Gender Differences in Functional Health and Mortality Among the Chinese Elderly: Testing an Exposure Versus Vulnerability Hypothesis

Toshiko Kaneda, Zachary Zimmer, Xianghua Fang and Zhe Tang

Research on Aging 2009; 31; 361 originally published online Jan 28, 2009;
DOI: 10.1177/0164027508330725

Research on Aging
Volume 31 Number 3
May 2009 361-388

10.1177/0164027508330725
http://roa.sagepub.com
hosted at
http://online.sagepub.com

Gender Differences in Functional Health and Mortality Among the Chinese Elderly

Testing an Exposure Versus Vulnerability Hypothesis

Toshiko Kaneda
Population Reference Bureau
Zachary Zimmer
University of Utah
Xianghua Fang
Zhe Tang
Capital Medical University

In this study, the authors focused on older adults in Beijing with three objectives: to examine gender differences in functional health and mortality at the end of a five-year study period, controlling for initial functional health; to determine the extent to which these differences were a function of exposure versus vulnerability to risk factors; and to analyze the relative importance of social, economic, and psychological risk factors in explaining gender differences. The results show that women were more likely to survive and to be functionally dependent at follow-up compared with men among those functionally independent at baseline. No significant differences among those who were initially dependent were apparent. Differential vulnerability to risk factors, more so than exposure, explained the variation in health outcomes across gender. Smoking, a lack of formal education, a lack of health insurance, a low sense of control, stressful events, and rural living played large roles in explaining the differences.

Keywords: *gender; mortality; functional status; aging; China*

Authors' Note: Part of this research was supported by grant 5R03AG025729-02 from the National Institute on Aging. We wish to thank John Bongaarts, Emily Agree, and two anonymous reviewers for their helpful comments on an earlier draft of this article.

It has long been recognized that gender differences in health are characterized by an apparent paradox: Men have shorter lives but women have a higher prevalence of a number of problems, particularly those that influence functional health (Nathanson 1975; Verbrugge 1989). Research has identified a number of social, genetic, and biological risk factors that function to influence these gender-health associations (Bird and Rieker 1999; Verbrugge 1989). Two popular hypotheses are differential "exposure" and differential "vulnerability." The former assumes that gender differences in health are a function of varying levels of contact with risk factors. The latter explains differences as a function of varying reactions to similar risk factors. Few studies have systematically examined the relative contributions of these two pathways for older adults, nor the effects of specific risk factors underlying the pathways to create gender difference in health and mortality.

In the current study, we tested these two hypotheses by examining gender differences in functional health and mortality among a sample of older adults living in the Beijing municipal area of China. Our objectives were threefold. The first was to compare functional health and mortality outcomes at the end of a five-year observation period. Given the paradox noted above, we expected men to be more likely to die over the five-year period, and we expected women to be more likely to survive but to be characterized as having functional health problems. The second objective was to determine the explanatory power of the differential exposure and vulnerability hypotheses in explaining any observed gender differences in functional health and mortality outcomes. The third was to examine the relative importance of groups of risk factors in determining outcome status. The latter two objectives were accomplished by using a decomposition technique that isolated the independent contributions of risk factors net of other variables.

Background

Women have lower rates of mortality than men throughout life, with differences being greater in developed than in developing countries and narrower in societies in which women are considered to have low status (Kinsella and Velkoff 2001). In contrast, studies examining functional health have tended to find women to be disadvantaged with respect to both prevalence and duration (Denton, Prus, and Walters 2004; Verbrugge 1985). As a result, women tend to live a greater proportion of their lives with functional health limitations. Thus, observed over time, men will be more likely to die, whereas women will have a higher prevalence of functional health problems, with women's higher

prevalence likely being a combination of several factors: a greater risk for developing functional health problems, a lesser tendency to recover from these, and, perhaps most important, a greater tendency to survive later into life with functional health problems.

Although some earlier studies examined social risk factors involved in mediating the impact of gender on health, few have quantified the net effects (Denton et al. 2004; McDonough and Walters 2001; Roxburgh 1996). The risk factors can be grouped into categories, for instance, socioeconomic status (SES), access to health care, health behaviors, social support, and psychological characteristics. Indicators of SES (e.g., education, occupational status, income) and health care access (e.g., health insurance coverage, health care use) capture structural differences that may exist across gender. For example, men tend to be advantaged with respect to SES, whereas women generally report higher use of services (Denton et al. 2004; Ross and Bird 1994). At the same time, research has suggested that women are more vulnerable to the adverse impact of low SES (Denton and Walters 1999; Shye et al. 1995). Differential impacts of health care have not received much attention. Behavioral risk factors include smoking, drinking, exercising, diet, and weight. Men tend to engage in negative behaviors more regularly than women, with the exception of exercise (Denton and Walters 1999; Ross and Bird 1994). Research has shown men to be more negatively influenced by smoking and drinking, while women appear to have greater vulnerability to the effects of weight and exercise (Denton and Walters 1999). Social support (e.g., intergenerational relations) and psychological characteristics (e.g., stress, self-esteem) capture psychosocial differences. Women tend to report higher levels of support exchanges, although they are also more likely to be widowed and to live alone (Umberson et al. 1996). Some research has indicated that women report lower levels of perceived control and self-esteem (Mirowsky and Ross 1989). In addition, women have been shown to suffer the consequences of psychosocial risks more so than men (Shye et al. 1995).

These risk factors are interrelated to some extent. For example, low SES has been shown to influence unhealthy behaviors and higher levels of stress (Denton and Walters 1999; Pearlin 1989). A high level of social support has been shown to improve psychological conditions (e.g., fewer depressive symptoms; Lincoln, Chatters, and Taylor 2005). To identify independent effects in this study, we used a decomposition method that allowed us to quantify the relative importance of different risk factors, and to assess two hypotheses, simultaneously controlling for all variables in the model. The exposure hypothesis states that because women and men differ with respect

to access to material resources and other social conditions of life, they are exposed to different levels of risk, which in turn results in different health outcomes (Arber and Cooper 1999; Denton et al. 2004; Ross and Bird 1994). For instance, higher SES among men provides a functional health advantage, while higher exposure to negative health behaviors explains their mortality disadvantage. The vulnerability hypothesis asserts that women and men react differently to various conditions of life and thus differ in their vulnerability to risk factors (McDonough and Walters 2001), which would explain why women appear to be more negatively affected by low SES, while men appear to be more negatively affected by certain behaviors, such as smoking and drinking (Denton and Walters 1999; Shye et al. 1995).

In the current study, both the extent to which these risk factors explain gender differences in health and the extent to which the exposure and vulnerability hypotheses are confirmed were tested among a sample of older Chinese living in the municipality of Beijing. The study fills several gaps in the literature. First, studies of gender differences in health are few in developing countries (exceptions include Lamb 1997; Rahman and Liu 2000; Yount and Agree 2005). A general neglect of the developing world is unfortunate, because analyses outside of North America and Europe, where most previous studies have been conducted, could be valuable for advancing theoretical understanding and the generalizability of associations. Second, studies of gender differences among older adults, even in developed countries, are not plentiful. Establishing the gender gap in late-life health, however, is critical. Mortality, health problems, and health care use are concentrated among those in older age. Late life is a time when individuals tend to develop functional health problems that can limit their ability to conduct daily activities and as a consequence limit the quality of life. Because women typically survive longer than men but are reported to have higher rates of functional health problems, factors that facilitate a male disadvantage in mortality and a female disadvantage in morbidity are particularly important to understand. Moreover, older adults are the fastest growing segment of population throughout the world and are growing particularly rapidly in a number of developing countries. China's population is aging at one of the fastest rates in the world, while mortality and morbidity are becoming increasingly concentrated at older ages (Du and Guo 2000; Poston and Duan 2000; Yuan et al. 1992). All of this suggests that an understanding of gender health differentials among the elderly in China is critical for informing health policy aimed at meeting the needs of this rapidly growing population.

Risk Factors in the Chinese Setting

Besides the aging of China, its history and cultural system make it an interesting setting to examine how various risk factors differentially explain gender variations in functional health and mortality in old age. There is currently limited understanding of the ways in which risk factors affect the health of older women and men in China, and there is therefore little research to draw on for speculating about possible effects. In this section, we briefly introduce groups of risk factors we considered in the current study and several possible scenarios based on what is known.

SES. The status of women has improved since the Communist Party introduced various changes in an attempt to eliminate gender inequality after coming to power in 1949 (Yu and Sarri 1997). One of the main changes involved the increased participation of women in the labor force. Although some gender discrimination still exists (e.g., women's younger retirement ages, less access to managerial positions), high labor force participation rates for women coupled with governmental control over the work environment may mean that men have less of an advantage in the labor force in comparison with their Western counterparts. Access to education also became more equal for boys and girls under Communist rule, but most elderly of today reached schooling age before these changes.

Health care access. China has made great improvements in health over the past five decades. According to statistics from the United Nations Population Division (2006), life expectancy increased from 41 years in 1950 to 1955 to 72 years in 2000 to 2005. This is partly attributed to the past public health care system, which relied heavily on subsidies and provided egalitarian access to basic and preventive health care (Henderson et al. 1994). However, the once admired system has been deteriorating since the 1980s, when privatization was introduced and the health sector was transformed into a market-oriented system. As out-of-pocket spending on health care increased, health care access may have become more difficult for the elderly, especially elderly women, who tend to have fewer financial resources.

Health behaviors. Choices regarding health behaviors may be somewhat limited in China because of custom and a lack of understanding of their health effects. It is much more acceptable for men to smoke and to drink

alcohol, and as such, smoking and drinking are much more prevalent among men than among women, especially in the older population. This might suggest that men would be more negatively affected by behaviors than women. Indeed, it is only until recently that the government began implementing antismoking campaigns. With respect to physical activity, the majority of the elderly labor force is still in agriculture, and because agriculture involves physical labor, it is possible that both women and men have high levels of activity, particularly in rural areas.

Social support. A public retirement pension system covers only a small minority of the population in China, and most elderly rely on their children for both financial and instrumental support (Chuanyi and Qin 1992; Leung 1997). The family-based support system for the elderly rests on strong patriarchal and patrilocal traditions, under which older adults live with one of their sons, often the eldest and his wife, and receive care and support from them in old age. Although these arrangements do not indicate the quality of intergenerational relationships or the receipt of emotional support, Chinese women and men are still far less likely than their Western counterparts to live alone in old age and are more likely to receive various types of support from their children. The opportunity to live with a son and his wife, however, will decline drastically for both men and women as cohorts affected by China's one-child family policy, introduced in 1979, begin entering old age in the coming decade. Still, recent research has suggested that women are more likely to coreside with their children after the loss of a spouse or during periods of illness (Zimmer 2005). Other research has suggested that in developing countries that have divisions of labor whereby women are more responsible for child rearing, emotional bonds between women and their children are stronger than between men and their children, resulting in higher quality support in old age (Kandiyoti 1988; Yount 2005). Moreover, elderly women may be seen as being more useful around the house and therefore more frequently live with children.

Psychological characteristics. Older adults in China have experienced a series of extraordinary political and social upheavals, including the war against the Japanese in the mid-1930s, the civil revolution that gave rise to the Communist Party between 1946 and 1949, the Great Leap Forward, famine in 1958, a decade of the Cultural Revolution starting in 1966, and more recent socioeconomic reforms. Being exposed to high levels of political and social stress throughout much of life may have had lasting

psychological impact on the elderly today regardless of gender. Both women and men have also been subject to strict government regulations under Communist rule, especially prior to the 1980s, which may translate into a feeling of little control over one's life (Harrell 2000).

Besides the above groups of risk factors, we considered several other characteristics: age, rural urban residence, and chronic health conditions. Lives in urban and rural areas are quite distinct in China and warrant special attention. Although urban and rural living conditions had differed greatly because of decades of legal distinctions, recent reform-era changes have created further socioeconomic divisions between these areas (Harrell 2000). This has resulted in very different characteristics across those living in urban versus rural areas of China. Because urbanites have greater access to health services, higher levels of education, higher levels of income, and other advantages, they are likely to exhibit more favorable health. Because of the greater overall access in urban areas to health care and other community resources, as well as a more egalitarian access to white-collar occupations in the labor force, gender differences in health may be reduced in urban areas compared with rural areas. Chronic conditions warrant special attention as well in a study of gender differences in functional health and mortality. Disease profiles differ by gender. Men may be more likely to suffer from conditions that are life threatening, such as heart disease, thereby influencing their survival chances, whereas women may be more likely to possess conditions that are debilitating, such as arthritis, thereby influencing their chances of having functional health problems (Verbrugge 1989). At the same time, any chronic health condition will affect functional health and mortality. Chronic conditions therefore may mediate associations between some risk factors and other health outcomes and thus should be controlled.

Data and Methods

Sample

The data came from 1992 and 1997 waves (herein referred to as baseline and follow-up, respectively) of the Beijing Multidimensional Longitudinal Study of Aging, a representative survey of older adults in three districts in the municipality of Beijing, administered by a research team at Capital Medical University in Beijing (Department of Social Medicine 1995). In the baseline survey, a representative sample of older

adults aged 55 years and older from three districts, selected on the basis of their ability to represent the total municipal area of Beijing with respect to socioeconomic, demographic, and geographical characteristics, were interviewed. Xuan Wu is an urban district located in metropolitan Beijing. The other two are rural districts located outside of the metropolitan area: Da Xing is an agricultural rural plains district south of the city, and Huai Ruo is an agricultural district located further from metropolitan Beijing in the mountainous area to the northeast. Within the three districts, 3,614 individuals were randomly selected for interviews, with oversampling in Xuan Wu and among the oldest-old. A total of 3,257 individuals completed initial interviews, for a response rate of about 90%. A weighting scheme was established so that the sample was representative of the older population within the three districts in 1992. The 1997 follow-up involved returning to original households. Survival status was determined through interviews with surviving household members and, when surviving household members were not available, with neighbors. The follow-up rate for the 1997 wave was about 90%. Individuals who were lost to follow-up included mostly those who had moved out of the areas within which they were originally interviewed. These data have been used in a number of previous studies, and more details can be found in these publications (e.g., Kaneda, Zimmer, and Tang 2005; Ofstedal et al., 2007; Zimmer, Kwong, et al. 2007). The analytical sample for this analysis, from which participants lost to follow-up and those with missing data for key variables were deleted, was 2,746. We performed sensitivity analyses and found that excluding the participants with missing data resulted in no significant biases.[1]

Dependent Variable: Functional Health at Follow-Up

Respondents were asked whether they could perform a series of activities without any help from others. Several of these were activities of daily living, or tasks necessary for self-maintenance (Katz et al. 1963). Others indicated an ability to conduct basic upper- and lower-body movements, often referred to as the Nagi items of physical functioning (Nagi 1965). In total, we used six activities to determine functional health: eating, dressing, getting on and off a bed, bathing, walking 300 meters, and walking up and down a flight of stairs. We defined two functional health states. An independent state was defined as being able to perform all six activities without assistance. A dependent state was defined as requiring help in performing at least one activity. At baseline, individuals were grouped into groups of those functionally

independent and dependent. At follow-up, they were grouped into functionally independent, dependent, and deceased groups. Thus, there were three possible outcomes at follow-up. We conducted two types of analyses. The first, which was descriptive, investigated gender differences in being in each of the three follow-up states, adjusting for the baseline state. The second, a decomposition analysis, modeled the follow-up state for those independent at baseline. Those dependent at baseline were omitted from the decomposition analysis because their number (n = 445) was too small to derive reliable estimates.

Independent Variables

Our framework considered that differences in functional health and mortality across gender are in part a function of SES, health care access, health behaviors, social support, psychological characteristics, chronic conditions, rural or urban residence, and age. Decomposition considered the impact of a number of these that were considered risk factors. Variables within each category were considered to be risk factors for ill health and were coded dichotomously as 1 if the risk factor was present and 0 if not. All independent variables in the analyses were measured at baseline.

SES. This group consisted of the variables education, occupation, and housing amenities. A lack of access to essential housing amenities was measured by whether one did not have access to water, gas, or a toilet. Occupation was measured using two questionnaire items. The first asked, "What kind of work have you done most of your life?" Because responses were categorized broadly, such as administrator, office worker, or peasant, we used a second questionnaire item that asked whether respondents would consider the work they conducted for most of their lives to be "heavy labor." We used a combination of these two items. Any clearly non-white-collar occupation, such as peasant, plus any occupation that was combined with a report of heavy labor, was considered to be in the blue-collar or heavy-labor category. For those who never worked, we relied solely on the latter question. Education was coded as having no education versus any formal education. Risks were considered to be having no formal education, working in a blue-collar or heavy-labor occupation for most of one's life, and not having access to essential household amenities.

Access to health care. Health care access consisted of health insurance coverage, routine health checkups, financial difficulty seeing a doctor, and

difficulty physically accessing a doctor. We coded individuals as having no health insurance coverage if they reported that they paid 100% of their medical costs out of pocket. A questionnaire item asking whether a respondent had had a checkup within the past year was used to indicate a routine health checkup. Financial difficulty and physical access came from a section of the questionnaire asking about difficulties individuals may have had in trying to access health services. For the latter variable, reporting either "traffic problems" or "standing in a queue for registration or paying fees" was considered to indicate physical access problems. Those at risk were considered to be those without insurance, without routine checkups, with financial difficulty seeing a doctor, and with physical access problems.

Health behaviors. We used three variables related to health behaviors: smoking, drinking, and exercising regularly. Smoking was whether one had ever smoked regularly. Immoderate drinking was based on questionnaire items asking about the amounts of beer, wine, and liquor consumed per day. We coded it as having at least two alcoholic drinks per day versus fewer. Exercise was based on a questionnaire item regarding how often one participated in the following activities in the past 12 months: going for walks, free-standing exercises, taijiquan, qigong, bowling, running, dancing, and other types of exercise. Those not participating at least once a week were considered as not exercising regularly. Those at risk were considered to be those who had ever smoked regularly, drank two or more alcoholic beverages every day, and did not exercise regularly.

Social support. Social support was measured with three variables: marital status, living arrangement, and having close friends. A questionnaire item asking about the number of relatives or friends besides children who kept in contact with the respondent in the previous 12 months was used to code whether one had close friends. Those at risk were considered to be those who were not married (widowed, divorced, or never married), who lived alone, and who had no close friends.

Psychological characteristics. Psychological variables are a sense of control, lifetime stressful events, and recent stressful events. A sense of control was based on whether one agreed (versus disagreed or said that he or she did not know) with the following statement: "Many times, I feel that I have little influence on the things that happen to me." Lifetime stressful events were based on a questionnaire item asking whether one had ever experienced political persecution, war, or natural disaster in one's lifetime.

Recent stressful events were measured with a questionnaire item asking whether one had experienced severe illness of a spouse, the death of children, and the death of close friends during the previous three years. Those at risk had a low sense of control and had experienced any lifetime stressful events and recent stressful events.

Other controls. Given that disease profiles differ by gender, and given that those with chronic health problems are likely to have more functional health problems and are more likely to die, we controlled for two types of disease conditions older adults have: serious disease conditions and chronic (less serious) disease conditions. The former included any of coronary heart disease; lung disorders including chronic bronchitis, emphysema, and tuberculosis; stroke; diabetes; or cancer. The latter included any of hypertension, asthma, ulcers, migraine, arthritis, glaucoma, or cataracts.

Research has shown a significant urban advantage in mortality existing among Chinese elderly (Zimmer, Kaneda, and Spess 2007), although little research has examined whether this advantage is maintained with respect to functional health outcomes. This, plus differences in living conditions and environments across urban and rural areas that are not captured by other individual-level risk factors, encourage the inclusion of an urban-rural covariate. There are many ways in which urban versus rural residence can affect gender differences in health, one being through differential access to resources within each area.

Finally, we controlled for age, which was measured both in single years and as a quadratic term to account for nonlinearity.

Decomposition

Most previous studies seeking to evaluate the relative importance of various factors on gender differences in health used an approach based on incremental additions of independent variables to regression models and the calculation of the contributions of the additional variables. One disadvantage of this approach is that it does not consider correlations across independent variables that are added to models, and therefore, it is difficult to determine the isolated effect that any one factor has on an outcome. In contrast, the method we used allows consideration of the independent contributions of any variable net of others by taking into account these correlations. Furthermore, the method allows for decomposing the contribution of each factor into an exposure and a vulnerability effect.

The method we used was an Oaxaca-Blinder type decomposition (Blinder 1973; Oaxaca 1973). This involved decomposing the gender difference in the likelihood of being in each follow-up state into an exposure effect, a vulnerability effect, and a residual effect (Case and Paxson 2005). Exposure was the portion of the difference accounted for by differences in mean characteristics across the risk factors. Vulnerability was the portion due to differences in the impacts of risk factors. The residual effect was the part due to other controls and unobserved factors. The method used ordinary least squares (OLS) regression, even though our outcomes were dichotomous. Although this is not standard procedure for dichotomous outcomes, the use of OLS for the decomposition was based on the need to extract the results of a linear decomposition into three additive components. Although this presents the common disadvantages of using OLS on a categorical outcome (e.g., allowing for predictive results that are confined to the natural boundaries of the variable, namely, scores of 0 and 1), the disadvantages were tempered by the results from preliminary analyses that showed that marginal effects from parameter estimates based on logit models were similar to those based on OLS models (Case and Paxson 2005). Thus, we used OLS to model health outcomes as a linear function of variables for the presence of n risk factors described earlier (denoted as R_i, $j = 1 \ . \ . \ . \ n$) and variables for age (in single years and squared) and serious and chronic conditions (X):

$$P(H) = \sum_{i}^{n} \beta_i^j R_i + X\gamma^j + \varepsilon;\ j = \mathrm{W}, \mathrm{M}. \tag{1}$$

We assumed that the coefficients in the model differed by gender and estimated equation 1 separately for women (W) and men (M) for each of the transitions. Estimates of β^{W} and β^{M} provided information on differences in the effects of risk factors on transitions across gender. We then obtained exposure and vulnerability effects by using parameter estimates that showed the levels of vulnerability and also mean values across the risk factors that showed the levels of exposure.

We calculated the exposure effect as the sum over differences in the mean values of each risk factor between women and men, multiplied by the risk factors' β values (averaged between the β values estimated for women and men):

$$\text{Exposure Effect} = \sum_i (\overline{R_i^{\mathrm{W}}} - \overline{R_i^{\mathrm{M}}})\ \bar{\beta}_i. \tag{2}$$

We calculated the vulnerability effect as the sum of differences in the coefficients for the risk factors for women and men, multiplied by the mean values of each risk factor over both women and men (denoted as $\bar{R}_i$):

$$\text{Vulnerability Effect} = \sum_i (\beta_i^W - \beta_i^M)\, \bar{R}_i. \quad (3)$$

The residual effect corresponded to the part of the gender difference not explained by either exposure or vulnerability. It was thus a sum of differences in the mean values of control variables *X*, gender differences in the effects of these variables on functional health or mortality, and unexplained differences.

Results

Functional Health Outcomes

Tables 1a through 1c compare the mean proportions of women and men across different functional health states. Table 1a uses data for the entire sample and compares the proportions across all six combinations between baseline and follow-up status. Tests of mean proportions are provided for each comparison. In total, a significantly higher proportion of men were functionally independent at baseline (.932 vs. .867), and the chances of being in six categories significantly differed by gender.

Tables 1b and 1c examine follow-up state conditional on baseline state. Among individuals functionally dependent at baseline (Table 1b), women were significantly more likely to be independent, but other outcomes did not significantly differ by gender. Among those independent at baseline (Table 1c), similar proportions (about two thirds) of both women and men remained independent. The proportion who are functionally dependent, however, was significantly higher among women (.124 vs. .070), while a significantly higher proportion of men died during the observation period (.161 vs. .109). Hence, among those who started functionally independent, women were more likely than men to have functional dependence five years later, but they were also more likely to survive. These results are consistent with findings found elsewhere and reviewed above.

Greater functional dependence among women may have been due in part to a greater tendency to survive the five-year observation period after developing functional health problems. This possibility is supported by the fact that the sum of the proportion who died and the proportion who had functional

Table 1a
Distribution of Follow-Up Functional Status by Baseline Functional Status and Gender

	All Men (n = 1,356)		All Women (n = 1,390)	
	Baseline Status		Baseline Status	
Follow-Up Status	Dependent	Independent	Dependent	Independent
Independent	.007	.718	.027***	.664**
Dependent	.020	.065	.039**	.108***
Deceased	.040	.150	.067***	.095***
Total	.068	.932	.133***	.867***

**$p < .01$. ***$p < .001$.

Table 1b
Distribution of Follow-Up Functional Status by Gender, Conditional on Being Dependent at Baseline

Follow-Up Status	Men (n = 157)	Women (n = 288)
Independent	.108	.201*
Dependent	.302	.295
Deceased	.589	.504
Total	1.000	1.000

*$p < .05$.

Table 1c
Distribution of Follow-Up Functional Status by Gender, Conditional on Being Independent at Baseline

Follow-Up Status	Men (n = 1,199)	Women (n = 1,102)
Independent	.770	.766
Dependent	.070	.124***
Deceased	.161	.109***
Total	1.000	1.000

***$p < .001$.

problems at follow-up was similar for both men and women. So, if men become functionally dependent at a similar rate, but their dependence is followed more quickly by death, a female disadvantage in the "transition"

from a functionally independent to a dependent state may be overestimated (Gu and Yi 2004). Still, some research also shows that men are more likely than women to die suddenly, for instance, from an acute heart incident, when still in a functionally healthy state (Romoren and Blekesaune 2003). Therefore, mortality differences alone are not likely to account for gender differences in the observed prevalence of functional dependence.

Gender Differences in the Prevalence of Risk Factors

Table 2 compares the characteristics of women and men who began the observation period in a functionally independent state. Because we omitted those dependent at baseline, we had slightly more men than women and a slightly younger age distribution, especially among women, than if those dependent at baseline had been included. There was no significant difference with respect to age and the prevalence of serious or chronic disease conditions by gender. As for the risk factors, the findings are generally compatible with those previously found in North American and European samples, with the exceptions that men were more likely to have regular health checkups and report lifetime and recent stressful events. The magnitudes of the differences for smoking and drinking were quite substantial. The proportion of women who had ever smoked regularly was about one third that of men, and the proportion who had two or more drinks a day was about one tenth that of men. Women were disadvantaged with respect to education, occupation, access to health care, exercise, marital status, living alone, and a sense of control, at least given our expectations of the influence of these risk factors.

Results of Decomposition

According to Tables 1a to 1c, being functionally independent at follow-up did not significantly differ by gender. We decomposed differences in the other two outcomes: being functionally dependent (versus being functionally independent or deceased) and being deceased (versus being functionally independent or dependent). All decomposition analyses were based on coefficient estimates obtained from multivariate analysis using OLS (the results are presented in the Appendix). Because outcomes were dichotomous variables, R^2 and standard errors were biased, but the results of separate logistic regressions showed that the independent variables in the analysis significantly contributed to the fit of these models. Specifically, the results of χ^2 tests were all highly statistically significant (at the .001 level), and pseudo-R^2 values ranged from .09 to .17. We decomposed the effects of each risk factor into exposure and

Table 2
Means for Risk Factors and Control Variables by Gender

Risk Factor or Control	Men (n = 1,199)	Women (n = 1,102)
Controls		
Age (years)	64.093	63.779
Age squared	4,154.427	4,114.962
Serious disease condition	.185	.213
Chronic disease condition	.554	.581
Socioeconomic status		
No formal education	.307	.666***
Blue-collar/heavy-labor occupation	.754	.884***
Lack essential household amenities	.624	.611
Health care access		
No health insurance coverage	.489	.609***
No health checkup	.846	.916***
Financial difficulty	.173	.232**
Difficulty physically accessing doctor	.121	.115
Health behaviors		
Ever smoked regularly	.707	.237***
Have two or more drinks a day	.420	.043***
Exercises regularly	.440	.503**
Social support		
Not married	.145	.268***
Lives alone	.039	.060*
No close friends	.477	.438
Psychological characteristic		
Low sense of control	.288	.462***
Lifetime stressful events	.111	.062***
Recent stressful events	.137	.095**
Rural residence	.523	.490

*p < .05. **p < .01. ***p < .001.

vulnerability effects, presented in Tables 3 and 4, by applying equations 2 and 3 to the corresponding coefficient estimates from OLS regressions. Below, we examine the relative importance of the exposure and vulnerability pathways through which social factors contribute to gender differences. We then examine the contribution of each risk factor.

Overall exposure versus vulnerability. Table 3 presents the overall decomposition results and provides a test of the exposure versus vulnerability hypotheses. The gender difference among those functionally dependent was 5.5 percentage points, meaning that women who survived

Table 3
Decomposition of Gender Differences in Follow-Up Functional Health Status, Controlling for Baseline Status, Showing Exposure, Vulnerability, and Residual Effects (n = 2,301)

	Functionally Independent at Baseline	
Variable	Functionally Dependent at Follow-Up (Percentage Points)	Deceased at Follow-Up Percentage Points)
Difference (women-men)	5.5	–5.1
Exposure effect	1.3	0.4
Vulnerability effect	3.8	–7.2
Residual effect	0.5	1.7

the five-year period were more likely than men to be dependent. Exposure to the risk factors accounted for 1.3 percentage points of the 5.5 percentage point difference. That is, if women and men shared the same risk factor characteristics, then women's disadvantage in functional dependence would be reduced by 1.3 percentage points, from 5.5% to 4.2%. The vulnerability effect was larger and accounted for 3.8 percentage points. If women and men were similarly vulnerable to the influences of the risk factors, women's disadvantage would be reduced by 3.8 percentage points and only be 1.7%. Thus, women were both more exposed to risk factors than men and more affected by these risk factors, both of which served to increase their disadvantage with respect to functional dependence. However, vulnerability played the larger role.

The second outcome was being deceased. Men were more likely to die over the five-year period, and therefore, women had the advantage. Subtracting the percentage of men who died from the corresponding percentage of women gives a 5.1 percentage point difference. The exposure effect is positive but relatively small at 0.4. We can interpret this as women being slightly more exposed to risk factors than men, and thus, if women and men were exposed to the risk factors in the same way, women's advantage would increase further by 0.4 percentage points. In contrast, the vulnerability effect was very large and in the opposite direction, at –7.2 percentage points. If women and men were similarly vulnerable to the risk factors we examined, not only would the advantage that women had disappear, but men would have an advantage totaling 2.1 percentage points. Hence, the main reason that men were more likely to die was because they were much more influenced than women by the risk factors, a result that supports the vulnerability hypothesis.

Table 4
Decomposition of Gender Differences in Follow-Up Functional Health Status, Controlling for Baseline Status, Showing Exposure and Vulnerability Effects of Specific Risk Factors (n = 2,301)

	Functionally Independent at Baseline			
	Functionally Dependent at Follow-Up		Deceased at Follow-Up	
Health Risk Factor	Exposure	Vulnerability	Exposure	Vulnerability
Socioeconomic status				
No formal education	0.5	0.0	1.1	–2.2
Blue-collar/heavy-labor occupation	0.2	–1.1	0.4	0.0
Lack essential household amenities	0.0	2.0	0.0	–0.4
Health care access				
No health insurance coverage	0.4	–1.5	0.3	–6.2
No health checkup	0.0	–3.4	0.0	–1.0
Financial difficulty	0.0	–0.8	0.1	–0.1
Difficulty physically accessing doctor	0.0	0.3	0.0	–0.8
Health behaviors				
Smoked regularly	–0.6	1.0	–1.4	–0.8
Have two or more drinks a day	0.5	–1.9	–0.8	3.2
Exercises regularly	0.1	1.8	–0.1	–1.8
Social support				
Not married	–0.2	–0.2	0.6	–1.0
Lives alone	0.0	–0.5	0.1	0.0
No close friends	0.0	0.6	0.0	–1.8
Psychological characteristic				
Low sense of control	0.5	3.1	0.2	1.4
Lifetime stressful events	–0.2	–0.1	–0.1	0.2
Recent stressful events	0.2	–0.3	0.1	0.8
Rural residence	0.0	4.8	0.0	3.3
Total	1.3	3.8	0.4	–7.2

Relative importance of risk factors. Table 4 shows decomposition results across specific risk factors. The first two columns of figures indicate the exposure and vulnerability effects of risk factors on being functionally dependent. The third and fourth columns indicate the effects for dying. The larger the absolute size of the number related to each risk factor, the greater

the impact of that risk factor in generating gender differences. A positive number indicates that a risk factor benefits men, and a negative number indicates the opposite. The sum of the factors equals the overall exposure and vulnerability effects shown in Table 3.

Functionally dependent at follow-up. The decomposition indicated that smoking contributed the most to the gender difference in being functionally dependent. If women and men had the same experience in smoking, women's disadvantage in being dependent would be increased further by 0.6 percentage points. The effect of smoking, however, was partly offset by the effect of drinking. The higher proportion among men who had more than two drinks a day increased women's disadvantage by 0.5 percentage points. This finding is the opposite of expectations, as it was assumed that drinking leads to unfavorable health. We speculate on this finding in our concluding section. Other factors with large exposure effects included access to education, health insurance, and a sense of control. It is noteworthy that significant gender differences in the prevalence of risk factors under the category of social support, more specifically the much higher proportions of women who were not married and lived alone, did not cause gender differences through exposure.

As for vulnerability, the rural residence effect was quite large. Women were also more vulnerable to having a low sense of control over life, not exercising regularly, and not having access to essential household amenities. In contrast to these disadvantages for women, a few worked to men's disadvantage. Men were more vulnerable to a lack of health insurance coverage, not having had annual checkups, and having two or more drinks a day.

Being deceased at follow-up. Women were shown to have a survival advantage over men, and this advantage was mostly explained by differential vulnerability to risk factors. The decomposition of exposure, however, indicated that smoking accounted for a fair portion, 1.4 percentage points, of women's advantage. Drinking also increased women's advantage through exposure. In contrast, education, occupation, and marital status reduced women's advantage. Despite the significant differences in health care access and psychological characteristics between women and men, these factors resulted in no or only small exposure differences in the likelihood of dying.

The decomposition of vulnerability showed that lack of health insurance coverage contributed much to men's disadvantage. That is, men who

did not have insurance were hurt more than women without insurance. This factor alone increased women's advantage by 6.2 percentage points. Men were also more vulnerable to a lack of education, no close friends, and not exercising regularly. In contrast, higher vulnerability among women to rural residence, drinking, and a lower sense of control reduced their advantage.

Summary and Discussion

Much previous research has indicated that women live longer than men but that their extra years of life are spent in states of functional dependence. These gender differences in health are likely due partly to biological and genetic factors, partly to social factors, and partly to interactions between these. Two hypotheses, differential exposure and vulnerability, have been put forward to explain the role of social factors. Exposure refers to the degree to which levels of risk differ between women and men, while vulnerability refers to the degree to which similar levels of risk differentially influence women versus men. Using data on older adults in Beijing our study contributes to the debate by examining the relative contributions of these two pathways as well as specific risk factors underlying the gender difference. The Beijing setting is important for several reasons, including extremely rapid population aging in China, the subsequent importance of understanding gender differentials in health among older adults for policy purposes, and the general lack of studies on gender differentials in adult health in developing parts of the world. We examined gender differences in functional health outcomes controlling for the baseline status, decomposed these into exposure and vulnerability effects, and decomposed the effects across specific risk factors. We used a decomposition method that isolated the independent contributions of each factor through each pathway, net of other variables.

Our descriptive analysis confirmed for China what has been found elsewhere: Women are more likely to survive but are also more likely to be functionally dependent at the end of an observation period, which in our case was five years, but this was true only among those who began the study period functionally independent. Among those who were functionally dependent at baseline, women and men were equally likely to end up dependent or deceased five years later. Although the latter results are based

on a small sample that began the observation period functionally dependent ($n = 445$), the results suggest that the mechanisms underlying gender differences (or lack thereof) may differ depending on the initial functional states. We were unable to further investigate transitions among adults who were dependent at baseline because of sample size. Future researchers may wish to extend our analysis by investigating the health transitions of those who are functionally dependent.

Among those independent at the baseline, decomposition results show that vulnerability explains much of the gender difference in mortality and functional dependency. In other words, men are more likely to die and women are more likely to be dependent at follow-up because of the different ways in which men and women are influenced by risk factor, rather than because of differences in the extent to which they are exposed to risk. Our results thus lend more support to the vulnerability hypothesis in comparison to the exposure hypothesis.

The residual effects show that significant parts of the gender differences in both outcomes remain unexplained by the social factors we considered in the analysis. Although we were able to incorporate a broad set of risk factors in our analysis, there are likely many others at work. Examining social factors simultaneously along with biological and genetic factors will likely prove to be fruitful in future studies.

We investigated the possible role of a number of potential risk factors that could explain gender differences in health. These were classified into five categories: SES, health care access, health behaviors, social support, and psychological characteristics. Although we had little previous research on the Chinese elderly to draw on, we speculated on some possible effects on the basis of what we did know about the setting and on the previous findings from North America and Europe. Our results were mixed. Some of our findings supported expectations and others did not, and some are straightforward to explain and others are more difficult. They highlight the complexity in which various factors operate through different pathways to create gender differences in functional health and mortality. To follow, we provide some possible explanations for our findings.

We suggested that health behaviors could lead to men's disadvantage, and we did indeed find that men's higher exposure to smoking resulted in unfavorable outcomes. Men are also more affected by smoking than women, but only in relation to mortality. This may be due partly to the fact that among smokers, men smoke more frequently and thus face higher

mortality from smoking-related diseases rather than surviving with disabling conditions. The mechanisms underlying the outcome-specific gender differences in the impact of smoking above need to be examined further in future studies. We also speculated that stress and a sense of control might equally affect women and men because of the universal exposure to dramatic political and social change as well as strict government control throughout life. Indeed, we find that having experienced lifetime stressful events explains little of the gender difference. However, we also find that women are more affected by the impacts of a low sense of control and recent stressful events (the latter only in the transition to death). Although these are opposite of our expectations for China, they are consistent with previous findings from Western, developed countries.

There are some other instances in which our initial speculations proved less insightful. We suspected that women's higher exposure to a lack of formal education would increase their risk. Although this proved to be the case, it is also the case that men are more vulnerable than women to lack of education when it comes to mortality. It may be that in a society with traditionally patriarchal and highly male dominated culture based on Confucian teachings, as in China, men without formal education have particularly low status, which in turn may have some influence on health unmeasured by the other variables in the model. We also suggested that women might be more favorably affected by social support, because earlier research has suggested more frequent and intense contact for the elderly women. However, support turned out to have little impact, which might suggest the universal benefit of instrumental ties that existed within the Chinese family.

Although a lack of health insurance impairs women's health through exposure as expected, it proves to be more important in impairing men's health through vulnerability. That is, even if men are more likely to have insurance than women, a lack of insurance is a greater risk for men's health than women's. It may be that several decades of relatively egalitarian access to health care during Mao's era resulted in health savings during the younger stages of life for today's elderly, especially for women. If women earlier had higher use of care than men (as is the case in the West), the benefits may have been substantial enough to negate the effect of reduced access to care in later life. It could also be the case that men tend to have much higher incidence of life-threatening diseases, such as cardiovascular disease, and therefore are in greater need of care and are hurt more by lack of access.

Also opposite of expectations, exposure to drinking among men is an advantage for them with respect to functional dependence. One possible explanation for this is that our measure was unable to capture heavy drinking, and instead we picked up the positive effects of moderate drinking. Another explanation is one of selection. If there is higher mortality among men who drink, then drinkers who have survived to old age are more robust than those who did not survive and thus less likely to become functionally dependent.

As discussed earlier, rural residence plays a major role in hampering women's health through vulnerability. Rural residence is associated with various characteristics that are linked to health, such as lower proportion with formal education, lower income, less health care access, and some that exist at a community level, such as less availability of health resources, clean water, and sanitation. The vulnerability effects for rural residence work toward women's disadvantage in both outcomes, even when controlling for some of the characteristics associated with rural areas, such as SES and health care access. The rural-urban measure may reflect a substantial influence of community and public health factors that benefit men. Still, the effects turned out to be quite a bit stronger than we might have anticipated, and future studies should incorporate community-level risk factors to fully examine the role of rural residence.

There are several important limitations to keep in mind when interpreting our results. First, although our independent variables are measured at baseline and predict outcomes at follow-up, we are still not able to isolate causal directions for most risk factors. Second, the dependent variable is based on only one functional health measure, which is a combination of functional task items, and our findings may not be generalizable to other measures of functional health, or health in general. An important next step will be to extend our analysis to other health outcomes and determine whether similar risk factors remain important through the same pathways. Third, our data on functional health are based on self-reports. It is possible that some of the effects we see are due to different ways in which men and women respond to functional health questions. Future studies may wish to address this issue by using more objective data (i.e., physical test results) or analytical tools, such as anchoring vignettes, that help correct for such potential bias. Fourth, as discussed earlier, transitions from functional independence to dependence may be underestimated using longitudinal data separated by several years, and lack of information on functional

health changes close to death results in overestimates of the effect of gender (Gu and Yi 2004). Data on health conditions close to death are essential for understanding how mortality differentials by gender account for the higher functional dependency among women. Although these data are rarely collected in surveys of older adults, our finding highlights the importance of incorporating these data in future data collections. Finally, our analyses are based on data from Beijing municipality, the capital of mainland China, where the standard of living is much higher than in much of the rest of the country. Thus, it may be difficult to generalize these findings. Assuming that other parts of China are developing with Beijing as a model, our findings may, however, provide some useful information in predicting future situations elsewhere in the country.

Despite these limitations, our results do serve to advance our understanding of gender differences in functional health and mortality. Some of our findings were consistent with the previous findings from North America and Europe, but many were not, which may reflect the influence of China's historical, social, and political contexts on the way social factors operate to create gender differences in health. We have demonstrated that gender differences in health are complex and are a function of various influences through both exposure and vulnerability that exist across a wide range of risk factors. Moreover, in support of the vulnerability hypothesis, we find that men and women who are similarly exposed to a risk factor may be affected differently by that risk factor. It is this pathway that explains a large part of the gender differentials. In other words, more exposure to a risk factor does not necessarily lead to less favorable health outcomes; much appears to depend on how women and men differentially react to similar risk factors.

In the end, on the basis of our findings, investing resources to reduce gender differences in particular risk factors, no matter how large the differences are, does not necessarily result in narrowing the gender gap in health. Ignoring the health risk factors for which women and men appear to be equal may also ignore their impacts through differential vulnerability. Policies must address the reasons that risk factors affect older women and men differently to have a substantial influence on reducing the gender gap in functional health and mortality. In turn, this may be important for overall population health, especially in a country such as China, where future health care challenges will follow rapid population aging.

Appendix

Coefficient Estimates From Ordinary Least Squares Models With Follow-Up Functional Health Status, Controlling for Baseline Status, by Gender

	Functionally Independent at Baseline			
	Functionally Dependent at Follow-Up		Deceased at Follow-Up	
Risk Factor or Control	Men (n = 1,199)	Women (n = 1,102)	Men (n = 1,199)	Women (n = 1,102)
Socioeconomic status				
No formal education	.012	.019	.058	.009
Blue-collar/heavy-labor occupation	.013	.013	.034	.037
Lack essential household amenities	.014	.011	.016	.010
Health care access				
No health insurance coverage	.046	.021	.081	–.026
No health checkup	.016	–.025	–.001	–.014
Financial difficulty	.027	–.013	.025	.022
Difficulty physically accessing doctor	–.003	.015	.095	.029
Health behaviors				
Smoked regularly	.003	.022	.038	.021
Have two or more drinks a day	.029	–.050	–.047	.092
Exercises regularly	–.007	.034	.010	–.033
Social support				
Not married	–.011	–.020	.078	.013
Lives alone	.059	–.038	.037	.029
No close friends	–.001	.013	.030	–.016
Psychological characteristic				
Low sense of control	–.005	.009	–.002	.006
Missing data on low sense of control	.171	–.123	.029	.101
Lifetime stressful events	.037	.024	.009	.032
Recent stressful events	–.038	–.052	–.054	.016
Rural residence	–.051	.062	–.040	.024
Age	.018	.014	–.083	–.065
Age squared	.000	.000	.001	.001
Serious disease condition	–.020	.023	.080	.063
Chronic disease condition	–.021	.043	.071	.022
Constant	–0.658	–0.530	2.402	1.942

Note

1. Specifically, we ran additional regressions that included mean replacement for missing data plus a dichotomous indicator for missing data. The results were not substantially different from those reported herein.

References

Arber, Sara and Helen Cooper. 1999. "Gender Differences in Health in Later Life: The New Paradox?" *Social Science and Medicine* 48:61-76.

Bird, Chloe E. and Patricia P. Rieker. 1999. "Gender Matters: An Integrated Model for Understanding Men's and Women's Health." *Social Science and Medicine* 48:745-55.

Blinder, Alan S. 1973. "Wage Discrimination: Reduced Form and Structural Variables." *Journal of Human Resources* 8:436-55.

Case, Anne and Christina Paxson. 2005. "Sex Differences in Morbidity and Mortality." *Demography* 2:189-214.

Chuanyi, Zhu and Xu Qin. 1992. "Family Care of the Elderly in China: Changes and Problems." Pp. 67-81 in *Family Care of the Elderly*, edited by J. I. Kosberg. Newbury Park, CA: Sage.

Denton, Margaret, Steven Prus, and Vivienne Walters. 2004. "Gender Differences in Health: A Canadian Study of the Psychosocial, Structural and Behavioural Determinants of Health." *Social Science and Medicine* 58:2585-2600.

Denton, Margaret and Vivienne Walters. 1999. "Gender Differences in Structural and Behavioral Determinants of Health: An Analysis of the Social Production of Health." *Social Science and Medicine* 48:1221-35.

Department of Social Medicine. 1995. "Report of the Beijing Multidimentional Longitudinal Study on Aging." Beijing, China: Beijing Geriatric Clinical and Research Center.

Du, Peng and Zhi-Gang Guo. 2000. "Population Aging in China." Pp. 194-209 in *Ageing in the Asia-Pacific Region: Issues, Policies and Future Trends*, edited by David R. Phillips. New York: Routledge.

Gu, Danan and Zeng Yi. 2004. "Sociodemographic Effects on the Onset and Recovery of ADL Disability Among Chinese Oldest-Old." *Demographic Research* 11:1-42.

Harrell, Stevan. 2000. "The Changing Meanings of Work in China." Pp. 67-76 in *Re-Drawing Boundaries: Work, Households, and Gender in China*, edited by Barbara Entwisle and Gail E. Henderson. Berkeley: University of California Press.

Henderson, Gail, John Akin, Li Zhiming, Jin Shuigao, Ma Haijiang, and Ge Keyou. 1994. "Equity and the Utilization of Health Services: Report of an Eight-Province Survey in China." *Social Science and Medicine* 39:687-99.

Kandiyoti, Deniz. 1988. "Bargaining With Patriarchy." *Gender and Society* 2:274-90.

Kaneda, Toshiko, Zachary Zimmer, and Zhe Tang. 2005. "Socioeconomic Status Differentials in Life and Active Life Expectancy Among Older Adults in Beijing." *Disability and Rehabilitation* 27 (5): 241-51.

Katz, S., A. B. Ford, R. W. Moskowitz, B. A. Jackson, and M. W. Jaffee. 1963. "Studies of Illness in the Aged: The Index of ADL, a Standardized Measure of Biological and Psychosocial Function." *Journal of the American Medical Association* 185:914-19.

Kinsella, K. and V. A. Velkoff. 2001. *An Aging World: 2001*. U.S. Census Bureau, Series P95/01-1. Washington, DC: U.S. Government Printing Office.

Lamb, V. L. 1997. "Gender Differences in Correlates of Disablement Among the Elderly in Egypt." *Social Science and Medicine* 45:127-36.

Leung, Joe C. B. 1997. "Family Support for the Elderly in China: Issues and Challenges." *Journal of Aging and Social Policy* 9:87-101.

Lincoln, K. D., L. M. Chatters, and R. J. Taylor. 2005. "Social Support, Traumatic Events, and Depressive Symptoms Among African Americans. *Journal of Marriage and the Family* 67 (3): 754-66.

McDonough, Peggy and Vivienne Walters. 2001. "Gender and Health: Reassessing Patterns and Explanations." *Social Science and Medicine* 52:547-59.

Mirowsky, John and Catherine E. Ross. 1989. *Social Causes of Psychological Distress*. Hawthorne, NY: Aldine de Gruyter.

Nagi, Saad Z. 1965. "Some Conceptual Issues in Disability and Rehabilitation." In *Sociology and Rehabilitation*, edited by M. B. Sussman. Washington, DC: American Sociological Association.

Nathanson, C. A. 1975. "Illness and the Feminine Role: A Theoretical Review." *Social Science and Medicine* 9:57-62.

Oaxaca, Ronald. 1973. "Male-Female Wage Differentials in Urban Labor Markets." *International Economic Review* 14:693-709.

Ofstedal, Mary Beth, Zachary Zimmer, Albert I. Hermalin, Aneqlique Chan, Yi-Li Chuang, Josefina Natividad, and Zhe Tang. 2007. "Short-Term Trends in Functional Limitation and Disability Among Older Asians: A Comparison of Five Asian Settings." *Journal of Cross-Cultural Gerontology* 21 (3): 243-61.

Pearlin, Leonard I. 1989. "The Sociological Study of Stress." *Journal of Health and Social Behavior* 30:241-56.

Poston, Dudley L., Jr. and Chengrong Charles Duan. 2000. "The Current and Projected Distribution of the Elderly and Eldercare in the People's Republic of China." *Journal of Family Issues* 21:714-32.

Rahman, M. O. and J. Liu. 2000. "Gender Differences in Functioning for Older Adults in Rural Bangladesh. The Impact of Differential Reporting." *Journal of Gerontology, Series A: Biological Sciences and Medical Sciences* 55:M28-33.

Romoren, Tor Inge and Morten Blekesaune. 2003. "Trajectories of Disability Among the Oldest Old." *Journal of Aging and Health* 15 (3): 548-66.

Ross, Catherine E. and Chloe E. Bird. 1994. "Sex Stratification and Health Lifestyle: Consequences for Men's and Women's Perceived Health." *Journal of Health and Social Behavior* 35:161-78.

Roxburgh, Susan. 1996. "Gender Differences in Work and Well-Being: Effects of Exposure and Vulnerability." *Journal of Health and Social Behavior* 37:265-77.

Shye, Diana, John P. Mullooly, Donald K. Freeborn, and Clyde R. Pope. 1995. "Gender Differences in the Relationship Between Social Network Support and Mortality: A Longitudinal Study of an Elderly Cohort." *Social Science and Medicine* 41:935-47.

Umberson, Debra, Meichu D. Chen, James S. House, Kristine Hopkins, and Ellen Slaten. 1996. "The Effect of Social Relationships on Psychological Well-Being: Are Men and Women Really So Different?" *American Sociological Review* 61:837-57.

United Nations Population Division. 2006. *World Population Prospects: The 2006 Revision*. New York: United Nations.

Verbrugge, Lois M. 1985. "Gender and Health: An Update on Hypotheses and Evidence." *Journal of Health and Social Behavior* 26:156-82.

———. 1989. "The Twains Meet: Empirical Explanations for Sex Differences in Health and Mortality." *Journal of Health and Social Behavior* 30:282-304.

Yount, Kathryn M. 2005. "The Patriarchal Bargain and Intergenerational Coresidence in Egypt." *Sociological Quarterly* 46:137-63.

Yount, Kathryn M. and Emily M. Agree. 2005. "Differences in Disability Among Older Women and Men in Egypt and Tunisia." *Demography* 42:169-87.

Yu, Mei-Yu and Rosemary Sarri. 1997. "Women's Health Status and Gender Inequality in China." *Social Science and Medicine* 45:1885-98.

Yuan, Tien H., Tianlu Zhang, Yu Ping, Jingneng Li, and Zhongtant Liang. 1992. "China's Demographic Dilemmas." *Population Bulletin* 47:1-44.
Zimmer, Zachary. 2005. "Health and Living Arrangements Transitions Among China's Oldest-Old." *Research on Aging* 27:526-55.
Zimmer, Zachary, Julia Kwong, Xianghua Fang, Toshiko Kaneda, and Zhe Tang. 2007. "Child Coresidence Among Older Adults in Beijing, China: Trends, Determinants and Transitions." Pp. 5-28 in *New Perspectives on China and Aging*, edited by Ian Cook and Jason Powell. New York: Nova Science.
Zimmer, Zachary, Toshiko Kaneda, and Laura Spess. 2007. "An Examination of Urban Versus Rural Mortality in China Using Community and Individual Data." *Journal of Gerontology: Social Sciences* 62B (5): S349-57.

Toshiko Kaneda is a research associate at the Population Reference Bureau. Her primary research interests are in the areas of health disparities and health transitions among older adults in developing countries. Her current research is focusing on understanding urban versus rural and sex differentials in a variety of health transitions in China and other Asian societies.

Zachary Zimmer is a senior scholar at the Institute of Public and International Affairs and a professor of sociology at the University of Utah. His research focuses on demographic issues related to aging in developing countries, with particular attention to the link between social and demographic change and the well-being of older adults.

Xianghua Fang is a professor in the Department of Epidemiology and Social Medicine at Xuanwu Hospital, Capital Medical University, in Beijing. Her primary interests are in the epidemiology of stroke and related diseases, including hypertension, coronary heart diseases, diabetes, and obesity, and in issues related to aging in China, especially the Beijing area. Some of her current research examines the primary and secondary prevention of stroke in older people and the impact of stroke on active life expectancy.

Zhe Tang is a professor and cardiologist in the Department of Epidemiology and Social Medicine at Xuanwu Hospital, Capital Medical University, in Beijing. His primary interests are in geriatrics and gerontology. His current research includes the epidemiology of Alzheimer's disease, active life expectancy, and social and economic determinants of healthy aging among the Chinese, particularly those living in the Beijing area. He directs the Beijing Multidimensional Longitudinal Study on Aging.