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Explaining Late Life Urban vs. Rural Health Discrepancies in Beijing

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Abstract

Social characteristics that differ by place of residence are consequential for health. To study implications of this among older adults in rural vs. urban China, this study employs data from the Beijing municipality, a region that has witnessed growth and gaps in development. Life and active life expectancy is assessed using a multistate life table technique that estimates hazard rates and subsequent expected years in various health states. Hazards are estimated for a model that adjusts regional differences for age and sex and for a series of other models including additional covariates. Results indicate urban residents have an advantage. Specific factors show socio-economic status and access to health service account for a large part, social support and health behaviors for little, while disease is a suppressor.

Introduction

Sociological studies have long implicated spatial and ecological setting as consequential for a wide variety of health and other well-being outcomes at various stages of life suggesting that place of residence itself is a critical social determinant of health (LeClere, Rogers and Peters 1997; Robert 1999). In some ways, the issue can be traced as far back as Engels and Marx' concern about the living environments of working classes in London. One of the reasons that location seems to matter is a number of characteristics that tend to distinguish individuals living across ecological settings that influence health outcomes, such as those related to domains of socio-economic status, behaviors, social cohesion and access to health services. A primary residential delineation distinguishing individuals across these domains is urban vs. rural residence. Yet, despite the history of research examining the affects of ecological setting on health, surprisingly little is known about health differences between people living in urban and rural areas, particularly in the developing world (Langmore 2001;

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Montgomery et al. 2003). Even in studies that include an urban/rural covariate, there is typically little consideration of underlying factors that generate discrepancies.

The current study quantifies the extent to which urban/rural differences in health exist with reference to mortality and functional health outcomes and assesses which of a series of socially related characteristics play a part in accounting for differences. The setting is the Beijing municipality of China, the data come from the mid 1990s, and the study sample comprises adults ages 55 and older. The evaluation of health discrepancies relies on *active life expectancy*, which divides total life expectancy into different states of functional health. Although a small number of studies have examined active life expectancy in China, these, for the most part, do not divide estimates by place of residence or across regions of the country. One study showed a slight rural advantage (M. Wang, cited in Saito et al. 2003). This was, however, based on cross-sectional prevalence rate estimates using the Sullivan method, a technique that results in biased estimates if large changes in mortality and morbidity incidence occur over time (Laditka and Hayward 2003). The current study uses a multi-state life table approach. It adjusts estimates for characteristics related to four individual-level social domains that are thought to differ across urban and rural areas – social support, socio-economic status, behaviors, and health access – and one health domain that considers differences in disease patterns. These adjustments allow for an assessment of the extent to which domains explain and mediate the residential impact on health.

Urban/Rural Health Differences Historically

Differences in health by urban vs. rural residence have been observed since the industrial revolution when urban living brought hazards owing to communicable diseases that were transferred easily across populations living in close proximity (Kearns 1988). An epidemiological transition, from communicable to degenerative disease, benefited urbanites, mostly due to public health, political factors and social dynamics (Preston and van de Walle 1978; Szreter 1997). Then in a landmark study, Kitagawa and Hauser (1973) reported mortality rates in non-metropolitan areas of the United States to be 5 percent below those in metropolitan areas. The advantage has more recently been confirmed by House et al. (2000) even after adjusting for individual-level social, demographic, economic and behavioral characteristics.

The situation for older adults in the United States is somewhat more complex. Indeed, a number of studies have reported a rural advantage in mortality and other health outcomes (Clifford and Brannon 1985; Hayward, Pienta and McLaughlin 1997; Laditka et al. 2007; Smith et al. 1995). Because urbanites have better access to health service, these findings present somewhat of a paradox, which is often explained with reference to levels of social support. Specifically, rural areas are characterized by greater cohesion, more frequent exchange and contact between generations, and more affective family relationships (Amato 1993; Beggs, Haines and Hurlbert 1996). In turn, social support characteristics have been implicated as health determinants (House, Landis and Umberson 1988).

In the developing world, urban/rural health differences have received less attention (Kinsella 2001; Langmore 2001). Much of what is known was summarized by the National Research Council's Panel on Urban Population Dynamics (Montgomery et al. 2003). The panel's work indicated that, on average, urban populations in modern-day periods live longer than do rural populations, and with the exception of HIV/AIDS, exhibit healthier levels across a range of indicators. Part of the advantage is thought to be a function of environmental factors, such as better equipped and a greater concentration of health facilities, and part a function of individual factors, such as characteristics among urban dwellers that relate to better health, like higher levels of income and education. Yet, the issue of health advantage in the developing world is far from settled. Importantly, there is wide intra-region variation.

Urban areas tend to include subpopulations of slum living poor, who constitute a subset of extremely disadvantaged city dwellers (Montgomery and Hewett 2005). Evidence also suggests that within-region inequalities may be widening, perhaps a result of economic globalization, concomitant market transformations, growing returns to education and weakening inequality-reducing infrastructure (Goesling 2001; Neckerman and Torche 2007). While virtually no studies have compared urban vs. rural poor, data do indicate that the former are substantially worse off than the average in urban areas.

Within-region inequalities in health are compounded by a number of related factors. The provision of public services and infrastructure, such as health care facilities, safe drinking water and sanitary waste disposal are often unequally distributed within regions, despite their increased availability on average in cities. This type of infrastructure is, in turn, exceptionally important in determining individual health risks (United Nations Habitat 2003). In addition, across the developing world, urban health care systems tend to be characterized by increasing privatization and monetization, in part due to rising average incomes. While the monetization of health care services in cities has resulted in excellent quality of care for some, privatized health care delivery results in limiting access to the urban poor even if facilities are physically present (Das and Hammar 2007; Dussault and Franceschini 2006).

A reading of the panel's findings indicate that most of the research on rural/urban differences in health in developing countries has considered issues that affect non-elderly populations, such as communicable diseases, infant mortality, reproductive health, and traffic-related injuries and deaths. In developing countries, rural/urban discrepancies in health problems typical among older people have been almost completely ignored. The issue, however, is of importance and becoming more so for a number of reasons, not the least of which is the rapid population aging occurring in much of the developing world. A rise in older adults means increasing proportions of budgets devoted to this segment of society, bringing their health needs to the forefront of policy (Zimmer 2006). Some seniors, by virtue of where they live, will have advantages over others. In the current study, we consider some of these advantages as factors that potentially explain urban vs. rural health differences among older adults.

The Beijing Municipality in Context

The Beijing municipality is both an interesting and important setting for this study. The city is the capital of the People's Republic of China. The municipality's boundary is broader than that of the city, equivalent to a province in China's administrative structure, and encompasses an area of about 17,000 square kilometers. The municipality's population has been growing quickly. According to census data, it was about 11 million in 1990 and a little less than 14 million in 2000. It was estimated at about 17 million in 2007 (China Data Online 2008). Although small in relation to the entire population of China, the municipality is nonetheless more populous than two-thirds of the world's countries. In addition, it holds special significance given China's recent political and economic history, its centrality within the country, and the reality that it sets the pace for the rest of the country with respect to social and economic change.

Specific categorizations for rural and urban within the municipality, and indeed for the entire country, are complicated by a system of definitions that differ across agency and have changed over time (Montgomery 2008; Chan 2007; Chan and Hu 2003). For example, there is an official national government system of rural and urban registration, which differs from the National Bureau of Statistics' definition used in censuses and surveys. The NBS system is based largely on population density and was newly altered in 2000 (Chan 2007). The official government *hukou* system has, since the establishment of the People's Republic of

China in 1949, been the legal division of rural vs. urban residents (Chan and Zhang 1999). The government system requires individuals to be registered as belonging to the “agricultural” and “non-agricultural” population depending on the official location of their household. What makes this legal system important is that agricultural and non-agricultural populations are subject to discrete economic, population, social and health policies. There are several administration models for city regions (Chan 2007). The Beijing municipality is fairly typical in this regard, with administrative definitions for rural and urban based on the division into 18 areas, officially classified as city districts (*shiqu*) and rural counties (*xian*). *Shiqu* are urbanized areas with high population densities and very few if any people actually working in agriculture. *Xian* are comparatively sparsely populated areas that include a large share of individuals working in agriculture. The population of *shiqu* is mostly registered as being non-agricultural, although substantial rural to urban migration from the *xian* into the core of the city means that some people living in a *shiqu*, and classified as living in an ‘urban’ area when it comes to the census definition, are officially registered with the government as being part of the agricultural population. These individuals are officially classified as “temporary” residents of the city and they do not necessarily receive access to the health care services available to the official city residents.

In contrast to much of the developing world, it is in rural China where health care has become more privatized and monetized. Moreover, China’s well-publicized transition to a market economy has been accompanied by a widening of the divide between urban and rural health services (England 2005). Historically, China witnessed improvements in health after the establishment of the PRC in 1949 (Cook and Dummer 2003). Life expectancy within the Beijing Municipality is now on par with many developed countries. Much of this progress was attributed to a system of cooperative medical care and free basic and preventive treatment in areas designated as rural by the government (Shi 1993). However, the reform era ushered in a decline in cooperative medicine and a subsequent increase in privatized fee-for-service practices. Subsequent deleterious effects have been well-documented (Cook and Dummer 2003; Liu et al. 2002; Meng, Liu and Shi 2000). While access to health service progresses slowly in rural areas of the Beijing municipality, urban residents maintain their subsidized care, have access to better qualified medical personnel, and are able to draw upon a larger array of health resources within closer proximity than their rural counterparts (Beach 2001; Chan 2007). The data employed for the current study covers a segment of the 1990s when urban/rural discrepancies on a social level were widening. The city of Beijing was developing rapidly; modern buildings and roads were quickly completed, contemporary and rapid transportation expanded, private sector activities picked up, and access to advanced medicine, quality health practitioners and technology increased. In contrast, rural areas that surround the city were largely involved in agriculture, maintained lower incomes and, by most accounts, witnessed deterioration in access to health services.

Older adults represent a particularly important sub-population within this region. China, which has the world’s largest older population, is aging at an exceedingly rapid rate. The 1982 census indicated that the proportion of those 55 and older in the Beijing Municipality at that time was 12 percent, while by the 2000 census it had increased to 16 percent, and by 2005 it was nearly 20 percent (National Bureau of Statistics China, 2010). Although specific projections for the municipality are not easy to come by, extrapolation from country-wide data suggest the proportion will nearly double to over 35 percent within the next 30 years. An increasingly larger proportion of functional health problems and mortality will be concentrated amongst the older population, which will, in turn, have implications for health services and related costs. Hence, understanding the mechanisms underlying urban/rural health discrepancies can be important for informing policies that can influence the health of elders.

Methods

Data

Data come from 1992 and 1997 waves of the Beijing Multidimensional Longitudinal Study of Aging conducted at the Capital Medical University (formerly the Capital University of Medical Sciences) in Beijing (Department of Social Medicine 1995; Jiang et al. 2004; Kaneda, Zimmer and Tang 2005; Tang, Jiang and Futatsuka 2002). The original BMLSA was funded by UNFPA and implemented by the Beijing Geriatric Clinical and Research Center at the Capital Medical University in conjunction with the Center for Aging Studies at Flinders University of South Australia. The 1992 baseline involved an age and sex stratified sample of older adults 55+ living in 3 of 18 official administrative regions within the municipality. Sampling was conducted by a three-stage stratified random clustering technique that was geared towards ensuring the representativeness to the older population of the Beijing municipality. The first stage was the selection of three regions able to represent the municipality with respect to social, economic, demographic and geographical characteristics based on information from the 1990 national census. Xuan Wu, the third largest urban district (*shiqu*) by area is located near the center of the city of Beijing. Da Xing is one of the rural counties (*xian*) located in the rural agricultural plains area to the south. Huai Ruo is the second rural county (*xian*) located in the mountainous northern part of the municipality. The second sampling stage involved the random selection of strata consisting of streets in the urban area and towns in the counties. The final stage involved a random target selection of 3,614 individuals from a roster of elderly residents from within strata with a relatively even distribution of men and women in five-year age cohorts (55–59, 60–64, 65–69, 70–74, 75–79 and 80+), and an oversampling within Xuan Wu. Of the target sample, 3,257 valid cases were interviewed, resulting in a total response rate of 90 percent. A weighting scheme is used to account for the sampling scheme and assure that results are representative of the districts in that year.

To further describe the regions, Table 1 is presented. It shows demographic information and provides a comparison with the total Beijing municipality and the country of China. Xuan Wu's urban character is made clear by a very high population density of well over 20,000 persons per square kilometer and virtually nobody employed in agriculture. In contrast, Da Xing and Huai Ruo have low population densities (Huai Ruo has only 139 persons per square kilometer) and much larger proportions of workers listing agriculture as their industry of employment (almost 44% in Da Xing). Other indicators shown in Table 1 are consistent with what would be expected of rural vs. urban regions. Moreover, The National Bureau of Statistics' definition for urban, used for the 2000 census, defines 100 percent of Xuan Wu residents as living in an urban metropolitan area compared to 28 percent of residents in Da Xing and 39 percent in Huai Rou (Chan 2007).

The 1997 follow-up involved returning to original households. The response rate for the 1997 wave was 90 percent. While response rates are respectable by traditional survey standards, higher non-response in Xuan Wu is a prominent feature of the BMLSA and deserves explanation. The number of interview refusals was small. Therefore, loss to follow-up was almost entirely a function of not being found, which was mostly due to moving. Unlike younger samples, older adults in China are less likely to move from rural to urban areas. The reason for higher non-response in Xuan Wu was therefore an elevated rate of movement within the city. Much of this was a result of city reconstruction. In all likelihood, the Xuan Wu residents remained in urban Beijing, moving in with other family members. In order to adjust results for differential non-mortality attrition, an additional weight was calculated using a regression procedure that determined the probability of being a respondent according to the characteristics age, sex, residence and health status at baseline. The initial weight that makes a case representative within the district at baseline was

multiplied by a function that represented the inverse of the probability of being a follow-up respondent, which is to say that respondents with characteristics typical of non-respondents were given greater weight. Because residence is one of the characteristics, follow-up respondents from Xuan Wu are weighted upwards.

Estimating Life Expectancy and Active Life Expectancy Using a Multistate Life Table Approach

Mortality as a health outcome among older adults is important for obvious reasons. But, functional health is equally critical because it provides an indication of the degree to which older adults can conduct daily activities and, consequently, the degree to which they require assistance. To facilitate examination of health differences across mortality and functional health, the current study considers measures of life and active life expectancy. The latter has become a widely used tool for assessing health across population groups in international research (Mathers 2002; Saito, Crimmins and Hayward 1999; Saito, Qiao and Jitapunkul 2003). It allows for the quantification of differences in health in terms that are not only easily understood but easily translated into future health care needs. Related, active life expectancy has the advantage of combining information on both mortality and morbidity into a single summary indicator. It does this by partitioning years of life into states of health, for example, expected number of remaining years of life with and without functional limitation.

Active life expectancy calculations require division of samples into functional health categories that represent active and inactive states. We consider someone to be functionally healthy or independent if they can conduct usual physical movements without help from others, and can complete tasks that are necessary for independent living. In the BMLSA, respondents were asked about a series of tasks that can be categorized as either activities of daily living, that is tasks necessary for self-maintenance, or more general physical movement tasks that may be necessary for independent living (Katz et al. 1963; Nagi 1965). We combine the two types of tasks, using six individual items – eating, dressing, getting on and off a bed, bathing, walking 300 meters, and walking up and down a flight of stairs – and define the active state as the ability to perform all six without help. The inactive state is defined as requiring help in performing at least one.

For the baseline state (i), individuals are coded as active or inactive based on responses to the six functional health tasks. The follow-up state (j) is based upon a combination of survival status and the response to the six functional health tasks at follow-up. Specifically, when interviewers returned they determined whether the respondent was still alive through interviews with those living in the household and others nearby. If still living, the follow-up interview was conducted, and questions about the ability to perform the six functional health tasks were repeated exactly. Like the baseline state, those who survived are coded as active or inactive based on whether they report needing help. Those who did not survive are simply coded as being deceased. As such, for each originating state there are three possible follow-up outcomes, resulting in a total of six possible transitions (ij).

Several methods have been suggested and compared for the estimation of active life or health expectancies, and software is now available that can derive these estimates (Laditka and Hayward 2003; Lievere, Brouard and Heattcote 2003; Mathers 2002; Saito, Crimmins and Hayward 1999; Wolf and Gill 2007). Because of its flexibility in the use of covariates, we adopt a method that applies hazard rate estimates as probabilities for inputs into multistate life-tables. (Crimmins, Hayward and Saito 1994; Hayward and Grady 1990). This method requires a two step procedure. The first is the estimation of the rates of transition from each originating state (i) to each follow-up state (j), conditional upon a set of

covariates. We begin with a base model that adjusts urban/rural transition rates by age and sex, and is denoted as follows:

$$m_{ij}(x) = \exp(\beta_{ij0} + \beta_{ij1}x + \beta_{ij2}\text{Sex} + \beta_{ij3}\text{Urban}) \quad (1)$$

where m_{ij} designates the hazard of making a transition to state j for an individual beginning in state i within an age interval x . The model provides for one estimate of the transition rate for each combination of covariates, meaning that the transition rate conditional on individual characteristics is assumed to be constant over time. We tested for a variety of functional forms of age dependence for all the transitions in the model but in no instance did a more complex functional form improve the model's fit compared to a model where the age effect was specified as linear.

In order to move to the second step of the estimation – the calculation of multistate life tables – the hazard rates (m 's) need to be converted to probabilities for use in standard life table functions. Hazard rates, which indicate likelihood of a transition for individuals *within* an age group, can be converted to the probability that an individual with a given set of characteristics who is an *exact* age will make a transition from i to j between time x and $x + n$ by:

$$p_{ij}(x, n) = (1 + .5 m_{ij}(x))^{-1} (1 - .5 m_{ij}(x)). \quad (2)$$

This calculation provides a matrix of probabilities from which to apply the survivorship function:

$$l_{ij}(x, n) = l_i(x) p_{ij}(x, n). \quad (3)$$

$l_{ij}(x+n)$ indicates the number of persons in state i at age x who end up in state j at age $x + n$. This function is determined by the product of the number of persons in states i at age x and the probability of transition from state i at age x to state j at $x+n$, with probabilities being derived from the hazard rate models. Assuming that hazard rates are constant over n , we can assume that a movement from active to inactive, inactive to active, or from either originating state to death occurs at the exact mid-point of the period, and therefore the total number of persons lived in state i for individuals aged x to $x + n$ is:

$$L_i(x, n) = \sum (.5(l_i(x) + l_{ij}(x, n))). \quad (4)$$

The sum of $L(x, n)$ beyond age x (denoted as $T_i(x)$) indicates the total number of person years lived in state i by those that survive to age x . Thus, the years expected in state i at exact age x , indicated as $e_i(x)$, for an individual with a particular set of characteristics, is:

$$e_i(x) = T_i(x) / l_i \quad (5)$$

The base model shown in equation (1) will display an urban advantage in mortality and functional health. Follow-up models will adjust for characteristics that represent domains of socio-economic status, access, social support, behaviors and disease profile. As various sets of characteristics are added to the base, we expect coefficients that describe discrepancies in transition rates across rural and urban regions to be reduced and thus expected years of life

and active life should converge. We conduct this stage of the analysis by first adding covariates from each domain separately, then testing an intermediate model that includes a selection of covariates that have a likely causal association with health outcomes, and finally a full model that adds all covariates simultaneously. In order to show the urban advantage that is accounted for by covariates represented by specific domains, we construct a series of multistate life tables for urban and rural areas based on transition probabilities derived when adjusting for age, sex, plus significant covariates within each domain separately. We also construct life tables that adjust for the covariates across domains that are statistically significant in the full model.

This technique for estimating life and active life expectancies makes several assumptions, in particular that one transition takes place over time and this transition occurs midway through the interval. These assumptions can result in an underestimation of the number of transitions (Laditka and Hayward 2003). However, the underestimation should not considerably influence estimates among survivors if hazards are constant over the time period and there is equal underestimation of transitions from the active to inactive state as from the inactive to the active state. More importantly, estimates of covariates are less likely to be biased, thus our urban/rural effects are likely to indicate valid influences on hazard probabilities. As confirmation of this, the hazard rate estimates that are found in the current analysis conform qualitatively to those from an earlier analysis that considered a multinomial logit model for transition probabilities (Zimmer et al. 2004).

Covariates

Social Support—First, marital status is coded as married or not married. The next two items are more qualitative. An item on how often individuals are consulted when making family decisions is employed to indicate perceived involvement in family decision making. Those consulted “most of the time” are considered to be involved. Additionally, whether an individual has a confidant on whom they can rely in times of need is determined with a survey question that asks, “Do you have anyone that you feel very close and intimate with?”

Socio-economic Status—Education is measured as having any vs. no formal education. Occupation codes are difficult to determine. However, we employ one item that classified “occupation most of one’s life” in broad categories and a second that asked whether the work the individual has done most of their lives involved heavy labor. Occupation is coded as white collar and non-heavy labor vs. non-white collar and/or heavy labor. Respondents were allowed to identify housework as their occupation, and 14 percent did so. They are coded according to their response to the second item. Having financial difficulty is considered a proxy for income. Specific Income or consumption information was not collected in the survey, and income measures that may be available would be difficult to interpret among an older population in China. Respondents were asked whether their income meets the needs of their daily living expenses. We code those who report they have enough money as having no financial difficulty.

Behaviors—First, respondents are coded into ever smokers or non-smokers. Second, they are coded into drinkers of at least one a day vs. those who drink less. Third, questions on diet asked about eating fruits and vegetables daily. We code those who answered “yes” as having a healthy diet.

Access—A questionnaire item asked who pays for medical expenses. Individuals responded in terms of the percent of costs they themselves cover. Individuals reporting that they personally pay for less than 100 percent are likely covered by some type of insurance, and having insurance is the first indicator. Second, individuals were asked whether they

received a medical check-up over the past year, which is an indication of obtaining regular health service. Third, they were asked whether they consider the cost of medical expenses to be a burden. Although this item is correlated with the one on insurance ($r = .361$, $p < .01$), the correlation is not as strong as might be expected, indicating that financial burden is separate. Fourth, two questions are combined to indicate time costs related to access. Individuals were asked whether they have a problem either with the time it takes to get to the nearest medical facility or the time it takes waiting to be seen by a doctor at their medical facility. Those that respond in the negative for both are considered to have no excess time costs when it comes to accessing health care.

Disease—If respondents report ever having coronary heart disease, lung disorders including chronic bronchitis, emphysema or tuberculosis, stroke, diabetes or cancer, they are coded as having a life-threatening disease. If they report ever having hypertension, asthma, ulcers, migraine headaches, arthritis, glaucoma or cataracts, they are considered to have a debilitating disease.

Results

Basic Urban/Rural Variations

Table 2 presents mortality and functional independence at follow-up by baseline status. Health outcomes are dependent on baseline status. Mortality is also a function of baseline status. In both urban and rural areas, the percent dying was several times higher among the inactive group. Initial finding suggests urbanites have an advantage. A higher percent of those in urban areas active at baseline were active at follow-up (about 83 vs. 70 percent), while a lower percent died (about 11 vs. 17 percent). Among those inactive at baseline, the association is not as transparent and is not statistically significant.

Table 3 presents urban vs. rural distributions for covariates. All are measured at baseline. Results illustrate drastically different characteristics among urban vs. rural residents. With the exception of sex, differences are statistically significant. Differences in some indicators are particularly dramatic. For example, 73 percent of urbanites have formal educations compared to 27 percent for those in rural areas. Variation in access confirms vast differences in formal health care opportunities. Differences in social support and behaviors are also significant. Despite the apparent advantage of urbanites across other domains, rural elders are less likely to report a life threatening or debilitating chronic disease.

Life Expectancies and Active Life Expectancies

Results of the base model are shown in Table 4. Living in an urban area significantly increases the hazard of remaining active relative to inactive and remaining active relative to dying. This means that urban residents classified as active at baseline are advantaged: they remain active for longer before becoming either inactive or dying. In contrast, residence has little impact on transitions from the inactive state. Age and sex have expected effects.

Figure 1 shows resultant life expectancy and active life expectancy estimates. The urban life expectancy advantage presented in the left-hand chart is robust. The order from highest to lowest life expectancy is: urban females, urban males, rural females and rural males. For example, at age 55 an urban woman can expect to live about 23 more years, until the age of 78. Her rural counterpart can expect about 19 more years, meaning that the urban woman has a four-year advantage. The net difference between urban and rural declines with age, but the urban advantage remains evident. Interactions between gender and residence were tested and were insignificant.

Urbanites also have an unambiguous active life expectancy advantage. At age 55 a man or woman living in an urban area can expect five to six more active years than their rural counterparts. The gap remains apparent with advancing age, and even at age 85 the urban man or woman can expect two more active years. Active life does not differ much between men and women. But, because women live longer than men, it implies that women are inactive for a greater proportion of their remaining years.

Accounting for the Urban Advantage

Results from the intermediate and full models are shown in Table 5. The effects of residence are generally not as strong in the intermediate and full model as in the base model. Living in an urban area decreases the hazard of moving from active to inactive, but other urban estimates are insignificant. The magnitude of the significant coefficient has been reduced from the base model ($-.943$ to $-.555$ and $-.578$). It appears then that some of the urban advantage is explained by the covariates, particularly those entered first in the intermediate model. How this translates precisely into differences in years of life and years of active life will be shown shortly.

Age and sex effects are generally significant and in expected directions. Similar to the base model, older individuals are more likely to die, transition to the inactive state and remain in the inactive state. Women are less likely to die, but more likely to become inactive or remain inactive. Social support variables generally relate to a decreased hazard of dying. There are substantial socio-economic effects with those with higher status having decreased hazards of moving to the inactive state or dying. Socio-economic effects among those originating in the inactive state are insignificant. Behaviors have limited influence with the exception that not smoking delays death among those who are active. There are some effects of access. Having insurance and no excess time costs increase the hazard of remaining active relative to dying, while the latter has a strong positive impact on the hazard of moving from inactive to active and a negative impact on the hazard of dying from the inactive state.

By subtracting estimated years in rural from urban areas across ages, Figure 2 shows the remaining life expectancy advantage of urbanites when adjusting for specific domains and for all domains simultaneously. At age 55 the urban advantage determined by base model is 4.6 years. To be specific, life expectancy for a 55 year old in the urban area is estimated to be 22 years, compared to 17.4 years for their rural counterparts. With increasing age, the net urban advantage decreases, but a distinction remains.

Although the multi-state life tables based on rates adjusting for covariates do not completely eliminate this advantage, some domains have an influence. At age 55 the urban advantage when adjusting for access decreases to 2.7 years. In other words, if 55-year-old urban and rural residents had the same level of access, as defined with measures available to us, the urban resident could expect to live 2.7 years longer than their rural counterpart, implying that the other 1.9 years is accounted for by the access measures at our disposal. When adjusting for socio-economic covariates, the life expectancy advantage declines to 3.3 years. Adjustments for social support and behavior do little to change the urban advantage. Adjustments for diseases, in contrast, increase the life expectancy advantage of urbanites, suggesting that disease differences are benefiting rural residents and suppressing a potentially larger urban advantage. This is due to the higher prevalence of disease in urban areas (as shown in Table 3). Also shown in the figure is the difference when adjusting for all covariates simultaneously. These results indicate that a 55-year-old urbanite can expect to live 2.5 more years than his or her rural counterpart and the advantage is reduced to one year by age 85.

The right-hand side of the figure shows results for active life. The base advantage at age 55 is 5.5 years. By age 85 it drops to 2.2 years. Adjustments for covariates from all domains simultaneously reduce the advantage to 3.3 years for those age 55 and 1.6 years for those age 85. Access and socio-economic status each accounts for about 1.8 years of the advantage at age 55, and about 4 years at age 85. Social support and behavior differences explain little and diseases have a suppressing effect.

Discussion

Our results indicated mortality and functional health experiences of older urban and rural adults in the Beijing municipality diverge, with urbanites in the Xuan Wu district maintaining a robust advantage in both life expectancy and expected years of active (or functionally independent) life in comparison to those living in the Da Xing and Huai Ruo rural areas. Urban and rural elders differed in other ways. Urban elders were far more likely to have health insurance, for example. Not only does the inequality in resources favor urbanites, but as many have commented the weakening of cooperative medicine and subsequent introduction of a fee-for-service system slowed advances in availability in the rural areas in the 1990s, the time during which the current data were collected (Beach 2001; Cook and Dummer 2003). However, differences in the health service environment, troubling as they may be, cannot completely explain health disparities. As has been shown with some certainty in the United States, availability across urban and rural communities does not translate neatly into health advantages in one area over another (Hayward et al. 1997). A range of additional influences may determine how those in different regions negotiate their health environment. For example, health service may be more readily available in urban areas, but expenses related to health care may mean that the urban poor are unable to afford treatment or treatment of reasonable quality (Dussault and Franceschini 2006; Montgomery et al. 2005).

We attempted to account for the urban advantage by adjusting life expectancy and active life expectancy using a series of covariates that reflect differences in the social composition of urban and rural areas. Controlling for access variables but no others, the urban advantage in life expectancy was reduced by 40 percent. Controlling for socio-economic status variables but no others, the urban advantage was reduced by 30 percent. While the full model indicated that some of this explained variance is shared, several access and socio-economic status factors have strong independent influences and their causal connections with health outcomes can be fairly well defended, pointing to the impact of education and job opportunities as well as the benefits of a publicly funded health service program that includes broader health insurance and better access to health facilities and practitioners. In contrast, social support and health behavior explained very little of the discrepancy, results that differ somewhat from those found in the United States. One possible reason for a lack of association in the Chinese context is that normative ideals of filial piety that translate into high levels of support for older adults in China occur across places of residence (Bian, Logan and Bian 1998; Whyte 2003).

Our findings bring up several additional issues that deserve further discussion. First, we found that controlling for diseases had the effect of augmenting the urban advantage. Urbanites were in fact more likely to report life threatening and debilitating diseases, a result that may be a function of several factors, including the above mentioned behavioral differences, longer survival in urban areas, difference in the tendency to report diseases, which itself may be a function of access to health service, and even effects of pollution on incidence of chronic conditions.

Second, the urban advantage in mortality and functional independence is primarily a function of the impact of urban residence on favorable transition rates among those originating in an active state, while urban residence has very little impact on transitions originating from an inactive state. Moreover, while socio-economic effects were strong when predicting transitions from the active state, they were less substantial and not significant when predicting transitions from the inactive state, results that support earlier research across a number of countries that has shown the impact of socio-economic status on functional health to be dependent on originating state (Grundy and Glaser 2000; Liang, Liu and Gu 2001; Zimmer and House 2003). This suggests the possibility of different processes for onset vs. progression of functional disorder. This idea is not new and has been discussed in other studies with respect to the impact of socio-economic inequality. Borrowing from this discussion, an explanation could be that urban residence results in delay of the onset, but when urbanites do become functionally unhealthy the severity of their disorder is great, and recovery and survival not probable.

Third, our results are in contrast to an earlier study by Zeng et al. (2002), who showed rural residents across 22 states of China to be in better functional health than their urban counterparts, which they speculate as being due to agricultural labor offering health advantages to the rural population. The difference in our findings may be a function of several factors, but we believe that a probable one is our focus on the Beijing municipality. Specifically, the differences in environments between rural and urban areas in the Beijing municipality are particularly stark, and rural elders living around but not in Beijing are particularly disadvantaged in comparison to their urban counterparts. This was clearly seen in our descriptive statistics (Table 3). Therefore, it is uncertain whether rural/urban discrepancies of the magnitude shown also exist in other provinces around the country or even in other regions of Asia, although the current study does provide a baseline against which to compare these differences.

There are several limitations worth noting. A study of residence on health outcomes is generally unable to determine causal direction. It is often uncertain whether lower socio-economic status is caused by living in rural areas or, alternatively, if lower socio-economic status individuals are somehow drawn to rural areas. However, in the case of the Beijing municipality, this limitation is constricted first by limited migration among older adults and second by the fact that living in an area classified by the government as rural kept people from obtaining high socio-economic status in some ways, for example, by limiting their access to non-agricultural employment and education. The very low non-response rates in our own data attest to the limited movement of older people across areas. Higher non-response in urban areas is likely a function of within-region movement, in turn a consequence of a rapidly changing urban environment, rather than urban to rural migration. Of greater concern is the potential overlap that exists between indicators in different domains. It is possible that socio-economic status explains some of the effect of health care access on health. While it is beyond the scope of the current study to examine these interactions in much detail, we did find that there are fairly robust independent effects.

The greatest limitation to the multistate life table technique employed here lies in the assumption that only one transition is completed over an observation period. While this assumption is not critical with respect to the effects of covariates, it will result in an underestimation of the number of transitions (Laditka and Hayward 2003; Wolf and Gill 2007). Although the underestimation should be minimal for those who remain alive, given that hazard rates are likely to be fairly even throughout the period, it may be a greater problem in the case of death. This is because those that are in the active state at time of origin and die before follow-up may have experienced a period of inactivity before death, which would not be captured in this data. Clearly, frequent follow-ups and a shorter time

interval make estimates more reliable, although such frequency is rarely available in surveys of older adults, particularly in China and other developing societies.

In conclusion, our data capture conditions in the early to mid-1990s within a limited but important region of China. China and the Beijing municipality are in some ways unique in that, in contrast to much of the developing world, increased privatization of health care has resulted in its monetization in rural rather than urban areas, which has negatively affected access for rural residents. Analyses based on more recent data is needed to test whether the widening of health discrepancies is continuing, and data from a wider geographic sample will certainly be necessary to test whether our findings can be generalized to other regions. In this sense, our study can serve as a baseline against which to compare and monitor trends. Moreover, our results may provide a sense of what the future holds for the rest of China as the country continues its rapid development and indeed for other developing countries in Asia. In this respect, we conclude that the main finding of our analysis is a strong mortality and functional health benefit that accrued to those in urban areas, some of which is explained by better access to service for individuals living in urban areas and higher socio-economic status among urbanites, both factors which themselves are important social determinants of health. Therefore, the implications of this for China, and possibly other countries in the region, are that investments in rural areas with respect to health infrastructure and actions that lead to greater socio-economic equity among individuals can be important for reducing health inequalities.

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Figure 1.
Life Expectancy and Active Life Expectancy

Figure 2.
Urban Advantage in Years of Life

Table 1

Demographic Information

	China	Beijing Municipality	Xuan Wu	Da Xing	Huai Rou
Population (in 100,000)	1,242.1	135.7	5.3	6.7	3.0
Sex ratio ¹	106.3	108.9	107.0	109.3	106.1
Population density ²	129	808	21,691	648	139
Average household size	3.5	3.1	2.9	3.7	3.1
% Single person households	91.5	12.1	14.6	7.5	9.7
% Han Chinese	91.5	95.7	92.6	96.2	92.2
Birth rate ³	11.4	6.0	4.0	7.0	7.2
Death rate ⁴	5.9	5.2	6.2	4.9	5.8
Total fertility rate ⁵	1.2	.7	.6	1.0	.8
% Ages 0–14	22.9	13.6	10.9	18.1	17.5
% Ages 55+	14.2	16.3	20.3	13.9	15.7
% Illiterate ages 15+	9.1	4.9	3.9	7.1	9.6
% Working in agriculture ⁶	64.4	13.0	.1	43.5	30.6

Table 2

Functional and Mortality Status

Follow-up State	State at Baseline	
	Active	Inactive
Rural	(N=811)	(N=244)
Active %	70.4	15.8
Inactive	13.1	30.2
Did not survive	16.5	54.0
Total	100.0	100.0
Urban	(N=1,529)	(N=255)
Active %	83.0	14.1
Inactive	5.9	24.2
Did not survive	11.1	61.6
Total	100.0	100.0

Table 3

Distribution of Covariates

	Rural	Urban
Mean age	65.4	64.6
% Female	49.0	50.5
Social Support		
% Married	72.6	81.0
% Consulted	45.9	53.4
% Having a confidant	67.2	82.0
Socio-economic Status		
% Having education	27.2	73.4
% White collar/ Non-heavy labor occupation	3.8	40.2
% No financial difficulties	38.4	65.3
Behaviors		
% Never smoked	50.5	55.5
% Not drinking daily	60.1	75.8
% Eats fruits and vegetables daily	28.3	67.2
Access		
% Having insurance	10.0	91.5
% Had check-up in last year	1.4	21.6
% Medical expenses not a burden	42.9	74.7
% No excess time costs	13.4	17.0
Diseases		
% Life-threatening disease	24.6	42.2
% Debilitating disease	22.9	45.8

Rural N = 1,055

Urban N = 1,784

Table 4

Parameter Estimates

	Transitions			
	Active to Inactive	Active to Deceased	Inactive to Active	Inactive to Deceased
Residence (1 = urban)	-.943**	-.517**	-.097	-.013
Age	+.064**	+.097**	-.036*	+.038**
Sex (1 = female)	+.594**	-.370**	+.588^	-.304*
Intercept	-8.039	-9.577	-.803	-4.333

Table 5

Parameter Estimates for Hazard Rate Model

	Transitions							
	Intermediate Model				Full Model			
	Active to Inactive	Active to Deceased	Inactive to Active	Inactive to Deceased	Active to Inactive	Active to Deceased	Inactive to Active	Inactive to Deceased
Residence (1 = urban)	-.555 *	-.045	-.414	.060	-.578 **	-.124	-.375	.035
Age	.059 **	.090 **	-.036 *	.038 **	.060 **	.082 **	-.036 ^	.037 **
Sex (1 = female)	.420 **	-.544 **	.818 ^	-.346 ^	.526 **	-.554 **	.768	-.206
Social Support								
Married					.151	-.273 *	.042	.026
Consulted					-.108	-.203 ^	.318	-.473 *
Having confidant					.029	-.025	-.204	-.159
Socio-economic Status								
Education	-.291	-.134	.418	-.093	-.310 ^	-.148	.494	-.003
White collar/ Non-heavy labor occupation	-.297	-.417 *	.166	-.174	-.310	-.411 *	.078	-.102
No financial difficulties	-.250 ^	.113	-.185	.089	-.231 ^	-.046	.247	-.019
Behaviors								
Never smoked					-.146	-.299 *	.035	-.068
Not drinking daily					-.144	-.134	.131	-.159
Eats fruits and vegetables					-.010	-.160	-.117	-.133
Access								
Insurance	-.146	-.346 *	.354	-.036	-.170	-.350 *	.527	-.070
Check-up					-.020	-.041	.004	-.092
Medical expenses not a burden					-.045	-.070	-.116	.002
No excess time costs	.027	-.457 **	.778 *	-.278 ^	.041	-.371 **	.899 *	-.279 ^
Diseases								
Life-threatening					-.123	.417 **	-.335	.324 ^

Transitions						
	Intermediate Model			Full Model		
	Active to Inactive	Active to Deceased	Inactive to Active	Inactive to Deceased	Active to Deceased	Inactive to Deceased
Debilitating						
				.466**	.272*	-.113
Intercept	-7.709	-8.632	-1.571	-8.098	-8.027	-4.127

Notes:
^ p < .10
* p < .05
** p < .01