	−0.236	−0.449	−0.21	−0.445
Aged 45–49	0.2	0.22	0.22	0.2	0.2	0.22
Aged 50–54	0.15	0.15	0.16	0.13	0.14	0.17
Aged 55–59	0.2	0.2	0.2	0.2	0.19	0.21
Aged 60–64	0.16	0.15	0.16	0.15	0.16	0.14
Aged 65–69	0.11	0.09	0.1	0.1	0.11	0.08
Aged 70–74	0.09	0.08	0.07	0.1	0.09	0.07
Aged 75+	0.1	0.12	0.1	0.12	0.11	0.11
Illiterate	0.12	0.39	0.33	0.09	0.27	0.24

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
Can read or write	0.17	0.16	0.2	0.1	0.16	0.17
Finished primary	0.25	0.17	0.22	0.18	0.21	0.21
Junior high or above	0.46	0.27	0.25	0.64	0.36	0.38
LogPCE	9.07	9.11	8.82	9.76	8.95	9.31
(Standard error)	-0.053	-0.062	-0.043	-0.094	-0.05	-0.095
<i>Health Outcomes</i>						
Health poor/very poor	0.22	0.27	0.27	0.19	0.28	0.21
ADL/IADL disability	0.23	0.31	0.3	0.19	0.3	0.22
Moderate/severe pain	0.18	0.27	0.26	0.15	0.25	0.18
BMI	23.24	24.49	23.45	25.05	23.47	24.52
(Standard error)	-0.101	-0.402	-0.143	-0.505	-0.098	-0.532
Underweight	0.06	0.07	0.07	0.04	0.08	0.05
Overweight	0.28	0.38	0.3	0.43	0.31	0.37
Hypertension	0.41	0.45	0.41	0.49	0.41	0.47
Under-diagnosis	0.43	0.41	0.44	0.36	0.4	0.44
Treatment	0.78	0.82	0.77	0.86	0.78	0.84
Not very likely/almost impossible to reach 75	0.19	0.24	0.26	0.12	0.26	0.16

Sample includes respondents 45 and older.

All weighted at individual level with household and response adjustment except BMI, underweight, overweight, hypertension, and under-diagnosis of hypertension.

BMI, underweight, overweight, hypertension, and under-diagnosis of hypertension are weighted by biomarker individual level with household and response adjustment.

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Weighted at individual level with household and response adjusted

Fig. 1.
Any disability and moderate or severe pain against age.

Fig. 2.
Distribution of BMI.

Weighted at individual level with household and response adjusted

Fig. 3.
Underweight, overweight and obese against age.

Fig. 4.
Hypertension, under-diagnosis and taking medication against age.

Self-reported health, by age and sex.

Table 1

	Men					Women					N
	Very good	Good	Fair	Poor	Very poor	Very good	Good	Fair	Poor	Very poor	
45-49	11.4 (1.4)	24.4 (1.8)	50.7 (2.4)	11.2 (1.1)	2.2 (0.4)	1553 (0.8)	20.3 (1.7)	51.9 (1.8)	18.4 (1.6)	2.3 (0.4)	1893
50-54	11.1 (1.7)	23.9 (1.9)	48.0 (2.4)	14.9 (1.2)	2.1 (0.4)	1250 (1.7)	15.6 (1.4)	52.0 (2.2)	21.3 (1.5)	3.5 (0.5)	1310
55-59	10.1 (1.8)	21.9 (1.4)	45.7 (1.7)	19.0 (1.3)	3.4 (0.5)	1736 (1.6)	18.6 (2.5)	46.7 (2.0)	24.0 (1.4)	4.2 (0.5)	1802
60-64	6.6 (0.7)	17.4 (1.3)	48.5 (1.7)	22.9 (1.7)	4.6 (0.7)	1439 (0.7)	14.9 (1.2)	48.3 (1.7)	25.6 (1.3)	6.4 (0.8)	1448
65-69	5.9 (0.9)	16.7 (1.4)	52.9 (2.5)	21.0 (1.7)	3.5 (0.6)	950 (0.8)	10.0 (1.2)	46.2 (2.2)	33.6 (2.4)	6.4 (0.9)	892
70-74	6.3 (1.4)	12.8 (1.7)	48.8 (2.7)	25.3 (2.1)	6.8 (1.2)	713 (1.2)	15.0 (1.7)	44.7 (2.4)	28.5 (2.1)	6.9 (1.2)	655
75+	3.2 (0.8)	14.7 (1.7)	44.6 (2.7)	29.2 (2.7)	8.3 (1.5)	730 (0.9)	14.8 (1.5)	39.7 (2.2)	31.5 (2.2)	9.3 (1.3)	821
Total	8.5 (0.6)	19.9 (0.8)	48.4 (0.9)	19.2 (0.6)	3.9 (0.3)	8371 (0.5)	16.5 (0.8)	47.9 (0.9)	24.7 (0.8)	5.0 (0.4)	8821

Weighted at individual level with household and response adjustment.

Sample includes respondents 45 and older.

Table 2

Regressions for self-reported health poor or very poor.

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
	(1)	(2)	(3)	(4)	(5)	(6)
Can read and write	-0.043** (0.018)	0.006 (0.015)	-0.018 (0.011)	0.025 (0.037)	0.008 (0.014)	-0.057*** (0.016)
Finished primary	-0.062*** (0.017)	-0.022 (0.015)	-0.040*** (0.012)	-0.024 (0.029)	-0.027* (0.014)	-0.064*** (0.016)
Junior high and above	-0.097*** (0.018)	-0.053*** (0.015)	-0.065*** (0.012)	-0.084*** (0.026)	-0.051*** (0.014)	-0.111*** (0.017)
LogPCE (<median)	-0.071*** (0.013)	-0.041*** (0.012)	-0.055*** (0.010)	-0.046 (0.029)	-0.061*** (0.011)	-0.051*** (0.018)
LogPCE (>median, marginal)	0.083*** (0.016)	0.041*** (0.015)	0.067*** (0.013)	0.039 (0.032)	0.072*** (0.014)	0.050** (0.021)
Female			0.048*** (0.009)	0.017 (0.013)	0.045*** (0.009)	0.036*** (0.011)
Rural hukou	0.032** (0.016)	0.032** (0.016)			0.040*** (0.014)	0.010 (0.020)
<i>F</i> -Tests						
Age dummies	14.50***	15.93***	18.68***	4.56***	19.25***	7.54***
(<i>p</i> -value)	0.000	0.000	0.000	0.000	0.000	0.000
Education dummies	10.30***	5.82***	9.60***	8.46***	6.68***	14.09***
(<i>p</i> -value)	0.000	0.001	0.000	0.000	0.000	0.000
LogPCE splines	15.02***	6.42***	16.08***	3.05**	16.52***	4.75**
(<i>p</i> -value)	0.000	0.002	0.000	0.049	0.000	0.011
Community FE	1.94***	2.48***	3.44***	1.18	3.01***	3.57***
(<i>p</i> -value)	0.000	0.000	0.035	0.035	0.035	0.000
I Interview month dummies	6.36***	1.19	3.24***	3.43***	3.90***	2.73***
(<i>p</i> -value)	0.000	0.304	0.001	0.001	0.000	0.007

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
Pooling test	1.86**		1.32		1.92**	
(<i>p</i> -value)	0.035		0.198		0.028	
Observations	8287	8719	13,222	3784	11,210	5796
<i>R</i> -Squared	0.040	0.026	0.036	0.033	0.037	0.038

Standard errors in parentheses, all clustered at community level.

LogPCE (>median, marginal) represents the change in the slope from the interval for logPCE below the median.

Sample includes respondents 45 and older. Age and community dummies are controlled in the regressions.

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

Table 3

Regressions for disability (any ADL or IADL).

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
	(1)	(2)	(3)	(4)	(5)	(6)
Can read and write	-0.030 (0.021)	-0.022 (0.016)	-0.022* (0.012)	-0.094*** (0.036)	-0.032** (0.015)	-0.029 (0.018)
Finished primary	-0.086*** (0.020)	-0.089*** (0.017)	-0.085*** (0.013)	-0.128*** (0.036)	-0.105*** (0.016)	-0.067*** (0.019)
Junior high and above	-0.113*** (0.020)	-0.124*** (0.019)	-0.114*** (0.014)	-0.169*** (0.033)	-0.125*** (0.017)	-0.118*** (0.021)
LogPCE (<median)	-0.076*** (0.012)	-0.023* (0.012)	-0.041*** (0.009)	-0.092* (0.050)	-0.049*** (0.012)	-0.045*** (0.017)
LogPCE (>median, marginal)	0.090*** (0.014)	0.026* (0.014)	0.054*** (0.011)	0.082 (0.054)	0.056*** (0.014)	0.054*** (0.019)
Female			0.069*** (0.009)	0.020* (0.011)	0.061*** (0.009)	0.053*** (0.012)
Rural hukou	0.040*** (0.015)	0.045** (0.021)			0.070*** (0.015)	-0.010 (0.028)
<i>F</i> -Tests						
Age dummies	40.29***	56.66***	72.38***	22.66***	58.19***	28.10***
(<i>p</i> -value)	0.000	0.000	0.000	0.000	0.000	0.000
Education dummies	16.19***	17.28***	31.07***	9.38***	25.34***	11.78***
(<i>p</i> -value)	0.000	0.000	0.000	0.000	0.000	0.000
LogPCE splines	21.64***	1.93	11.43***	3.94**	8.34***	4.06**
(<i>p</i> -value)	0.000	0.147	0.000	0.021	0.000	0.020
Community FE	2.88***	3.55***	4.95***	1.63***	5.13***	5.12***
(<i>p</i> -value)	0.000	0.011	0.000	0.011	0.000	0.011
I Interview month dummies	2.72***	3.31***	3.85***	6.41***	2.92***	4.95***
(<i>p</i> -value)	0.005	0.001	0.000	0.000	0.003	0.000

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
Pooling test	2.17 **		2.59 ***		1.56 *	
(<i>p</i> -value)	0.011		0.002		0.095	
Observations	8280	8716	13,216	3780	11,201	5795
<i>R</i> -Squared	0.094	0.097	0.105	0.093	0.107	0.101

Standard errors in parentheses, all clustered at community level.

LogPCE (>median, marginal) represents the change in the slope from the interval for logPCE below the median.

Sample includes respondents 45 and older. Age and community dummies are controlled in the regressions.

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

Table 4

Regressions for moderate or severe body pain.

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
	(1)	(2)	(3)	(4)	(5)	(6)
Can read and write	0.002 (0.017)	0.006 (0.015)	-0.006 (0.012)	0.020 (0.036)	0.007 (0.014)	-0.020 (0.017)
Finished primary	-0.013 (0.017)	-0.013 (0.015)	-0.016 (0.012)	-0.013 (0.031)	-0.013 (0.015)	-0.028* (0.016)
Junior high and above	-0.059*** (0.017)	-0.026 (0.016)	-0.039*** (0.012)	-0.067** (0.027)	-0.042*** (0.014)	-0.059*** (0.016)
LogPCE (<median)	-0.039*** (0.011)	-0.035*** (0.011)	-0.031*** (0.008)	-0.080** (0.036)	-0.032*** (0.009)	-0.046*** (0.014)
LogPCE (>median, marginal)	0.045*** (0.013)	0.026* (0.013)	0.028*** (0.010)	0.081** (0.039)	0.035*** (0.012)	0.035** (0.016)
Female			0.095*** (0.008)	0.063*** (0.011)	0.093*** (0.008)	0.082*** (0.010)
Rural hukou	0.028* (0.015)	0.047** (0.022)			0.048*** (0.016)	0.015 (0.026)
F-Tests						
Age dummies	1.60	4.38***	4.86***	0.22	1.97*	3.12***
(p-value)	0.147	0.000	0.000	0.972	0.071	0.008
Education dummies	9.91***	1.42	3.88***	7.90***	4.61***	5.16***
(p-value)	0.000	0.236	0.010	0.000	0.004	0.002
LogPCE splines	6.67***	8.00***	8.31***	2.49*	5.78***	7.48***
(p-value)	0.001	0.000	0.000	0.085	0.004	0.001
Community FE	3.18***	3.66***	5.59***	1.64***	5.35***	4.41***
(p-value)	0.000	0.000	0.136	0.000	0.136	0.136
I Interview month dummies	2.79***	1.88*	6.68***	17.29***	4.39***	347.68***
(p-value)	0.004	0.055	0.000	0.000	0.000	0.000
Pooling test	1.45		1.12		0.93	

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
(<i>p</i> -value)	0.136		0.340		0.519	
Observations	8264	8689	13,180	3773	11,174	5779
<i>R</i> -Squared	0.014	0.012	0.027	0.026	0.027	0.033

Standard errors in parentheses, all clustered at community level.

LogPCE (>median, marginal) represents the change in the slope from the interval for logPCE below the median.

Sample includes respondents 45 and older. Age and community dummies are controlled in the regressions.

*
p < .1.
**
p < .05.

p < .01.

Table 5

Regressions for underweight.

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
	(1)	(2)	(3)	(4)	(5)	(6)
Can read and write	-0.016 (0.014)	0.009 (0.010)	0.003 (0.008)	0.003 (0.023)	0.006 (0.009)	-0.012 (0.012)
Finished primary	-0.014 (0.014)	-0.012 (0.008)	-0.006 (0.008)	-0.014 (0.019)	-0.008 (0.009)	-0.014 (0.011)
Junior high and above	-0.006 (0.013)	0.000 (0.008)	-0.001 (0.008)	0.005 (0.020)	0.006 (0.009)	-0.011 (0.010)
LogPCE (<median)	-0.030*** (0.008)	-0.017** (0.008)	-0.022*** (0.006)	-0.021 (0.017)	-0.022*** (0.007)	-0.028*** (0.010)
LogPCE (>median, marginal)	0.025** (0.010)	0.014 (0.009)	0.020*** (0.007)	0.015 (0.019)	0.025*** (0.008)	0.015 (0.011)
Female			0.001 (0.006)	-0.001 (0.008)	0.004 (0.006)	-0.007 (0.007)
Rural hukou	0.021** (0.010)	-0.002 (0.010)			0.021*** (0.008)	-0.005 (0.014)
<i>F</i> -Tests						
Age dummies	12.45***	16.54***	26.69***	3.36***	19.69***	7.23***
(<i>p</i> -value)	0.000	0.000	0.000	0.003	0.000	0.000
Education dummies	0.77	1.67	0.44	1.13	1.54	0.61
(<i>p</i> -value)	0.513	0.173	0.726	0.336	0.207	0.610
LogPCE splines	9.11***	3.27**	7.05***	2.36*	5.02***	16.11***
(<i>p</i> -value)	0.000	0.039	0.001	0.097	0.007	0.000
Community FE	1.85***	1.89***	2.29***	1.65***	2.84***	1.28
(<i>p</i> -value)	0.000	0.000	0.000	0.000	0.000	0.622
I Interview month dummies	5.94***	1.48	5.92***	3.29***	5.90***	3.24***
(<i>p</i> -value)	0.000	0.154	0.000	0.001	0.000	0.003
Pooling test	0.84		2.53***		1.73*	

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
(<i>p</i> -value)	0.622		0.003		0.055	
Observations	6292	6957	10,715	2534	8814	4435
<i>R</i> -Squared	0.037	0.037	0.039	0.021	0.034	0.044

Standard errors in parentheses, all clustered at community level.

LogPCE (>median, marginal) represents the change in the slope from the interval for logPCE below the median. Sample includes respondents 45 and older. Age and community dummies are controlled in the regressions.

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

Table 6

Regressions for overweight.

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
	(1)	(2)	(3)	(4)	(5)	(6)
Can read and write	-0.000 (0.019)	-0.005 (0.017)	-0.012 (0.013)	0.018 (0.044)	0.001 (0.014)	-0.032 (0.022)
Finished primary	0.021 (0.018)	0.000 (0.019)	-0.002 (0.014)	0.029 (0.040)	0.006 (0.014)	-0.014 (0.028)
Junior high and above	0.044** (0.020)	-0.024 (0.020)	0.014 (0.016)	-0.025 (0.035)	0.005 (0.017)	-0.004 (0.025)
LogPCE (<median)	0.050*** (0.011)	0.044*** (0.012)	0.041*** (0.008)	0.065 (0.046)	0.037*** (0.010)	0.068*** (0.016)
LogPCE (>median, marginal)	-0.053*** (0.014)	-0.059*** (0.015)	-0.055*** (0.011)	-0.063 (0.050)	-0.047*** (0.012)	-0.080*** (0.020)
Female				0.124*** (0.021)	0.097*** (0.012)	0.114*** (0.017)
Rural hukou	-0.066*** (0.020)	-0.005 (0.022)			-0.058*** (0.018)	-0.014 (0.026)
F-Tests						
Age dummies	8.16***	14.24***	19.78***	3.42***	16.22***	4.09***
(p-value)	0.000	0.000	0.000	0.003	0.000	0.001
Education dummies	2.74**	0.62	1.02	1.53	0.07	0.83
(p-value)	0.044	0.603	0.384	0.208	0.977	0.483
LogPCE splines	9.77***	8.06***	13.73***	1.16	7.69***	8.57***
(p-value)	0.000	0.000	0.000	0.314	0.001	0.000
Community FE	2.05***	2.52***	3.09***	1.18	3.13***	2.84***
(p-value)	0.000	0.000	0.000	0.747	0.000	0.000
I Interview month dummies	4.98***	6.13***	30.36***	1.76*	1.33	12.42***
(p-value)	0.000	0.000	0.000	0.086	0.229	0.000
Pooling test	3.57***		4.72***		0.92	

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	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
(<i>p</i> -value)	0.000		0.000		0.534	
Observations	6292	6957	10,715	2534	8814	4435
<i>R</i> -Squared	0.026	0.021	0.042	0.017	0.032	0.035

Standard errors in parentheses, all clustered at community level.

LogPCE (>median, marginal) represents the change in the slope from the interval for logPCE blow the median.

Sample includes respondents 45 and older. Age and community dummies are controlled in the regressions.

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

Table 7

Regressions for hypertension.

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
	(1)	(2)	(3)	(4)	(5)	(6)
Can read and write	0.019 (0.021)	0.002 (0.017)	-0.003 (0.014)	-0.002 (0.043)	-0.010 (0.016)	0.006 (0.021)
Finished primary	0.061*** (0.022)	-0.006 (0.019)	0.008 (0.015)	0.066* (0.035)	0.012 (0.016)	0.019 (0.026)
Junior high and above	0.023 (0.021)	-0.013 (0.019)	0.009 (0.015)	-0.016 (0.032)	-0.003 (0.017)	-0.004 (0.022)
LogPCE (<median)	0.020 (0.015)	0.002 (0.013)	0.012 (0.010)	-0.024 (0.031)	0.005 (0.012)	0.020 (0.018)
LogPCE (>median, marginal)	-0.022 (0.019)	-0.008 (0.015)	-0.013 (0.013)	0.017 (0.033)	-0.008 (0.014)	-0.024 (0.022)
Female			0.051*** (0.011)	0.014 (0.019)	0.054*** (0.011)	0.021 (0.018)
Rural hukou	-0.030 (0.022)	-0.006 (0.027)			0.001 (0.020)	-0.066** (0.029)
F-Tests						
Age dummies	35.60***	85.62***	78.83***	28.70***	68.36***	37.59***
(<i>p</i> -value)	0.000	0.000	0.000	0.000	0.000	0.000
Education dummies	3.14**	0.21	0.28	3.02**	0.86	0.42
(<i>p</i> -value)	0.026	0.891	0.841	0.031	0.463	0.740
LogPCE splines	0.85	0.54	0.67	0.61	0.18	0.65
(<i>p</i> -value)	0.427	0.582	0.511	0.546	0.838	0.524
Community FE	1.96***	2.01***	2.89***	1.33**	3.00***	2.48***
(<i>p</i> -value)	0.000	0.000	0.000	0.000	0.000	0.000
I Interview month dummies	3.33***	19.51***	289.65***	91.12***	8.33***	150.88***
(<i>p</i> -value)	0.001	0.000	0.000	0.000	0.000	0.000
Pooling test	5.14***		1.97**		1.19	

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
(<i>p</i> -value)	0.000		0.023		0.283	
Observations	6470	7149	10,989	2630	9073	4546
<i>R</i> -Squared	0.044	0.090	0.064	0.081	0.064	0.068

Standard errors in parentheses, all clustered at community level.

LogPCE (>median, marginal) represents the change in the slope from the interval for logPCE below the median.

Sample includes respondents 45 and older. Age and community dummies are controlled in the regressions.

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

Table 8

Regressions for underdiagnose of hypertension.

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
	(1)	(2)	(3)	(4)	(5)	(6)
Can read and write	-0.073** (0.036)	-0.042 (0.030)	-0.057** (0.023)	0.030 (0.062)	-0.055** (0.027)	-0.040 (0.035)
Finished primary	-0.031 (0.035)	-0.047 (0.031)	-0.042* (0.025)	0.071 (0.060)	-0.043 (0.027)	-0.013 (0.039)
Junior high and above	-0.067* (0.036)	-0.043 (0.032)	-0.067** (0.026)	0.071 (0.054)	-0.058** (0.029)	-0.037 (0.037)
LogPCE (<median)	0.002 (0.023)	-0.026 (0.019)	-0.008 (0.016)	-0.046 (0.046)	-0.005 (0.019)	-0.017 (0.023)
LogPCE (>median, marginal)	-0.015 (0.029)	0.030 (0.024)	0.007 (0.019)	0.045 (0.052)	-0.002 (0.023)	0.021 (0.027)
Female			-0.084*** (0.018)	-0.037 (0.026)	-0.074*** (0.019)	-0.070*** (0.024)
Rural hukou	0.059* (0.034)	0.099*** (0.033)			0.084*** (0.029)	0.083* (0.047)
F-Tests						
Age dummies	3.78***	4.06***	3.91***	1.22	1.23	3.35***
(p-value)	0.001	0.001	0.001	0.297	0.293	0.005
Education dummies	1.97	1.07	2.69**	0.65	1.85	0.66
(p-value)	0.118	0.360	0.047	0.586	0.139	0.579
LogPCE splines	0.59	0.91	0.13	0.53	0.47	0.30
(p-value)	0.556	0.404	0.882	0.587	0.626	0.742
Community FE	1.43***	1.47***	1.77***	1.14	1.77***	1.74***
(p-value)	0.000	0.079	0.000	1.509	0.000	0.000
I Interview month dummies	88.59***	3.69***	3.70***	32.09***	4.15***	61.40***
(p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Pooling test	1.62*		0.84		0.87	

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
(<i>p</i> -value)	0.079		0.616		0.590	
Observations	2530	3015	4294	1251	3612	1933
<i>R</i> -Squared	0.025	0.021	0.019	0.028	0.017	0.041

Standard errors in parentheses, all clustered at community level.

LogPCE (>median, marginal) represents the change in the slope from the interval for logPCE below the median.

Sample includes respondents 45 and older. Age and community dummies are controlled in the regressions.

* $p < .1$.

**

$p < .05$.

$p < .01$.

Table 9

Regressions for not very likely or almost impossible to reach 75.

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
	(1)	(2)	(3)	(4)	(5)	(6)
Can read and write	0.005 (0.030)	-0.043** (0.020)	-0.025 (0.017)	-0.089 (0.061)	-0.015 (0.019)	-0.051* (0.027)
Finished primary	-0.033 (0.028)	-0.073*** (0.019)	-0.057*** (0.018)	-0.091 (0.058)	-0.041** (0.018)	-0.097*** (0.032)
Junior high and above	-0.092*** (0.028)	-0.076*** (0.024)	-0.089*** (0.018)	-0.142** (0.058)	-0.085*** (0.018)	-0.117*** (0.035)
LogPCE (<median)	-0.038** (0.017)	-0.071*** (0.017)	-0.050*** (0.014)	-0.110*** (0.037)	-0.049*** (0.015)	-0.070*** (0.026)
LogPCE (>median, marginal)	0.028 (0.019)	0.070*** (0.020)	0.048*** (0.016)	0.108** (0.042)	0.044** (0.018)	0.070** (0.028)
Female			0.039*** (0.010)	0.004 (0.016)	0.025** (0.010)	0.046*** (0.015)
Rural hukou	0.035 (0.024)	0.051* (0.029)			0.054** (0.025)	0.033 (0.036)
F-Tests						
Age dummies	2.98**	0.88	2.31*	0.49	1.85	0.57
(p-value)	0.032	0.454	0.077	0.693	0.139	0.636
Education dummies	11.67***	5.15***	8.97***	2.81**	9.60***	4.36***
(p-value)	0.000	0.002	0.000	0.041	0.000	0.006
LogPCE splines	3.67**	9.02***	6.55***	5.95***	5.77***	3.63**
(p-value)	0.027	0.000	0.002	0.003	0.004	0.030
Community FE	2.59***	2.55***	3.95***	1.26	4.16***	2.60***
(p-value)	0.000	0.004	0.000	0.004	0.004	0.004
I Interview month dummies	17.51***	2.37**	490.04***	5.30***	4.54***	17.69***
(p-value)	0.000	0.014	0.000	0.000	0.000	0.000

	Men	Women	Rural hukou	Urban hukou	Inland	Coastal
Pooling test	2.66 ***		1.10		1.02	
(<i>p</i> -value)	0.004		0.364		0.424	
Observations	4724	5116	7663	2177	6501	3339
<i>R</i> -Squared	0.018	0.016	0.019	0.023	0.019	0.032

Standard errors in parentheses, all clustered at community level.

LogPCE (>median, marginal) represents the change in the slope from the interval for logPCE below the median.

Sample includes respondents 45 and older. Age and community dummies are controlled in the regressions.

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