Environment and Subjective Well-Being of Rural Chinese Elderly: A Multilevel Analysis

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Introduction. The purpose of this study was to examine the effects of environment on the subjective well-being (SWB) of older Chinese villagers after controlling for personal and social characteristics.

Method. Data collected from the Chinese Health and Retirement Longitudinal Survey Pilot Study were used to examine the relationship between (a) SWB (i.e., happiness and depressive symptoms) of Chinese rural elderly and (b) environmental characteristics, controlling for personal and social characteristics. A total of 850 older villagers from 2 Chinese provinces were analyzed using multilevel regression models.

Results. Five of the 8 environmental variables had significant effects on SWB: A natural disaster in the past 5 years, rainy days, and use of coal in the home were associated with lower SWB, whereas village wealth and sewer system were associated with higher SWB. Personal and social characteristics of importance included health, age, place of birth, perception that future help is available if needed, and providing help to others.

Discussion. The proposition that the environment of older Chinese villagers is associated with their SWB was supported after accounting for personal and social characteristics. SWB may be improved by improving environments as well as by changes to personal and social conditions.

Key Words: Functional limitations—Happiness—Mental health—Social capital—Village infrastructure.

Social gerontologists have shown an interest in the quality of life of older adults since the establishment of the field. Some of the first studies by these sociologists and psychologists focused on the well-being of older adults (Cumming & Henry, 1961; Maddox, 1963). Researchers initially showed an interest in personal characteristics believed to affect an older person’s feelings of well-being (e.g., health, sex). This interest eventually expanded to include social conditions (e.g., marital status, availability of help when needed). Today, some researchers have begun considering whether the natural environment (e.g., air pollution, rainy days) and the physical infrastructure surrounding older persons (e.g., condition of neighborhoods and roads) affect their sense of well-being. One question raised is whether the environment has independent effects on well-being after considering personal and social factors. The purpose of this article is to address this question by using multilevel regression analysis that simultaneously considers the effects of personal, social, and environmental characteristics. The analysis is limited to rural elderly because the urban and rural Chinese have very different environments and the rural elderly make up a significant portion of the elderly population in China. Provided later is a brief summary of rural Chinese development, literature review, and description of the methods, findings, and conclusions.

Rural Chinese Villages in Transition

In the late 1970s, the Chinese Communist Party began changing policy to allow for major political, economic, and social changes in China. Reduced central state planning and the development of an increasingly market-led economy, that is, the emergence of a capitalist China, have substantially affected its rural areas (Yeatts, Cready, Pei, Shen, & Luo, 2014). Many villages have taken the initiative to attract various means of development with mixed results. On one hand, they have prospered financially with the addition of industry and business. On the other hand, the lack of enforced environmental regulations has generated a variety of environmental problems such as serious shortages of drinkable water, clean air, and arable and forested land (Ash, 2006; Dresner, 2008; Zhou & Yang, 2004).

The “marketization” of the countryside has been accompanied by the central government’s relaxation of restrictions prohibiting rural-to-urban migration. Attracted by the potentially greater opportunities of urban areas, substantial numbers of young villagers have moved to these areas, creating a major disruption in rural Chinese family practices and norms. Many from the younger generation are unable to perform traditional caregiving roles to their parents and parents-in-law because they no longer live near them. These changes in family structure appear to be having detrimental...
effects on village elderly (Ge & Shu, 2001; Gu & Yang, 1989; Jenkins, Baingana, Ahmad, McDavid, & Atun, 2011).

ENVIRONMENTAL, SOCIAL, AND PERSONAL EFFECTS ON SUBJECTIVE WELL-BEING

The subjective well-being (SWB) of older adults has been studied from a variety of perspectives. The earliest studies focused primarily on the effects of personal characteristics. These studies eventually grew to include social conditions. Most recently, researchers have begun to consider the effects of the environment. Research on these is reviewed later following the definition of SWB.

SWB Defined

George (2010) conducted an extensive literature review and found that the concept of SWB was measured as happiness, psychological well-being, positive affect, and morale, with these often used interchangeably (Diener, Suh, Lucas, & Smith, 1999; Lawton, 1975, 1977; Neugarten, Havighurst, & Tobin, 1961; Ryff & Keyes, 1995). Further, George (2010, p. 332) concluded that researchers are largely measuring the same thing: “individuals’ subjective perceptions that life as a whole is good” (see also Dolan et al., 2008). On the other hand, the World Health Organization has equated well-being to positive mental health (Huppert, 2009). Thus, this article examines two dimensions of SWB: happiness and mental health. Happiness is defined as the elderly person’s perception of how often she/he feels “happy.” Mental health is defined as the older person’s level of psychological well-being as measured by an index of eight questions.

Environmental Conditions Affecting SWB

In the 1960s and 1970s, there was heightened interest among social scientists in examining how the “environment” affects social institutions, organizations, social groups, and individuals. This interest did not escape gerontologists. As Lawton noted in 1977, “There has been a strong surge of interest in environment and aging during the past decade” (Lawton, 1977, p. 276). More recently, the environment has received renewed interest among social gerontologists as they focus on health and SWB. Factors that have been used to characterize the environment include climate and topography, pollution, and a community’s infrastructure and neighborhood characteristics. When considering climate, Rehdanz and Maddison (2005) found that temperature and precipitation were significantly related to “happiness” among persons in 67 countries using the World Database of Happiness. Kelly and colleagues (2011) examined the univariate relationship between SWB (measured as mental health and life satisfaction) and climate and found that drought-related worry had a significant association with SWB (see also Dolan et al., 2008; Tilt, 2010). It is also reasonable to suspect that other natural environmental characteristics are associated with SWB. Older adults are more likely to be frail and vulnerable to natural disasters than younger adults and, consequently, may feel more concerned and stressed about future disasters leading to lower SWB. Finally, older adults, who are typically less mobile, may feel added stress and subsequently lower SWB if living in areas where it is difficult to travel such as mountainous areas and conversely feel higher SWB if living in easily traveled plains.

Studies examining pollution include that of Lim and colleagues (2012) who found a positive relationship between pollution and depression in their longitudinal study of 537 older adults. Similarly, Welsch (2006) examined the relationship between air pollution and life satisfaction among 80 residents from 10 European countries using annual data from 1990 to 1997. He found a negative effect of air pollution (e.g., nitrogen dioxide, air particulates, lead) on life satisfaction after controlling for per capita income (see also Chen et al., 2011; Ferrer-i-Carbonell & Gowdy, 2007; Welsch, 2002; Wen and Gu, 2011).

Roh and colleagues (2011) examined the relationship between neighborhood characteristics and SWB measured as mental health. Their sample included 420 Korean American older adults living in the New York City metropolitan area. After controlling for the effects of individual level variables, they found that neighborhood environment had a direct effect on the older adults’ satisfaction and depressive symptoms. Other studies have reported significant effects when examining factors such as neighborhood wealth, stability, safety, and social cohesion (Beard et al., 2009; Burton, Mitchell, & Stride, 2011). A review of the literature by Mair, Diez, and Galea (2008) found that 37 of 45 studies found support for an association between neighborhood characteristics and depression or depressive symptoms, with six of seven longitudinal studies finding significant effects. Further, Lou and Gui (2011) found community programs and services to have a positive effect on SWB and Muramatsu, Yin, and Hedeker (2010) found similar results. Finally, Lawton (1977) emphasized the importance of transportation to the SWB of elderly residents, particularly as it provides a means of access to life-supporting and life-enriching facilities (see also Ajiboye, 2011).

It is important to note that not all studies examining the relationship between the environment and SWB have found significant effects. As noted earlier, Kelly and colleagues (2011) surveyed a stratified random sample of 2,639 adult Australian respondents and found drought-related worries to affect SWB. However, once controlling for individual-level factors, they found that the environmental effects became insignificant and concluded that most of the explanation for respondents’ SWB was at the individual level.
Social Conditions Affecting SWB

Researchers have examined the relationship between an individual’s social conditions and SWB with a primary focus on informal relationships, social supports, social activities, and social organizations. Informal relationships include those with a spouse, family members, and friends. Studies have found that married persons tend to report higher SWB than widows/widowers and those living alone (Das, Do, Friedman, McKenzie, & Scott, 2007; Diener, Gohnn, Suh, & Oishi, 2000; Lee & Browne, 2008; Lin, 2000). In addition, Pei and Pillai (1999) found in their study of the Chinese elderly that the number of children was positively related to SWB measured in terms of happiness (see also Bjornskov, 2003; Haller & Hadler, 2006; Olesen & Berry, 2011). Closely related to informal relationships are social supports with research showing that SWB is higher among persons who believe they have social supports available if needed (Kelly et al., 2011; Lou & Gui, 2011; Molarius et al., 2009; Muramatsu et al., 2010).

Research examining SWB and participation in social activities has also found positive effects (Argyle, 1987; Helliwell, 2003; Helliwell & Putnam, 2005; Huppert, 2009; Putnam, 2000; Warr, Butcher, & Robertson, 2004). Other studies have focused more specifically on participation in social organizations and volunteering and found positive effects (Ellison, Boardman, Williams, & Jackson, 2001; Greibn et al., 2011; Greenfield & Marks, 2004; Morrow-Howell, Hinterlong, Rozario, & Tang, 2003; Pavlova & Silbereisen, 2012; Warr et al., 2004). Similarly, research reviewed by Huppert (2009) and Brown, Nesse, Vinokur, and Smith (2003) suggests that providing care to others may have positive effects on SWB.

Personal Characteristics Affecting SWB

Personal characteristics have received the most attention when attempting to explain SWB. These include health (George, 2010; Pinquart & Sorensen, 2000), physical activity (Kerr, Rosenberg, & Frank, 2012; Molarius et al., 2009), wealth (Kim, Sargent-Cox, French, Kendig, & Anstey, 2011; Shields & Price, 2005), psychological resources (DeNeve & Cooper, 1998; Doyle & Youn, 2000; Verme, 2009), education (Blanchflower & Oswald, 2004; Bukenya, Gebremedhin, & Schaeffer, 2003), gender (Borsch-Supan et al., 2008), and age (Das et al., 2007; Lee & Browne, 2008). Perhaps, the most important of these has been health. George (2010, p. 334) in her review of the literature on SWB noted: “Health is an important predictor of SWB at all ages and the strongest predictor of SWB during late life.” Pinquart and Sorensen (2000) came to similar conclusions in their meta-analysis of 286 studies. Closely related to health is physical activity such as walking in a park, horse riding, and boating. It was found to positively affect SWB among 263 respondents in the U.K. (Pretty et al., 2007; see also Baker, Cahalin, Gerst, & Burr, 2005; Biddle & Ekkekakis, 2005; Dolan et al., 2008; Ferrer-i-Carbonell & Gowdy, 2007; Molarius et al., 2009).

Several studies have focused on personal wealth and SWB measured as “happiness” or “life satisfaction” (Kim et al., 2011; Shields & Price, 2005). For example, Pei and Pillai (1999) in their study of the Chinese elderly found pensions to be positively related to SWB. On the other hand, some studies suggest this relationship is less than clear (Blanchflower & Oswald, 2004; Clark, Frijters, & Shields, 2008; Dolan et al., 2008; Easterlin, 1995; Frank, 2005; Lou & Gui, 2011). Somewhat related and specific to China is “Hukou” status (HS). All Chinese residents have a HS that is linked to a rural or urban location. HS is typically obtained from one’s village or city of birth but can be transferred to a different village, to a city, or from a city to a village with government approval. Urban HS has historically been associated with greater privileges and available resources than rural HS (Chan, 2008) and thus may have positive effects on SWB.

Method

Data Collection Design and Procedures

Data collected from the Chinese Health and Retirement Longitudinal Survey (CHARLS) Pilot Study were used to examine the relationship between the environment and SWB of Chinese rural elderly while controlling for social and personal characteristics. The design and data collection procedures for the CHARLS are described in detail by Zhao, Strauss, and Sun (2009) and are only briefly summarized here. The survey instruments and procedures were developed by a team of researchers from Peking University, the University of Southern California, and Oxford University. Persons aged 45 and older were randomly selected from two Chinese provinces between July and September 2008. Multiple visits were made by the CHARLS team to interview each respondent (and spouse if married) and a local official of the village or community where the respondent resided in order to obtain environmental characteristics. Although spouses of elderly respondents were included in the pilot study, we limited our analysis to the person in each household who was initially randomly selected for the study. In addition, as noted earlier, we limited our analysis to respondents living in rural areas.

The sampling procedure used probability proportionate to size techniques. Sampling occurred at four stages with the primary sampling units being rural villages and urban communities. The number of households sampled from each unit ranged from 5 to 24 with one or two individuals in each household interviewed, depending on marital status in the household. The two provinces surveyed included Gansu and Zhejiang. Gansu is the poorest and one of the most rural provinces located in the north central to western part of the country (Strauss et al., 2011). Zhejiang is a wealthy
province with a strong and relatively large private sector located on the central east coast of China. Because analyses (not shown) indicated no substantive differences in the effects of the factors considered on SWB by province, the rural village elderly from these two provinces were treated as a single group in the results. The total number of respondents living in a village was 1,267, representing 73 villages, 37 in Zhejiang and 36 in Gansu. However, interviewers were instructed to administer the “cognition” section of the questionnaire, where the SWB items were located, only to respondents who had little or no help with answering questions in the preceding “health status” section of the questionnaire. Accordingly, the number of respondents eligible for our analysis dropped to 930. Listwise deletion of cases due to missing values further reduced the sample. For example, four villages with a total of 39 respondents were missing one or more village-level characteristics. Another village was excluded because only one respondent remained. Final sample size was 850 respondents in 68 villages (34 in Zhejiang and 34 in Gansu) with a range of 4–21 and an average of 12.5 respondents in a village.

Dependent and Independent Variables

The dependent variable, SWB, has been measured in many different ways. The CHARLS data allow for two different measures of SWB: “happiness” and an index of depressive symptoms. Each of these was constructed from the respondent’s report of how often an experience occurred “in the last week.” For example, “happiness” was measured with the statement: “In the last week I was happy: (1) rarely or none of the time (<1 day), (2) some or a little of the time (1–2 days), (3) occasionally or a moderate amount of the time (3–4 days), or (4) most or all of the time (5–7 days).” To better reflect the distribution of responses and to assist with substantive interpretation, “happiness” was recoded 1 for those who responded “most or all of the time” (33.9% of respondents) and 0 for those who responded with one of the remaining three categories.

The eight “experiences” used for the index of depressive symptoms were: “I was bothered by things that don’t usually bother me”; “I had trouble keeping my mind on what I was doing”; “I felt depressed”; “I felt everything I did was an effort”; “I felt fearful”; “My sleep was restless”; “I felt lonely”; and “I could not get ‘going’.” A factor analysis indicated that the eight “depressive symptoms” items measured a single factor (Cronbach’s α = .828 with the aforementioned “happiness” item loading on a second factor). Hence, the respondent’s responses to each of the “depressive symptoms” items (on the original 4-point scale) were summed to create an index, ranging from 0, indicating that he or she experienced all eight symptoms “rarely or none of the time” in the last week, to 32, indicating that he or she experienced all eight symptoms “most or all of the time” in the last week.

The independent variables in our analysis included personal characteristics, social conditions, and environmental conditions. Of the seven personal characteristics considered, four were coded as dummy variables to better reflect their distribution in the sample and to assist with substantive interpretation of their effects. These included: “sex” (male = 1; female = 0), “place of birth” (born in village = 1; not born in village = 0), “education” (no formal education/literate = 1; some formal education = 0), and “HS” (1 = rural; 0 = urban). “Age” (in years) was measured by a single question asking date of birth. Following previous studies of China and other developing countries, the respondent’s wealth was measured by expenditures (Herrin, Amaral, & Balihuta, 2013; Strauss et al., 2011), specifically the natural logarithm of his or her “household’s expenditures (in yuan) per member in 2007.” Because six households in the sample reported 0 expenditures in 2007, a 1 was added to the variable before it was logged. Finally, “number of IADL/functional limitations” was measured by creating a “count” variable. Respondents were asked if they had difficulty with five instrumental activities of daily living (IADLs) including household chores, preparing hot meals, shopping for groceries, managing money, and taking medications. They were also asked about difficulties with seven other functional activities: running or jogging about 1 km; getting up from a chair after sitting for a long period; climbing several flights of stairs without resting; stooping, kneeling, or crouching; reaching or extending arms above shoulder level; lifting or carrying a weight (such as a heavy bag of groceries); and picking up a small coin from a table. The original response set for each of the items included: “(1) no, I don’t have any difficulty, (2) yes, I have difficulty, and (3) I cannot do it.” Responses were recoded 0 for “no, I don’t have any difficulty” and 1 for “yes, I have difficulty” or “I cannot do it.” These responses were then summed to construct the variable with a range of 0, indicating no IADL/functional limitations, to 12, indicating difficulty performing all 12 activities.

Four social conditions were included in the analysis. All were coded as dummy variables: “marital status” (married, spouse present = 1; other = 0), “received help from others last year” (respondent/spouse received financial/other help from others last year = 1; no = 0), “provided help to others last year” (respondent/spouse provided financial/other help to others last year = 1; no = 0), and “perception of future help” (yes, help available if needed = 1; no = 0).

Environmental conditions encompassed both the village’s natural habitat and its infrastructure. The natural environment was measured by “village located in the plains” (yes = 1; no = 0), “village had a natural disaster in past 5 years” (yes = 1; no = 0), and “number of rainy days in the village last year.” Infrastructure was measured by “type of roads” (paved = 1; not paved = 0), “coal used for heating and/or cooking in the respondent’s household” (yes = 1; no = 0), “sewer system in village” (yes = 1; no = 0), and a
measure of village wealth, the natural logarithm of “village net income (in yuan) per capita in 2007.” Although village wealth varied by province, it was, nevertheless, highly correlated with being in Zhejiang province \( (r = .78, p < .001) \). Thus, as we could not include both village wealth and province in the same model, for substantive reasons, we chose to include only village wealth. However, when province was substituted for the village wealth variable in sensitivity analyses (not shown), the effects of the other variables in the model did not change. The final infrastructure variable, “number of social amenities/program for seniors in the village;” indicated how many of a variety of 12 opportunities were provided by the village, including: an activity center for the elderly; an elderly association; rooms for card games and ping pong; and other entertainment facilities, and assorted exercising facilities.

**Analytical Strategy**

Multilevel regression analyses with a random intercept were used to estimate the effects of individual, social, and environmental characteristics on SWB. Multilevel logistic regression results (odds ratios) are presented for the “happiness” measure of SWB, whereas multilevel linear regression results are presented for the depressive symptoms index. More specifically, for happiness, Stata 11’s (StataCorp, Inc., College Station, TX) multilevel logistic regression procedure, xtologit, was used. For the depressive symptoms index, Stata 11’s multilevel linear regression procedure, xtreg (with maximum likelihood estimation), was used. These techniques account for the clustering of respondents within village (Rabe-Hesketh & Skrondal, 2012a, 2012b). Tolerance checks revealed no problems with multicollinearity.

The linear regression results include unstandardized coefficient estimates \( (B) \). We did not present standardized estimates because those associated with dichotomous variables are not interpretable, and our analysis included a large number of dichotomous variables (Fox, 1997). For both the logistic (happiness) and linear (depressive symptoms) regressions performed, Model 1 examines the effects of the village’s personal characteristics. Model 2 adds social conditions. And, Model 3 adds environmental conditions. The goodness-of-fit of the different models was compared using deviance or likelihood ratio tests and Akaike’s information criterion (AIC). The difference in deviance (−2 log likelihood) of two nested models had a χ² distribution with degrees of freedom \( (df) \) equal to the additional number of predictors in the larger model. AIC is an alternative measure of fit that corrects for model complexity (i.e., number of predictors). Two-tailed \( p \) values are reported to reflect significance of the independent variables.

A “baseline” or intercept-only model was examined to assess the extent of the dependent variables’ variation between villages and the advisability of using a multilevel modeling strategy. According to the results of these preliminary analyses (not shown), the intraclass correlation coefficient (ICC) for the depressive symptoms index was 0.170, indicating that about 17% of the variation in symptoms was associated with differences between villages. Further, based on a likelihood ratio test, the null hypothesis that this variation is zero (and, thus, a multilevel model would not be required) is rejected \( (p < .001; \) see Rabe-Hesketh & Skrondal, 2012a, p. 142). The results for the “happiness” variable were similar \( (ICC = 0.081; p < .001) \).

**Results**

An examination of the descriptive statistics for our sample of older Chinese villagers shows that 34% of the sample was happy most days, and scored, on average, 14 out of a possible 32 on the depressive symptoms index (the higher the score the more symptomatic of depression; Table 1). The sample was fairly evenly split on sex and education: 52% of the respondents were male and 56% had at least some formal education. Although only a slight majority (61%) of the sample lived in the same village in which they were born, an overwhelming majority (96%) had rural HS. The sample was relatively young and physically healthy, averaging 59 years of age and 2 out of a possible 12 functional/IADL limitations. Overall, the villagers’ economic situation tended to be relatively poor. They lived in households with an average annual expenditure per member of only 6,200 yuan in 2007 (exchange rate was roughly 6.5 yuan to one U.S. dollar).

When considering the villagers’ social conditions, they were quite varied. About three fourths were married (73%) and nearly two thirds (65%) indicated that they (or their spouse) had received financial/other support from others in the last year. Thus, it is not surprising that most (77%) believed that help would be available to them in the future if needed. However, fewer (51%) of the villagers reported providing financial/other support to others in the last year.

The natural environment of the sample was also quite varied. The number of rainy days experienced by villagers in the year before they were interviewed ranged from 8 to 160 and averaged 62. About 61% of the villagers lived in hilly or mountainous areas. One fourth (25%) lived in an area that had experienced a recent natural disaster. Many of the respondents lived in villages with relatively poor infrastructure. For example, nearly one half (46%) lived in villages that had no major paved road, and more than two thirds (69%) lived in villages that had no sewer system. Over one third (38%) used coal for heating or cooking in their household. The average village provided only 3 out of the 12 social amenities/programs for elderly that were considered. Finally, the typical village was relatively poor, averaging only about 4,771 yuan in net income per capita in 2007.
The multilevel logistic regression analysis of happiness shows that, when considering the personal characteristics, four had significant effects: place of birth, HS, household expenditures, and number of IADL/functional limitations (Table 2, Model 1). Somewhat surprising, respondents living in their birth village were 38% less likely (100*[odds ratio – 1] = 100*[0.62 – 1] = −38%) than those living elsewhere to feel happy most days (p < .05). As expected, however, respondents with rural HS, which historically has been associated with fewer privileges, were 50% less likely than those with urban status to feel happy most days (p < .10). Also, as expected, poor health had a negative effect: The odds of feeling happy most days were reduced 18% with each additional physical limitation experienced (p < .001). Household wealth had the predicted positive effect (p < .05).

Adding the social conditions to the personal characteristics shows that HS and household wealth lost significance but, with the addition of the social variables, the fit of the model for happiness was significantly improved (\( \chi^2 = 16.950, df = 4, p < .01; \) AIC = 1036.885; Table 2, Model 2). Contrary to expectations, the social variables, marital status and receiving help from others in the last year, had no significant effects on happiness (p > .05). Believing help would be available in the future if needed was significant: Those that held this belief were 72% more likely to feel happy most days (p < .01). Likewise, respondents who provided help to others in the last year were 64% more likely to feel happy most days (p < .01).

With the addition of the environmental variables, little change occurred regarding the effects of the personal and social variables on happiness (Table 2, Model 3). The fit of the model also remained essentially the same (\( \chi^2 = 15.249, df = 8, p = .0554; \) AIC = 1037.636). Nevertheless, two of the environmental variables had effects on happiness worth noting. Specifically, as expected, the odds of feeling happy most days were 45% lower in villages that had recently experienced a natural disaster (p < .01) and 45% higher in villages with a sewer system (p < .10).

The multilevel linear regression analysis of the depressive symptoms index shows that, when considering personal characteristics alone, 24% of the variation in level of depression was explained (\( R^2 = .236; \) Table 3, Model 1). The effects of household wealth and physical limitations on depressive symptoms were consistent with their effects on happiness. As expected, household wealth decreased depression (p < .10), and physical limitations increased it (p < .01). Age was found to have a negative effect (p < .01). The addition of social conditions significantly improved the fit of the model (\( \chi^2 = 26.41, df = 4, p < .001; \) AIC = 5015.310) and increased the variation in level of
Table 2. Multilevel Logistic Regression Models Predicting Feeling Happy Most Days

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed effects</td>
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<tr>
<td>Villager’s personal characteristics</td>
<td></td>
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<tr>
<td>Sex (0 = female; 1 = male)</td>
<td>1.24</td>
<td>1.30</td>
<td>1.41</td>
</tr>
<tr>
<td>Age</td>
<td>1.01</td>
<td>1.02</td>
<td>1.01</td>
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<tr>
<td>Place of birth (0 = not born in village; 1 = born in village)</td>
<td>0.62*</td>
<td>0.59**</td>
<td>0.62*</td>
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<tr>
<td>Hukou (0 = urban; 1 = rural)</td>
<td>0.50</td>
<td>0.54</td>
<td>0.56</td>
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<tr>
<td>Education (0 = some formal education; 1 = no formal education)</td>
<td>0.91</td>
<td>0.95</td>
<td>0.95</td>
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<tr>
<td>LN household expenditures in 2007*</td>
<td>1.22*</td>
<td>1.15</td>
<td>1.11</td>
</tr>
<tr>
<td>Number of IADL/functional limitations</td>
<td>0.82***</td>
<td>0.83***</td>
<td>0.85***</td>
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<tr>
<td>Social conditions</td>
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<tr>
<td>Marital status (0 = other; 1 = married, spouse present)</td>
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<tr>
<td>Received help from others last year (0 = no; 1 = yes)</td>
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<tr>
<td>Provided help to others last year (0 = no; 1 = yes)</td>
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<tr>
<td>Perception of future help (0 = other; 1 = available if needed)</td>
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<tr>
<td>Environmental conditions: natural and infrastructure</td>
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<tr>
<td>Village located in the plains (0 = no; 1 = yes)</td>
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<tr>
<td>Village had natural disaster in past 5 years (0 = no; 1 = yes)</td>
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<tr>
<td>Number of rainy days in village last year</td>
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<td>Type of most roads in village (0 = not paved; 1 = paved)</td>
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<tr>
<td>Coal used for heating/cooking in villager’s household (0 = no; 1 = yes)</td>
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<td>Sewer system in village (0 = no; 1 = yes)</td>
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<tr>
<td>Number of social amenities/programs for seniors in village</td>
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<tr>
<td>LN village net income per capita in 2007*</td>
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<tr>
<td>Random effects (intercept only)</td>
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<tr>
<td>Between-village variance ((\psi); SE)</td>
<td>0.466 (0.126)</td>
<td>0.378 (0.138)</td>
<td>0.082 (0.462)</td>
</tr>
<tr>
<td>Intraclass correlation coefficient (p)</td>
<td>0.062</td>
<td>0.042</td>
<td>0.002</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>−513.918</td>
<td>−505.443</td>
<td>−497.818</td>
</tr>
<tr>
<td>Akaike’s information criterion</td>
<td>1045.835</td>
<td>1036.885</td>
<td>1037.636</td>
</tr>
</tbody>
</table>

Notes. N = 850 older adults in 68 villages; odds ratio = \(e^B\), where \(B\) is unstandardized logistic regression coefficient estimate; IADL = instrumental activities of daily living; LN = natural logarithm; SE = standard error.

*Exchange rate was roughly 6.5 yuan to one U.S. dollar.
***p ≤ .001, **p ≤ .01, *p ≤ .05, †p ≤ .10 (two-tailed tests).

Discussion

A review of the literature showed that historically the majority of research on SWB has focused on personal characteristics. If a social scientist chose to consider only personal characteristics for explaining SWB, our analysis suggests a host of significant variables would be identified (Tables 2 and 3, Model 1). More specifically, “happiness” increased as the respondent’s number of physical limitations (proxy for health) decreased, the respondent had urban HS, the respondent was not living in the village where she/he was born, and the respondent had relatively high household expenditures (a proxy for income). Depressive symptoms decreased as physical limitations decreased and as income and age increased. Further, 24% of the variation in depressive systems was attributed to personal characteristics alone (Table 3, Model 1).

Social conditions have not received the same amount of attention among researchers. Nevertheless, a great deal of research has focused on informal relationships, social supports, social activities, and social organizations. Our examination of Chinese village elderly supports the emphasis on social conditions even after controlling for personal characteristics. Respondents were more likely to feel happy...
It is not surprising that those who have experienced a natural disaster in the past 5 years were less likely to be happy. Similarly, rainy days were generally associated with more depressive feelings. This supports the work of Rehdanz and Maddison (2005) who found climate to be significantly related to “happiness” with climate characteristics including temperature and precipitation. No literature was identified that examined the relationship between village wealth (measured as natural logarithm [LN] village net income per capita) and SWB. However, the findings indicate that those in wealthier villages experienced fewer depressive symptoms. Perhaps, the village had the resources to provide elderly villagers with what they needed to maintain good mental health and subsequently SWB. A second possible explanation is that the elderly in wealthier villages may have felt more confident that the village could help them if needed. Alternatively, those in poorer villages may have been more concerned that their village could not adequately support their needs.
An examination of air pollution via the use of coal in the household found a significant positive association between its use and depressive symptoms. One explanation is that breathing contaminants in the air resulted in negative physical reactions including feelings of depression. This explanation is supported by the work of Lim and colleagues (2012) who found pollutants in the air (particulate matter, nitrogen oxide, ozone) to be significantly associated with depressive symptoms among an elderly population in Korea and provides support for the work of Welsch (2006) who found a negative effect of air pollution (particulate matter, nitrogen dioxide, lead) on life satisfaction. An additional explanation is that the use of coal may have served as a reflection of the older villager’s general living environment. Those who had been unable to convert from coal to cleaner energy sources such as gas and electricity may have been living in what was considered a less desirable situation, which contributed to feelings of depression.

Also significant was a positive association between the existence of a village sewage system and feelings of happiness. Here again, this may reflect the general living environment with those having a sewage system feeling better about their situation and subsequently feeling happier. These explanations have been used by Roh and colleagues (2011) in their examination of the relationship between “mental health” and neighborhood characteristics. They concluded that individuals who were less satisfied with their overall neighborhood environment were more likely to have depressive symptoms.

Those personal, social, and environmental variables having the most consistent associations with SWB, that is, with both happiness and depressive symptoms, included health (measured as physical limitations), perception that help is available when needed, and giving help to others. These associations support the previous research noted earlier—people are happier and have fewer depressive symptoms when they are healthier, believe they have help available when needed and provide help to others.

Interestingly, the data do not support previous research regarding several of the personal characteristics once controlling for social and environmental conditions. Men were not found to be happier and with fewer depressive symptoms than women although effects are in the directions expected. Likewise, education and income (measured as LN of household expenditures) had no effects on happiness or depressive symptoms once controlling for social and environmental factors. These findings support those of Lou and Gui (2011) who concluded that income appears to be less important than factors such as social attitudes and health among the rural elderly. A second possible explanation is that Chinese rural elderly are not accustomed to having large sums of income or expenditures so having small expenditures do not reduce their SWB.

In sum, we proposed that environmental factors are important to the SWB of Chinese rural elderly. The findings show that five of the eight environmental variables affected happiness or depressive symptoms after controlling for personal and social characteristics. On the other hand, the variation explained in depressive symptoms beyond personal and social factors was modest. Further, the most consistent factors associated with SWB were two social conditions, “help available if needed” and “provided help to others” and a single personal characteristic, health.

A major limitation of the study was the lack of longitudinal data. Any suggestions or references to causal effects can only be hypothetical. A second limitation was the use of a village leader to obtain seven of the environmental conditions. Chinese village leaders were required to provide these types of information to government township offices. Unfortunately, the specific methods used by village leaders to collect these data are unclear. Therefore, it is unclear how accurate or unbiased these data are and so they must be considered cautiously. A third limitation was the inability to control effectively for the amount of outmigration that occurred from villages to urban communities. It is reasonable to suspect that villages with a large amount of outmigration may have been different in some ways from those that experienced little outmigration and these differences may have affected SWB. Finally, making the connection between environmental characteristics and SWB is a relatively new one. Consequently, there has been relatively little conceptual development or studies examining these relationships. This can make the research process more challenging to the extent that important factors have yet to be identified and/or are not measured during data collection.

Implications for Social Policy

There are several findings that standout with regard to social policy in China. The use of coal in the home and the lack of a sewage system were found to be negatively associated with SWB. Thus, the establishment of village sewage systems and the reduction of coal use may increase SWB. Health was also found to be important to the elderly villager’s SWB. Programs designed to help older villagers maintain or improve their health, such as China’s New Cooperative Medical Scheme, which is intended to provide universal health coverage may result in improved SWB of elders (Lei & Lin, 2009; Li & Zhang, 2012). Finally, programs that assure elders that help is available if needed may create higher feelings of well-being as may programs that are designed to help elders help others.

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contributed to the conceptualization of the paper, variables considered, and discussion section. Drs. H. Luo and Y. Shen contributed to the discussion section and literature review.

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**References**


