PSYCHOLOGICAL DISPOSITION AND SELF-REPORTED HEALTH IN OLD AGE: AN EXAMINATION OF THE OLDEST OLD IN CHINA[*]

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ABSTRACT

Using data from the Chinese Longitudinal Healthy Longevity Survey (1998 and 2000), our analysis examines the effect psychological disposition has on self-rated health among the oldest old (those aged 80+) in China. China will continue to depend on non-medical and preventative strategies for promoting healthy ageing because deficient public resources. Our principal objective is to identify whether psychological disposition represents an avenue toward successful ageing. Our findings demonstrate that a robust psychological disposition does indeed improve self-rated health. The influence of psychological disposition is independent of variance in health status, health bevaviours, gender, and major sociodemographic variables. Our findings also show that this effect differs between age groups, as the relationship between psychological disposition and self-rated health is significant for octogenarians and nonagenarians, but is non-significant for centenarians.

Key words: Psychological disposition, self-reported health, oldest old, China

PSYCHOLOGICAL DISPOSITION AND SELF-REPORTED HEALTH IN OLD AGE: AN EXAMINATION OF THE OLDEST OLD IN CHINA

There were 87 million elderly individuals (those 65+) in mainland China by the year 2000, up from 26 million in 1950, amounting to approximately 7 per cent of the general population (United Nations 2002). Consistent with global demographic trends, the oldest old (those 80+) represent an especially fast growing segment of the Chinese elderly population. Numbering around 12 million persons today, a recent United Nations report projects the Chinese oldest old population to reach over 30 million persons by 2025 and almost 100 million persons by 2050. But these massive and commendable demographic shifts have also been accompanied by a higher prevalence of health challenges. In particular, diminished functional capacity is a health issue among the Chinese oldest old, as about 16 per cent of octogenarians, 37 per cent of nonagenarians, and 63 per cent of centenarians report having mild or severe activities of daily living disabilities (Zeng and Vaupel 2002; Zeng et al. 2001). The prevalence of functional limitations is an insightful measure because it provides a reasonable proxy for overall health status, quality of life, and health care demands among the oldest old (Zeng et al. 2002).

Increasingly high risks of morbidity and disability are well-established realities for advanced age groups, and chronic diseases and functional impairments impinge upon the day-to-day routines and life satisfaction of the oldest old (Manton and Soldo 1992; Smith, Borchelt, Maier, and Jopp 2002). But the growing ranks of the oldest old population are not doomed to have their final years stifled by poor health status. As Suzman and Associates (1992) point out, the common perception that advanced age is characterized by frailty and disability is a pessimistic attitude toward the ageing process that ignores possibilities for successful ageing. A crucial factor moderating the well-being of oldest old individuals is how functional limitations are confronted and managed. There are considerable grounds for optimism, however, for

mounting evidence illustrates that the ageing process is more dynamic than earlier viewpoints imagined, as many elderly individuals manage to adapt to their changing life circumstances. The principal task of this paper is to identify whether aspects of psychological disposition create an avenue toward successful ageing (as defined by global self-rated health) among the oldest old in China.

This study analyzes data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS) to investigate the correlation between psychological disposition and self-rated health within the oldest old population. The CLHLS offers an in-depth perspective into health patterns among the oldest old population, and contains an exceptionally large study sample, which is essential for accurately representing sub-populations and generating valid results. Besides China, most other developing and developed countries are experiencing rapid population ageing. Apart from its relevance to China scholars and Chinese policy-makers, this study takes advantage of rare data in order to contribute a broader look into successful ageing within oldest old populations. As with China, most developing countries will continue to depend largely on non-medical and preventative strategies for promoting healthy ageing because deficient public resources and budgetary constraints limit per capita medical expenditures and access to formal health care services.

Background

Among the inhabitants of the World's less developed regions, improved living standards and medical advancements have raised life expectancies at birth by 56 per cent over the past five decades (United Nations 2002). But there are some concerns whether life satisfaction – a subjective measure of quality of life and a cornerstone of successful ageing – parallels these gains in longevity. Indeed, gerontological research in Taiwan indicates that life satisfaction

declines beyond 65 years of age, largely because of effects associated with the ageing process, such as income decline, health deterioration, and changes in living arrangements (Chen 2001). Self-rated health, our dependent variable, is an integral component of life satisfaction in old age (Mannell and Dupuis 1996), and thus provides a lucid understanding of whether living better accompanies longer life span. The following sections provide a summary of the analytical importance of global self-rated health and a definition of successful ageing. We then provide a brief overview of theoretical models that may explain why having a robust psychological disposition is an important determinant of successful ageing.

Self-Rated Health

A substantial literature details the meaning of global self-ratings of health, which are well-established, powerful, and cost-effective mechanisms of assessing current and future health statuses, including morbidity, disability, and mortality (Benyamini, Leventhal, and Leventhal 1999; Idler, Hudson, and Leventhal 1999; Kaplan and Baron-Epel 2002). An individual's self-rated health is a brief but comprehensive statement of their overall health status that covers multiple objective and subjective assessments of personal health, such as medical history, current physical symptoms and body sensations, health beliefs and behaviors, and psychological well-being (Kaplan and Baron-Epel 2002). The value of self-ratings of health stems from their capacity to predict short- and long-term survival, the onset of functional limitations, and health care demands (Benyamini, Leventhal, and Leventhal 2003; Idler et al. 1999). Self-rated health is a general indicator of successful ageing, and thus reflects an individual's ability to adapt to changing health status and life circumstances (Smith et al. 2002). In this respect, self-rated health is associated with psychological disposition, for personal attitudes and motivations guide subjective evaluations of health status, which implies that individuals may assign different

assessments to similar health conditions because of differences in how these conditions are perceived and confronted.

Successful Ageing

Successful ageing involves maximizing life span while simultaneously reducing the number of health disorders and compressing the time spent in poor health during old age (Baltes and Baltes 1990). A strictly medical approach is expensive and inefficient, in these regards, for it focuses on treating health disorders rather than on preventative strategies that promote successful ageing (Fries 1990). Our analysis adopts the perspective that healthy ageing is a dynamic process involving efficacious adaptation to changes in health status during old age (Baltes and Baltes 1990). We prefer this perspective because successful ageing is not simply a matter of being free from disease or disability, for the relatively high prevalence of chronic conditions and functional limitations at advanced ages would thus result in generally poor self-ratings of health among the oldest old. But self-rated health is robust throughout this population. Among Chinese octogenarians, for instance, 60 per cent reported being in good health (the best rating) and another 31 per cent reported being in moderate health (Zeng and Vaupel 2002). Only 8 per cent of octogenarians reported being in poor health. These self-ratings decline somewhat among nonagenarians and centenarians, but the percentage reporting poor health remains more or less similar to octogenarians.

A study by von Faber and Associates (2001) indicates that many oldest old people are satisfied with their lives despite having functional limitations. This finding is termed the *disability paradox* and refers to an individual's ability to adjust to and accept changing physical circumstances. Although being healthy and functionally independent are important criteria of successful ageing, the standard for health and functional independence is variable across age

groups and between individuals. For example, what constitutes the optimal standard for health and independence for centenarians is presumably lower than for octogenarians because personal health expectations and beliefs about successful ageing change with age (Knight and Ricciardelli 2003), and thus centenarians may report similar self-rated health as octogenarians even if they experience poorer health. Rather than characterizing health within oldest old populations by the absence or presence of disease, then, we follow Smith and Associates (2002), who suggest using a multi-faceted definition based on assessments of health status relative to age and cohort norms. By using this definition, global self-rated health may be the single most effective instrument for gauging overall health among the oldest because it captures what biomedical assessments cannot: how individuals interpret and cope with health disorders.

Psychological Resources and Health

Zeng and Vaupel (2002) speculate that a good self-rating of health may be a "secret" of Chinese longevity, protecting even individuals with less than optimal functional capacity, and allude to the influence of positive thinking on healthy ageing. Aaron Antonovsky's (1979, 1987) innovative concept of *salutogenesis* is instructive for understanding the association between positive thinking and healthy ageing. This concept refers to "health causing" processes (i.e., examines why some people are healthy), in contrast to pathogenesis, which refers to the origins of disease. The salutogenic model proposes that the belief that "life is comprehensible, manageable, and meaningful" – which Antonovsky terms *sense of coherence* – benefits health outcomes because it provides individuals with the psychological and emotional fortitude necessary to effectively confront and manage negative life experiences. Sense of coherence is an important dimension of personality structure because it influences how an individual interprets their internal and external environments, and represents a "dynamic feeling of confidence" that

they have control over adverse situations. A strong sense of coherence produces a salutogenic effect because it helps an individual mobilize resources to cope with difficult circumstances, whereas an individual with a weak sense of coherence feels helpless under similar circumstances.

A long-standing course of research shows that differences in psychological resources offer a plausible reason for individual variation in health outcomes (e.g., Gecas 1989; Kobasa 1982; Thoits 1995). Having a firm sense of control is associated with numerous positive health practices and outcomes, including proactive help-seeking behaviour, preventative health care, less overall incidence of illness, and high self-rated health, among other things (Schieman and Turner 1998). A positive attitude appears to be a particularly important salutogenic resource for elderly people, with a sense of control becoming more relevant in old age because biological changes experienced in later life intensify the need for coping with illness and practicing good health behaviours (Rodin 1986). For example, a positive sense of control may counterbalance the harmful effect a functional limitation would otherwise have on self-rated health because this attitude directly influences an individual's confidence in their ability to handle or accept adverse situations. A sense of control, moreover, is associated with an orientation toward good health behaviour, and this attitude may therefore prevent or postpone the onset of age-related health problems through healthy practices such as eating a balanced diet, getting regular exercise, and not smoking (Grembowski et al. 1993).

A recent study by Smith, Gerstorf, and Li (2004) confirms that psychological resources are predictive of mortality among the Chinese oldest old, observing that these resources generally shape individual responses to social losses (e.g., widowhood), health problems, and functional limitations. The authors illustrate that psychological disposition consists of two dimensions: a positive or salutogenic side defined by personality qualities such as optimism, conscientiousness, control, and happiness; and a negative or pathogenic side defined by problems

such as neuroticism, loneliness, and low self-esteem. The salutogenic side contributes to successful ageing because optimism, conscientiousness, control, and happiness are important factors behind effective coping and adaptation. On the other hand, consisting of neuroticism, social isolation, and low self-esteem, the negative side contributes to passivity, avoidance, denial, and helplessness, which foster an inability to manage changing life circumstances (Kobasa, Maddi, and Kahn 1982). As Smith and Associates (2004) indicate, a robust psychological disposition is therefore characterized by an emphasis on optimism, control, and happiness, which improve coping, and a minimization of neuroticism, social isolation, and low self-esteem, which undermine coping.

Hypotheses

Our analysis is grounded in the notion that psychological disposition is a major indicator of health status. We consider five hypotheses.

1. We hypothesize that psychological disposition will predict self-rated health among the oldest old, and specifically that a more robust disposition at time 1 (1998) will increase self-rated health at time 2 (2000).
2. We hypothesize that the correlation between psychological disposition and self-rated health could be spurious, for differences in physical health status at time 1 could explain differences in self-rated health at time 2. We introduce controls for health status because prior research indicates that previous illness can lower future self-ratings of health (Benyamini et al. 1999).
3. We hypothesize that differences in health behaviour may confound the relationship between psychological disposition and self-rated health. We introduce controls for time 1

health behaviours because prior research shows that these modify self-rated health (Li, Zhang, and Wang 2004).

4. We hypothesize that gender may confound the relationship between psychological disposition and self-rated health. We control the effects of gender because oldest old women outnumber and have more health problems and other disadvantages than oldest old men (Zeng et al. 2002).
5. We hypothesize that an age effect may modify the relationship between psychological disposition and self-rated health. We disaggregate the oldest old into octogenarians, nonagenarians, and centenarians to examine whether the effect of psychological disposition differs by age group.

We also introduce controls for sociodemographic variables, including education, age, marital status, living arrangements, children and siblings, ethnic status, and rural residence, as these have well-established effects on health status.

Data and Methods

Data

Our empirical analysis uses data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), including the 1998 baseline survey and 2000 follow-up survey (see Zeng et al. 2001 for detailed information on the sample design). The survey covers a random selection of half the counties and cities in 22 provinces (n = 631), using multi-stage cluster sampling design, representing about 85 per cent of the Chinese population. The baseline survey tried to interview all centenarians in the included areas. For each centenarian respondent, an octogenarian (aged 80-89) and a nonagenarian (aged 90-99) living in the same or in a neighboring area, with pre-

determined age and sex characteristics, were interviewed. The survey aimed for an equal gender distribution at each age within the octogenarian and nonagenarian categories. The survey over-sampled extremely old individuals and oldest old men because these individuals are few in numbers.

The CLHLS was funded primarily by the National Institutes of Health (NIH) and conducted by the Center for Healthy Aging and Family Studies, Peking University, and the China National Research Center on Aging, in 1998 with follow-ups in 2000 and 2002. The survey was designed to generate comprehensive interview data on healthy longevity and mortality patterns within the oldest old population. Extensive information was collected on health status and indicators of healthy ageing, such as family profile, living arrangements, geographic proximity to children, formal and informal support, physical health status, health risk behaviors, activities of daily living, self-rated health, several dimensions of mental health, and medical care services. The survey also included supplementary demographic, socioeconomic, and environmental questions. A doctor or nurse gave each respondent a basic medical examination. The overall response rate was 88 per cent, but this figure rises to 98 per cent when the deceased, recent migrants, and individuals too infirm to participate are excluded.

The 1998 baseline survey or time 1 (T1) contains 9,093 oldest old respondents: this includes 2,262 respondents aged 100-105 years; 3,013 respondents 90-99 years; and 3,550 respondents aged 80-89. The survey also includes 112 individuals aged 78-79 and 156 individuals aged 106 and above. The 2000 follow-up survey or time 2 (T2) includes 4,831 respondents from the original sample and proxy responses (from a close relative) for 3,368 respondents who died before the follow-up. In total, 894 original respondents (9.8 per cent) were lost in the 2000 follow-up. After removing cases where the key variables are missing, our study sample contains 4,366 individuals from the 2000 follow-up survey.

Measures

Our dependent variable is self-rated health. We measure self-reported health based on responses to a five-level ordinal variable, ranging from excellent (5) to poor (1).

Our main independent variable is psychological disposition. Each respondent was prompted with the following statement: "People have their own disposition [personality]. Here are some statements of people's description of their disposition. How similar are you to these people?" The statements on psychological disposition were as follows: I always look on the bright side of things; I like to keep my belongings neat and clean; I often feel fearful or anxious; I often feel lonely and isolated; I can make my own decisions concerning my personal affairs; The older I get, the more useless I feel; I am as happy now as when I was younger. There were five possible responses to each statement, including very similar, similar, so-so, not similar, and not similar at all. An overall assessment of psychological disposition was derived from the total score of the responses to these statements (Cronbach's alpha = .63). These questions measure psychological disposition by tapping levels of optimism, conscientiousness, personal control, happiness, neuroticism, loneliness, and self-esteem (Smith et al. 2004).

[Table 1 About Here]

We measure physical health status with two variables. We use a three-level categorical variable to indicate: a) the presence of a serious chronic health condition, b) the presence of any chronic health condition, and c) the absence of any chronic health condition. The list of chronic conditions includes hypertension, diabetes, stroke, respiratory problems, vision problems, cancers, ulcers, Parkinson's disease, and others not specified. Over half of the target population (52 per cent) report a chronic health problem, and 11 per cent report a serious chronic condition. We use an ordinal scale to measure activities of daily living, which covers bathing, dressing,

toileting, transferring, continence, and feeding. The prevalence of activities of daily living limitations is generally low, with the average number of impairments being well under one per elderly person.

We measure health behavior based on vegetable and fruit consumption and amount of exercise. We measure vegetable and fruit consumption by frequency in diet, with a four-level ordinal scale between rare/never and almost everyday. We measured exercise using a dummy variable indicating regular exercise or performing physical labour. We indicate female gender with a dummy variable. Women form about 64 per cent of the target population.

We measure education by years of completed schooling. We measure age in years. The mean age of the target population is about 84 years. We use a three-level categorical variable to measure marital status. We combine the separated and the divorced with never married respondents because these events were uncommon for oldest old. Approximately 70 per cent of the target population are widowed, 27 per cent are married, and less than 4 per cent are separated, divorced, or never married. We measure living arrangement with a five-level categorical variable: with a spouse only (13 per cent); with children and/or grandchildren (65 per cent); with siblings, parents, and/or others (2 per cent); in a nursing home (7 per cent); and living alone (13 per cent). We use a continuous variable for the number of living children and another for the number of living siblings. On average, elderly persons in the target population have 2.7 surviving children and less than one surviving sibling. We use a dummy variable to indicate ethnic minority group membership (8 per cent) and another to indicate rural residence (64 per cent).

Statistical Model

We used random effects models in the data analysis (Laird and Ware 1982) to adjust for the cluster effects in the survey and obtain valid estimates of parameters and standard errors. In this study, we propose the following simplified random effects model:

$$y_{ij} = \mu_N + \sum_{k=1}^{m} x_{ijk}\beta_k + \alpha_i + \varepsilon_{ij}\ ,\ i = 1, 2, \ldots, c,\ j = 1, 2, \ldots, n_i \qquad (1)$$

where y_{ij} is the observed value of the dependent variable for the *j*th respondent in the *i*th county/city; μ_N is the intercept (the overall mean of the response measure); x_{ijk} represents the *k*th explanatory variable (psychological disposition and covariates in Table 1); β_k is the corresponding unknown fixed-effects parameter; $\alpha_i \sim$ iid N(0, δ_N^2), and $\varepsilon_{ij} \sim$ iid N(0, δ_ε^2). The first two terms on the right-hand side of equation (1) comprise the fixed effects part of the model, whereas ($\alpha_i + \varepsilon_{ij}$) forms the random effects part of the model. The variance components δ_N^2 and δ_ε^2 measure the variations of counties/cities and respondents in terms of the response measure, respectively. Equation (1) can also be seen as a two-level hierarchical linear model (Bryk and Raudenbush 1992) because the respondents are nested within each city or country in the target population. The parameters and variance components in the random effects models were all estimated using the Restricted Maximum Likelihood (REML) method available in the SAS mixed models procedure (Littell et. al 1996).

Results

Table 2 presents the random effects models of psychological disposition on self-reported health. All explanatory variables are T1 variables, and all models include T1 self-reported health to control for the stability/floor effect. We began our analysis with a simple model (model 1),

which includes only T1 psychological disposition. Our results indicate that psychological disposition is associated with T2 self-reported health.

[Table 2 About Here]

We hypothesized that physical health differences at T1 may confound how psychological disposition influences T2 self-ratings of health, for previous literature indicates that disease history can lower self-rating health by reminding people of the *potential* for serious illness (Benyamini et al. 1999). Model 2 examines whether differences in T1 health status explain away the effect of T1 psychological disposition on T2 self-rated health. Our results indicate that the effect of T1 psychological disposition is independent of variance in physical health status. But the findings also demonstrate that poor health status significantly lowers self-rated health, even though health status does not change the magnitude of influence psychological disposition exerts upon self-rated health.

We also hypothesized that the connection between T1 psychological disposition and T2 self-rated health may be confounded by differences in health behaviour, as a recent study identifies a strong correlation between this variable and self-rated health among the Chinese oldest old (Li et al. 2004). Model 3, however, disproves this hypothesis, and thus builds an addition base of support for our hypothesis that psychological disposition has an independent effect on self-rated health, although our findings show that good health practices do indeed improve self-rated health.

We found no support for our hypothesis that gender may account for the connection between T1 psychological disposition and T2 self-rated health, as indicated in Model 4, even though previous literature suggests that oldest old women face disadvantages that lower their self-rated health in comparison to oldest old men (Zeng et al. 2002). Our results do indicate that

women have lower self-rated health than men, but this difference does not significantly alter how psychological disposition affects self-rated health.

Our final model, which combines the variables from the previous models and introduces major sociodemographic controls, provides an overall confirmation for our hypothesis that T1 psychological disposition has an independent effect on T2 self-rated health. The effect of psychological disposition declines slightly in model 5 from previous models, but the decline is not statistically significant ($p > .05$).

As expected, Table 2 confirms that poor health status, health behavior, and being female all lower self-rated health. Further, both variance components δ_N^2 and δ_ε^2 are highly significant in all models, indicating significant variations of counties/cities and respondents in terms of T2 self-rated health, respectively.

Table 3 presents the random effects models of psychological disposition on self-reported health by our selected age groups. The results confirm our hypothesis that the effect of psychological disposition varies by age group. In specific, our findings show that the effect weakens with age, as the relationship between psychological disposition and self-rated health is non-significant for centenarians. Again, the effects of the other covariates are generally consistent with what would be expected, and the variance components are significant in all models.

[Table 3 About Here]

Discussion and Conclusion

This study examined the relationship between psychological disposition and self-rated health among the Chinese oldest old. As noted, a substantial literature indicates that psychological resources constitute a major health variable, and consist with this, our findings

confirm that psychological disposition predicts self-ratings of health in advanced age. A robust psychological disposition likely affects health status by maximizing positive thinking and coping, which are crucial personal assets for adapting to life changes, accepting life changes, and avoiding behaviours that trigger or exacerbate disease and functional limitations (Grembowski et al. 1993; Kobasa et al. 1982; Smith et al. 2004). A robust disposition also represents the ability to minimize thoughts and behaviours (e.g., neuroticism, low self-esteem, helplessness) that can suppress coping ability or induce illness.

Our findings show that psychological disposition has an independent effect on self-rated health among elderly people. Based on evidence from prior literature, we hypothesized that health status, health behaviours, and gender may dismiss this relationship. Our controlled results, however, illustrate that this relationship is not spurious. The non-significant difference in the effect of psychological disposition between our baseline and the full models disprove that health status, health behaviour, gender, and major sociodemographic variables explain away the connection between disposition and self-rated health.

But our findings appear to indicate that this relationship is not uniform across selected oldest old age groups. We disaggregated the oldest old population into octogenarians, nonagenarians, and centenarians to examine whether the effect of psychological disposition differs by age. Our results illustrate that disposition predicts self-rated health among octogenarians and nonagenarians, but is non-significant for self-rated health among centenarians. Prior research shows that centenarians cope through having ample social support, necessary because they have many functional limitations (Dello Buono, Urciuoli, and De Leo 1998), which may bypass the significance of psychological resources. Having far outlasted mean life expectancy, we cannot expect that disposition will diffuse biological realities among

centenarians, even though having a robust disposition likely helped many of them achieve their advanced age.

Rodin (1986) remarks that conventional health care and social service systems operate according to principles that ignore or oppose patient-directed health management. This is a flawed directive because a strictly biomedical approach to health care among the aged is inefficient and expensive (Fries 1990). Successful ageing is dependent upon patient-directed strategies aimed at reducing the amount and duration of illness in old age. Such strategies are crucial for promoting longer active life expectancies, as well as minimizing the impact of rapid population ageing on health care systems. Our study contributes to the literature by providing further evidence that psychological disposition, a non-medical resource, is an important indicator of self-rated health, and thus successful ageing, for the oldest old. However, our study is limited in that insufficient data prevented us from explicating why disposition predicts self-rated health. Are individuals with robust dispositions particularly good at coping with and accepting changing life circumstances? Further research is required to answer this question.

References

Antonovsky, Aaron. 1987. "The Salutogenic Perspective: Toward a New View of Health and Illness." *Advances* 4: 47-55.

Antonovsky, Aaron. 1979. *Health, Stress, and Coping*. San Francisco, CA: Jossey-Bass.

Baltes, Paul B. and Margret M. Baltes. 1990. "Psychological Perspectives on Successful Aging: The Model of Selective Optimization with Compensation." Pp. 1-34 in *Successful Aging: Perspectives from the Behavioral Sciences*, edited by Paul B. Baltes and Margret M. Baltes. Cambridge, England: Cambridge University Press.

Benyamini, Yael, Elaine A. Leventhal, and Howard Leventhal. 2003. "Elderly People's Ratings of the Importance of Health-Related Factors to Their Self-Assessments of Health." *Social Science and Medicine* 56: 1661-1667.

Benyamini, Yael, Elaine A. Leventhal, and Howard Leventhal. 1999. "Self-Assessments of Health: What Do People Know That Predicts Their Mortality?" *Research on Aging* 21: 477-500.

Bryk, Anthony S. and Stephen W. Raudenbush. 1992. *Hierarchical Linear Models*. Newbury Park, CA: Sage.

Chen, Chaonan. 2001. "Aging and Life Satisfaction." *Social Indicators Research* 54: 57-79.

Dello Buono, Marirosa, Ornella Urciuoli, and Diego De Leo. 1998. "Quality of Life and Longevity: A Study of Centenarians." *Age and Aging* 27: 206-116.

Fries, James F. 1990. "Medical Perspectives upon Successful Aging." Pp. 35-49 in *Successful Aging: Perspectives from the Behavioral Sciences*, edited by Paul B. Baltes and Margret M. Baltes. Cambridge, England: Cambridge University Press.

Gecas, Victor. 1989. "The Social Psychology of Self-Efficacy." *Annual Review of Sociology* 15:

291-316.

Grembowski, David, Donald Patrick, Paula Diehr, Mary Durham, Shirley Beresford, Erica Kay, and Julia Hecht. 1993. "Self-Efficacy and Health Behavior Among Older Adults." *Journal of Health and Social Behavior* 34: 89-104.

Idler, Ellen L., Shawna V. Hudson, and Howard Leventhal. 1999. "The Meanings of Self-Ratings of Health." *Research on Aging* 21: 458-476.

Kaplan, Giora and Orna Baron-Epel. 2002. "What Lies Behind the Subjective Evaluation of Health Status?" *Social Science and Medicine* 56: 1669-1676.

Knight, Tess and Lina A. Ricciardelli. 2003. "Successful Aging: Perceptions of Adults Aged Between 70 and 101 Years." *International Journal of Aging and Human Development* 56: 223-245.

Kobasa, Suzanne C., Salvatore R. Maddi, and Stephen Kahn. 1982. "Hardiness and Health: A Prospective Study." *Journal of Personality and Social Psychology* 42: 168-177.

Laird, N. M. and J. H. Ware. 1982. "Random-Effects Models for Longitudinal Data." *Biometrics* 38: 963-974.

Li, Jianxin, Zhang Zhen, and Wang Jiabao. 2004. "Association between Lifestyle and Self-Rated Health of Chinese Oldest-Old." Paper Presented at the Max Planck Institute for Demographic Research, Workshop on Determinants of Healthy Longevity in China.

Littell, R. C., G. A. Milliken, W. W. Stroup and R. D. Wolfinger. 1996. *SAS System for Mixed Models*. Cary, NC: SAS Institute.

Mannell, Roger C. and Sherry Dupuis. 1996. "Life Satisfaction." Pp. 59-64 in *Encyclopedia of Gerontology: Age, Aging, and the Aged*, Volume 2, edited by J. E. Birren. San Diego, CA: Academic Press.

Manton, Kenneth G. and Beth J. Soldo. 1992. "Disability and Mortality among the Oldest Old:

Implications for Current and Future Health and Long-Term Care Service Needs." Pp. 199-250 in *The Oldest Old*, edited by Richard M. Suzman, David P. Willis, and Kenneth G. Manton. New York, NY: Oxford University Press.

Rodin, Judith. 1986. "Aging and Health: The Effects of Sense of Control." *Science* 233: 1271-1276.

Schieman, Scott and Heather A. Turner. 1998. "Age, Disability, and the Sense of Mastery." *Journal of Health and Social Behavior* 39: 169-186.

Smith, Jacqui, Markus Borchelt, Heiner Maier, and Daniela Jopp. 2002. "Health and Well-Being in the Young Old and Oldest Old." *Journal of Social Issues* 58: 715-732.

Smith, Jacqui, Denis Gerstorf, and Li Qiang. 2004. "Psychological Resources for Healthy Longevity." Paper presented at the Workshop on "Determinants of Healthy Longevity in China" at the Max Planck Institute for Demographic Research, Rostock, Germany, August 2-4.

Suzman, Richard M., Tamara Harris, Evan C. Hadley, Mary Grace Kovar, Richard Wiendruch. 1992. "The Robust Oldest Old: Optimistic Perspectives for Increasing Healthy Life Expectancy." Pp. 341-358 in *The Oldest Old*, edited by Richard M. Suzman, David P. Willis, and Kenneth G. Manton. New York, NY: Oxford University Press.

Thoits, Peggy A. "Stress, Coping, and Social Support Processes: Where are We? What Next?" *Journal of Health and Social Behavior* 36: 53-79.

United Nations. 2002. *World Population Ageing 1950-2050*. New York: United Nations.

von Faber, Margaret, Annetje Bootsma-van der Wiel, Eric van Exel, Jacobijn Gussekloo, Anne M. Lagaay, Els van Dongen, Dick L. Knook, Sjaak van der Geest, and Rudi G. J. Westendorp. 2001. "Successful Aging in the Oldest Old." *Archives of Internal Medicine* 161: 2694-2700.

Zeng, Yi and James W. Vaupel. 2002. "Functional Capacity and Self-Evaluation of Health and Life of the Oldest Old in China." *Journal of Social Issues* 58: 733-748.

Zeng, Yi, James W. Vaupel, Xiao Zhenyu, Zhang Chunyuan, and Liu Yuzhi. 2001. "The Healthy Longevity Survey and the Active Life Expectancy of the Oldest Old in China." *Population: An English Selection* 13: 95-116.

TABLE 1. Definitions and Descriptive Statistics for Control Variables Used in the Multivariate Analyses of Psychological Hardiness: China, 1998-2000

Variable	Variable Definition and Code	Mean or %	S.D.
Psychological disposition	Seven item scale (Cronbach's alpha = 0.63)[a]	25.475	4.048
Health Status			
Chronic condition			
Serious chronic condition	Dummy indicator (1 = yes, 0 = no)	11.1%	—
Any chronic condition	Dummy indicator (1 = yes, 0 = no)	40.8%	—
No chronic condition	Reference category	48.1%	—
ADLs	Number of limitations of activities of daily living (max = 6)[a]	0.276	1.000
Health Behavior			
Veg	Frequency of having vegetables (1 = rare/never, …, 4 = almost everyday)	3.596	0.964
Fruit	Frequency of having fresh fruits (1 = rare/never, …, 4 = almost everyday)	2.036	1.080
Exercise	Dummy indicator (1 = regular excerise or physical labor, 0 = otherwise)	88.8%	—
Female	Dummy indicator (1 = female, 0 = male)	63.8%	—
Sociodemographics			
Education	Completed years of schooling	1.908	4.003
Age	Age in years	83.556	4.601
Marital status			
Widowed	Dummy indicator (1 = yes, 0 = no)	69.5%	—
Separated/divorced/never married	Dummy indicator (1 = yes, 0 = no)	3.8%	—
Married	Reference category	26.7%	—
Living arrangements			
Spouse only	Dummy indicator (1 = yes, 0 = no)	13.1%	—
Children/great/grandchildren	Dummy indicator (1 = yes, 0 = no)	64.7%	—
Siblings/parents/others	Dummy indicator (1 = yes, 0 = no)	2.3%	—
Nursing home	Dummy indicator (1 = yes, 0 = no)	6.9%	—
Living alone	Reference category	13.0%	—
Children	Number of living children	2.665	2.461
Siblings	Number of living siblings	0.862	1.388
Minority	Dummy indicator (1 = ethnic minority, 0 = Han)	8.0%	—
Rural residence	Dummy indicator (1 = yes, 0 = no)	64.4%	—
N		4,366	

Note: Weighted means or percentages, unweighted *N*.

[a] See text for detailed description.

TABLE 2. Random Effects Models of Psychological Disposition on Self-Reported Health: China 1998-2000

Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Psychological disposition	0.027 ***	0.025 ***	0.024 ***	0.026 ***	0.022 ***
Self-reported (T1)	0.197 ***	0.168 ***	0.190 ***	0.195 ***	0.158 ***
Health Status					
Chronic condition					
Serious chronic condition	—	-0.227 ***	—	—	-0.220 ***
Any chronic condition	—	-0.126 ***	—	—	-0.128 ***
No chronic condition[a]					
ADLs	—	-0.030 *	—	—	-0.035 *
Health Behavior					
Veg	—	—	0.042 *	—	0.035 *
Fruit	—	—	0.040 *	—	0.043 **
Exercise (1 = *yes*)	—	—	0.088 *	—	0.056
Female (1 = yes)	—	—	—	-0.057 *	-0.025
Sociodemographics					
Education	—	—	—	—	0.005
Age	—	—	—	—	0.097 *
Age square	—	—	—	—	-0.001 *
Marital status					
Widowed	—	—	—	—	-0.009
Separated/divorced/never married					-0.045
Married[a]	—	—	—	—	
Living arrangements					
Spouse only	—	—	—	—	0.072
Children/great/grandchildren	—	—	—	—	0.147 **
Siblings/parents/others	—	—	—	—	0.128
Nursing home	—	—	—	—	0.030
Living alone[a]					
Children	—	—	—	—	0.020 **
Siblings	—	—	—	—	0.014
Minority (1 = *yes*)	—	—	—	—	-0.004
Rural residence (1 = *yes*)	—	—	—	—	0.039

Table 2 Continued

Intercept	2.126 ***	2.368 ***	1.918 ***	2.190 ***	-2.509
Covariance Parameter Estimate					
$\hat{\sigma}^2_N$	0.051 ***	0.051 ***	0.053 ***	0.051 ***	0.051 ***
$\hat{\sigma}^2_e$	0.766 ***	0.759 ***	0.762 ***	0.766 ***	0.751 ***
- 2 REML Log Likelihood	10526	10503	10526	10527	10550

[a] Reference category.
* $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed test).

TABLE 3. Random Effects Models of Psychological Disposition on Self-Reported Health by Selected Age Groups: China, 1998-2000

Independent Variable	< Age 90	Age 90-99	Age 100+
Psychological disposition	0.021 ***	0.028 **	0.007
Self-reported (T1)	0.171 ***	0.163 ***	0.091 †
Health Status			
Chronic condition			
Serious chronic condition	-0.156 *	-0.380 ***	-0.132
Any chronic condition	-0.152 ***	-0.067	-0.154 †
No chronic condition[a]			
ADLs	-0.061 *	-0.011	-0.023
Health Behavior			
Veg	0.013	0.025	0.099 *
Fruit	0.035 †	0.050 †	0.067
Exercise (1 = *yes*)	0.094	-0.025	0.030
Female (1 = yes)	0.012	-0.087	-0.181 †
Sociodemographics			
Education	0.012 *	-0.010	-0.015
Age	0.008	-0.010	-0.015
Marital status			
Widowed	-0.027	0.043	-0.016
Separated/divorced/never married	-0.097	0.087	-0.125
Married[a]			
Living arrangements			
Spouse only	0.088	-0.032	0.138
Children/great/grandchildren	0.146 *	0.235 **	-0.030
Siblings/parents/others	0.174	0.177	-0.189
Nursing home	0.059	0.031	-0.157
Living alone[a]			
Children	0.024 **	0.031 *	-0.015
Siblings	0.015	0.012	-0.015
Minority (1 = *yes*)	0.026	-0.141	0.010
Rural residence (1 = *yes*)	0.081 †	-0.050	0.089

Table 3 Continued

Intercept	1.302 *	2.909 **	4.311 **
Covariance Parameter Estimate			
$\hat{\sigma}^2_N$	0.012 ***	0.068 ***	0.125 ***
$\hat{\sigma}^2_e$	0.792 ***	0.695 ***	0.715 ***
- 2 REML Log Likelihood	6044	2817	1806

[a] Reference category.
* $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed test).
† $p < .05$ (one-tailed test).