# Longitudinal Healthy Longevity Study
# Denies the Traditional Son Preference in China

*Zeng Yi[1]\* and James W. Vaupel[2]*

**Abstract:**

This study is based on analyzing the unique data sets from the Chinese Longitudinal Healthy Longevity Survey of interviews to 16,057 and 15,638 elderly aged 65-112 in the 22 provinces in 2002 and 2005. The results clearly demonstrates that having daughter(s) is beneficial at old ages in China, with respect to enjoying better filial piety of and relationship with children, care provided by children, and also maintaining a better cognitive capacity and reducing mortality risk, while controlling for various confounding factors. Such daughter-advantages are mostly more profound among the oldest-old as compared to younger elderly, and more profound in rural areas as compared to urban areas. We conclude that the publicly predominant perception of son preference in rural China, which leads to action of aborting the girl fetus to insure having at least one son under low fertility, is not a rational choice of peasants' own interests for better old age care.

One of the most pressing issues in China, which has received serious attention from inside and outside of the country, is the remarkable increase in sex ratio at birth (SRB) since 1980. The SRB is the number of male births per one hundred female births in a reference period, usually a year. According to reliable data from numerous countries over the past centuries, the SRB in normal circumstances is around 105 (*1*). The SRB in China was rather close to 105 in the 1960s and 1970s, but climbed quickly

[1] Duke University and Peking University, Durham, NC 27710, U.S.A. and Beijing, 100871, China.
[2] Max Planck Institute for Demographic Research and Duke University, Rostock, Germany and Durham, NC 27710, U.S.A.
\* To whom correspondence should be addressed. Email: zengyi68@gmail.com.

after 1980, up to 110.9 in 1986, 116 in 1995, 119.9 and 118.9 in 2000 and 2005. The SRB in rural areas in China were 121.7 and 121.1 in 2000 and 2005, while the corresponding figures in the urban areas were 116.5 and 115.3 (*2*). The SRB in the Taiwan area rose from 106 in 1980 to 110 in 2006 (*3*).

When fertility was high, the couples' preference to have at least one son could be naturally met after several deliveries without intervention. Consequently, SRB was normal or close to normal even in the societies where son-preference prevailed, such as in China before 1980. However, when fertility is low after the 1970s, the desire to have son(s) cannot be naturally met through limited births. The economic boom in China has made the medical technology for prenatal sex identification widely available and affordable. Thus, people who have strong son preference may possibly bribe the medical personnel to perform illegal prenatal sex examination and abort girl fetus to achieve their desire of having a son (*4*). In fact, this problem has occurred not only in China, but also in some other developing countries where son preference is prevalent during the process of economic development, technological progress and rapid fertility decline (*5*, *6*). For example, the SRB in India climbed from 105 in 1981 to 113 in 2003 (*7,8*). SRB in South Korea increased from 107 in 1982 to 115 in the middle of 1990s, and decreased to 110 in 2003 (*8,9*). The SRB in some Caucasus countries such as Armenia and Georgia climbed to more than 116 in recent years (*10*).

A loss of female births and infants due to illegal prenatal sex determination and sex-selective abortions, as well as female infanticide, abandonment and neglect, will create an unbalanced population sex structure in the future and result in serious social problems (*11,12*). Furthermore, the behaviours leading to loss of female births and infants reflect serious violations of the fundamental human rights of women.

While significant progress has been made in urban China, male domination and discrimination against women, which have deep historical roots, are still very strong in rural areas. The old Chinese saying "Yang Er Fang Lao (Having a son for prevents difficulties at old ages)" is one of the main

reasons why many people in rural China strongly prefer to have at least one son. In rural China, adult sons are more likely to provide financial support to their old parents than adult daughters are. The traditional belief that only sons can continue the family line has deep roots and is still very popular in rural areas (*13, 14*). Such a classic ideology, especially in rural areas, results in Chinese old parents who have both son(s) and daughter(s) choosing to live with a married son, and only son(s) inheriting the family properties. In the cases where old parents have no son and live with a married daughter, the son-in-law may likely be looked down upon by the villagers (*14*). Moreover, rural household labor supply is practically in favor of sons and presence of son(s) may likely enhance family power in the kinship network and local conflicts (e.g. agricultural irrigation in the dry season) (*15*). All such kinds of traditions have led to the continuously popular pre-conception of son-preference in rural China.

On the other hand, various empirical studies across different cultures have consistently shown that adult daughters are more likely to help with daily life and personal/emotional care in both industrialized and developing nations (*16, 17, 18*). Some studies reveal that married daughters in some cities in China provide the same level of financial support to their old parents as married sons do after controlling for relevant covariates (*18*). The recent data show that in relatively developed urban areas the proportion of elderly who mainly rely on daughters for care exceeded the proportion of elderly who mainly rely on sons by nearly six percent. But the corresponding proportion in rural areas is much lower than that in urban areas by a margin of ten percent (*19*).

Are the publicly predominant perceptions of depreciating the value of daughters and expecting that son(s) may provide better support and care to old parents correct under the current social and economic context in rural China? Is the action of aborting the girl fetus to insure having at least one son under low fertility a rational choice of the peasants' own interests for better old age care? This study intends to evaluate and provide answers to these questions based on analyzing the unique data sets from the Chinese Longitudinal Healthy Longevity Survey (CLHLS).

**DATA SOURCE AND METHODS**

Data used in this article are from the third and the fourth waves of CLHLS conducted in 2002 and 2005. The CLHLS was conducted in randomly selected half of the counties/cities in 22 out of 31 provinces in China, covering about 85 percent of the total population of China (a list of the 22 provinces and the sampling procedure are included in the Supporting Online Materials (SOM)). The CLHLS interviewed about 10,000 oldest-old aged 80-112 only in 1998 and 2000, but was expanded to interview 16,057 and 15,638 elderly aged 65-112 in 2002 and 2005, respectively. At each wave, the longitudinal survivors were re-interviewed, and the deceased interviewees were replaced by additional participants. Extensive questionnaire data for the elderly were collected, covering demographics, family and household characteristics (including number of living children by sex), life style, diet, psychological characteristics, economic resources, family support, subjective well-being, functional capacity, etc. All information is obtained through in-home interviews. Data on date and cause of death and health status before dying for the elderly who died between the waves were collected through interviews with a close family member of the deceased. The CLHLS study had a randomized sub-sample of 4,478 elderly interviewees' adult children aged 35-65 in 2002 with follow-up in the 2005 wave. The CLHLS is a longitudinal project with the largest sample size of the oldest-old and comparable sub-sample of the younger elderly (since the 2002 wave) ever conducted in a developing country. The systematic assessments on data quality concerning accuracy of age-reporting, reliability, validity, and consistency of the main measures and randomness of attrition show a reasonably good data quality in the CLHLS data sets (*20, 21*).

Based on the longitudinal data sets of the CLHLS 2002 and 2005 waves which were expanded to include younger elderly as well, we employ the multivariate ordered logit regression model, binary logistic regression model, and the parametric Weibull hazards survival analysis model in this study. Brief

descriptions and references of these three statistical models and the percentage distributions of the study variables and the covariates derived from the CLHLS data sets can be found in the SOM.

**FINDINGS**

*Filial piety to old parents: daughters versus sons.*

In the 2002 CLHLS, the sampled adult children were asked to evaluate nine statements concerning filial piety to old parents, such as whether and how adult children should respect and care for their old parents (see SOM for details). Using these data, we constructed the Filial Piety Index (FPI) for each of the adult children, and conducted the multivariate ordered logit regressions to investigate gender differentials of FPI.

The estimates of the odds ratios (*22*) of FPI of daughters versus sons are presented in Table 1. As compared to adult sons, while controlling for various confounding factors of old parents and adult children, adult daughters' FPI is significantly higher by a margin of 26 percent (P<0.01). The oldest-old parents aged 80+ and the younger old parents aged 65-79 enjoy 29 percent (P<0.05) and 18 percent (not statistically significant) higher FPI of their daughters, as compared to that of their sons. The daughters' merit of FPI over sons is much more profound in rural areas (35% higher, P<0.01) than in urban areas (18% higher, not statistically significant).

--- Table 1 is about here—

*Adult children's emotional relationship with old parents*

We conducted multivariate ordered logit regressions to investigate gender differentials in adult children's emotional relationship with parents, based on the 2002 CLHLS data set. The estimates presented in the last row of Table 1 show that adult daughters' emotional relationships with old parents are significantly better than adult sons by a margin of 30 percent (P<0.01), while controlling for various

confounding factors of old parents and adult children. The beneficial effect of a good emotional relationship between old parents and daughters (as compared to sons) is stronger among the old-old than among the younger elderly, and there is no notable difference between the rural and urban elderly (see Table 1).

### *ADL disabled old parents' satisfaction with care provided by their adult children*

Figure 1 presents the estimates of the odds ratios of satisfaction with care provided by the primary caregiver who is a daughter versus a son among the elderly parents who are disabled in activities of daily living (ADL), based on data from the 2005 CLHLS data set. ADL disabled elderly whose primary care-providers are a daughter and son-in-law are 43 percent more likely to be satisfied with care received from children than their counterparts whose primary care-providers are a son and daughter-in-law, and the estimate is statistically significant (P<0.01). The corresponding estimates are 45 percent (P<0.01) among the urban elderly and 38 percent (P<0.10) among the rural elderly. As compared to sons, the daughter advantages associated with parental satisfaction with care received from children are much stronger among the oldest-old (+45%, P<0.01) than that among the younger elders aged 65-79 (+13%, not statistically significant).

--- Figure 1 is about here ---

### *Old parents' functional capacity, subjective well-being and frailty index*

Based on the available CLHLS data and following international standards, we use ADL and Mini Mental State Examination (MMSE) to measure the physical and cognitive functional capacity of elderly; we use self-reported health and self-reported life satisfaction to measure elders' subjective wellbeing; we also employ the Frailty Index (FI) as a summary measure of various indicators of health outcome, which is widely applied in studies of healthy aging (*23*). The definitions and discussions of ADL, MMSE, self-

rated health and life satisfaction, and the FI are presented in detail in the SOM. We conducted multivariate binary logistic regressions using the ADL, MMSE, self-reported health, and life satisfaction as the dependent variables, and multivariate ordered logit regression analysis using FI as the dependent variable. The elderly respondents were categorized into four groups: having one or more surviving sons only (abbreviated as "having son(s) only" hereafter); having one or more surviving daughters only (abbreviated as "having daughter(s) only" hereafter); having both son(s) and daughter(s); and having no surviving children (*24*).

As compared to having son(s) only, about 69 percent of the thirty-five estimates of the odds ratios of having daughter(s) only on impairment of ADL and MMSE, self-reported poor health and life satisfaction, and frailty index of old parents shown in the first panel in Table 2 are less than one, and the other 31 percent of the estimates are greater than or equal to one, but all of the estimates are not statistically significant. As compared to having both son(s) and daughter(s), about 74 percent of the thirty-five estimates of the odds ratios of having daughter(s) only on old parents' deteriorated health outcome are greater than one (see the second panel in Table 2), and almost all of the thirty-five estimates are not statistically significant (except two). These results may be explained by the counter-balancing effects of daughter-advantages in daily/emotional care and the son-advantages in providing financial support including medical costs, etc., especially in rural areas, to be discussed later.

---Table 2 is about here---


**Follow-up declining cognitive capacity**

We conducted the multivariate ordered logit regression analysis to explore the difference in follow-up declining cognitive capacity among those elderly who most frequently talk to a daughter & son-in-law in daily life *versus* those who most frequently talk to a son & daughter-in-law. The follow-up declining

cognitive capacity was measured by comparing the old parents' MMSE scores in 2005 and 2002 among those elderly who had a MMSE score of 18 or higher in 2002 (see SOM for more details).

As compared to those elderly who most frequently talk to a son & daughter-in-law in daily life, the elderly who most frequently talk to a daughter & son-in-law had 24 percent (P<0.05) lower risk of follow-up declining cognitive capacity in the 3-year period (see Figure 2). The estimates of the reduction of risk of declining cognitive capacity associated with most frequently talking to daughter & son-in-law (vs. most frequently talking to son and daughter-in-law) is 43% (p<0.05) among the younger elderly, and 20% (not statistically significant) among the oldest-old. Such daughter-advantage in preventing decline in cognitive capacity at old ages is much stronger in rural areas (33%, p<0.05) than that in urban areas (16%, not statistically significant).

--- Figure 2 is about here---


**Mortality risks of the old parents**

We employ the parametric Weibull hazards model and the CLHLS follow-up data sets to explore the effects of gender composition of adult children on mortality risk of the old parents. We examine the effects of gender composition of children on survival of old parents over a three-year interval between 2002 and 2005 in which both oldest-old and younger elderly subjects were recruited in the samples (see SOM for details).

Table 3 presents the estimates of the relative risk of mortality of old parents associated with the gender composition of their adult children. As compared to those female and male elderly who have son(s) only, the female and male elderly who have daughter(s) only had 13% (p<0.05) and 2% (not significant) lower mortality risk in the 3-year follow-up period. It is interesting to note that the estimates of the mortality reduction associated with having daughter(s) only (vs. having son(s) only) are much stronger in rural areas (13%, p<0.05) than in urban areas (5%, not significant), and significant among the oldest-old

(10%, p<0.05), but not significant (and the relative risk is slightly great than one) among the younger elderly. As shown in the last line of Table 3, the estimates of the relative risk of mortality in comparison between elderly who have daughter(s) only versus those who have both son(s) and daughter(s) are mostly and slightly greater than one, and all of the estimates are not statistically significant.

    --- Table 3 is about here---

## DISCUSSIONS AND CONCLUSION

This study clearly demonstrates that, while controlling for various confounding factors, having daughter(s) is beneficial at old ages in China, with respect to enjoying better filial piety of and relationship with children, care provided by children, and maintaining a better cognitive capacity, and reducing (or at least retaining the same level of) mortality risk, as compared with having son(s). Such daughter-advantages are mostly more profound among the oldest-old as compared to younger elderly, and more profound in rural areas as compared to urban areas.

How to explain these findings, which are contradictory to the popular perception of the son preference, which values daughters much less than sons in rural China? We believe that it may be at least partly explained by the gender differentials in adult children's roles in supporting old parents and family ethics, and the changes of these roles in recent years. Based on the 2002-2005 CLHLS data, the average financial supports of cash and materials received from sons are 85.1 percent (p<0.001) and 36.2 percent (p<0.001) more than that received from daughters among the rural and urban old parents, respectively (*25*). After subtracting the cash and materials given to the adult children by the old parents, the average net financial supports received from sons are 81.4 (p<0.001) percent more than that from daughters among the rural old parents, but the net financial support received from sons among urban elderly is 30.3 percent less than that from daughters (p<0.001). The financial support is particularly crucial for rural elderly who mostly do not have any retirement pension income. This financial support, plus the

traditionally viewed son-advantages in continuing the family line and enhancing household labor and family power for local kinship, competition and conflict, may lead peasants to still retain their pre-conception of strong son-preference.

However, adult daughters are much more likely to have higher filial piety and provide better daily life and emotional care which are frequently needed at advanced ages, as evidently shown in this study (see Table 1, Figures 1 and 2) and other studies (*16, 17, 18*). Furthermore, the conflicts in daily life between daughter-in-law and mother-in-law are much more likely to occur, or even to be serious, as compared to daughter-mother relation, especially in rural areas (*26, 27*). Such daughter-in-law and mother-in-law conflict may be more likely to occur in the cases of absence of the son due to rural-to-urban labor migration, which increased dramatically in recent years. Also, after more than 20 years of rapid economic and social development, rural daughters and their husbands can also acquire educational intelligence, technical skills and economic capacity, which may reduce their disadvantages in household labor and family power (*28*). Therefore, although peasants' pre-dominant perception of son-preference retains, the traditional advantages of sons may be relatively weaker today.

In rural China, the elderly who have no sons are very likely to live with a married daughter. The elderly who have son(s) only may be relatively better-off in terms of financial support, but their daily and emotional care received may be significantly less than those elderly who have daughter(s) only (see Table 1 and Figure 1). This plus changes in the traditional son-advantages as discussed above may lead to the result that elderly who have daughter(s) only are substantially better-off in follow-up changes in cognitive capacity and survival probability (see Figures 2 and Table 3).

One may imagine that the elderly who have both son(s) and daughters may enjoy both daughter-advantage and son-advantage, and may be expected to be substantially better off. But this speculation was not supported by our empirical study, and the elderly who have both son(s) and daughter(s) did not do significantly better in health outcome and survival, as compared to those who have daughters only. This

empirical result may be explained by that the effects of dual advantages of having son(s) and daughter(s) may be offset by the fact that they may likely live with a married son and daughter-in-law, and may more likely have conflicts with daughter-in-law in daily life, as compared to those elderly who have daughter(s) only.

Note that rural sons provide significantly more financial support to old parents than do daughters, and the rural-urban differentials in daughter-advantages of emotional relation with old parents and old parents' satisfaction with care provided by children are not substantial (see Table 1 and Figure 1). But the advantages of daughter(s) over son(s) in survival and preventing follow-up decline of cognitive capacity are substantially more profound in rural areas than in urban areas (see Table 3 and see Figure 2). This interesting phenomenon may be explained to some extend by the rural-urban differentials in likelihood of daily conflict between daughter-in-law and mother-in-law. As revealed by China's 2000 census data, the proportion of elders living with a married son and daughter-in-law in rural areas is substantially higher than that in the urban areas (*29*). Moreover, the more complicated household work in rural areas may result in more frequent direct interactions and higher likelihood of conflicts in daily life between daughter-in-law and mother-in-law than that in urban areas. The lower education level in rural daughters-in-law and mothers-in-law may also result in their poorer capability of resolving their daily life conflicts as compared to their urban counterparts.

Based on the empirical evidences gained in this study, we conclude that the publicly predominant perceptions of depreciating the value of daughters and expecting that son(s) may provide better support and care to old parents in rural China is incorrect. It is based on traditional pre-conception, but does not represent the reality today. Those who abort the girl fetus to insure having at least one son in the context of low fertility do not make a rational choice with respect to their own interests for better old age care. It is true, however, a large majority of the old parents in rural areas in China still rely on son(s) for financial support since they do not have any kind of pension support. Such a situation will certainly affect people's

decision-making to choose to abort girl fetus to have at least one son when fertility is low. Thus, the efforts of establishment of an old age insurance program in rural areas sponsored by the government will largely reduce the necessity of having at least one son for financial support at old ages. We recommend that China consider such efforts as one of the top priorities in social development, while informing the public that having daughter(s) is beneficial in daily and emotional care and likely reducing long-term mortality risk at old ages, especially in rural areas and at oldest-old ages. Integration of the efforts of establishing rural old age insurance and educational propaganda aimed at correcting the wrong pre-conception of son-preference will reduce and eventually eliminate prenatal sex determination and sex-selective abortions. The dangerous trend of increasing sex ratio at birth is thus reversible, if China acts in the right direction.

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Table 1. Odds ratios of adult children's self-reported Filial Piety Index and emotional relation with elderly parents: daughters versus sons, based on the 2002 CLHLS data

| Age range and residence of elderly parents | All Ages 65+ n=4,331 | All Ages 65-79 n=1,678 | All Ages 80+ n=2,653 | All Urban n=2,305 | All Rural n=2,026 |
|---|---|---|---|---|---|
| Adult children's Filial piety index (daughter versus son) | 1.26** | 1.18 | 1.29* | 1.18 | 1.35** |
| Good emotional relation with parents (daughter versus son) | 1.30** | 1.41* | 1.31* | 1.25+ | 1.24+ |

Notes: (1) The estimates presented in this table are adjusted for various confounding factors of old parents and adult children. The confounding variables controlled for the elderly parents include number of living children, single year of age, urban/rural residence, ethnicity, socioeconomic status (SES), marital status, proximity to children, and health conditions; confounding variables controlled for adult children include age, SES, marital status, number of children, and health conditions. (2) #, p<0.10, statistically significant at 90% confidence level; *, p<0.05, statistically significant at 95% confidence level; **, p<0.01, statistically significant at 99% confidence level; ***, p<0.001, statistically significant at 99.9% confidence level; without #, *, **, or *** means not statistically significant. (3) "n=" means number of observations.

Table 2. Comparisons of odds ratios of old parents' health outcomes by the gender composition of their adult children, based on the 2002-2005 CLHLS data

| sex, age range, rural/urban residence of old parents | All Ages 65+ n=7,839 | Women Ages 65+ n=4,282 | Men Ages 65+ n=3,557 | All Ages 65-79 n=3,590 | All Ages 80+ n=4,249 | All Ages 65+ Urban n=3,439 | All Ages 65+ Rural n=4,400 |
|---|---|---|---|---|---|---|---|
| *Having daughter(s) only versus having son(s) only* | | | | | | | |
| ADL disabled | 0.97 | 1.05 | 0.89 | 0.78 | 0.97 | 0.94 | 1.00 |
| Cognitive impaired | 0.89 | 0.93 | 0.83 | 1.08 | 0.87 | 0.81 | 1.03 |
| Self-reported bad health | 0.96 | 1.13 | 0.78 | 1.16 | 0.90 | 0.85 | 1.05 |
| Self-reported bad life satisfaction | 0.99 | 1.13 | 0.82 | 0.99 | 1.02 | 0.77 | 1.20 |
| Frailty index | 0.91 | 0.99 | 0.83 | 1.12 | 0.85 | 0.85 | 0.98 |
| *Having daughter(s) only versus having both daughter(s) & son(s)* | | | | | | | |
| ADL disabled | 1.09 | 1.05 | 1.16 | 0.86 | 1.19 | 0.81 | 1.38* |
| Cognitive impaired | 1.04 | 1.03 | 1.02 | 1.07 | 1.05 | 1.05 | 1.01 |
| Self-reported bad health | 1.08 | 1.14 | 1.04 | 1.20 | 1.05 | 1.13 | 1.01 |
| Self-reported bad life satisfaction | 1.21 | 1.13 | 1.31 | 1.87* | 1.06 | 1.26 | 1.17 |
| Frailty index | 0.96 | 0.84 | 0.92 | 0.96 | 0.90 | 0.84 | 0.92 |

Notes: (1) All estimates are controlled for gender, single year of age, number of living children, proximity to children, urban/rural residence, ethnicity, SES, marital status, and health practice. (2) and (3): the same as note (2) and (3) in Table 1.

Table 3. Comparisons of relative risk of old parents' mortality by gender composition of their adult children, based on 2002-2005 CLHLS data

| sex, age range, rural/urban residence of old parents | All Ages 65+ n=13,768 | Women Ages 65+ n=7,867 | Men Ages 65+ n=5,901 | All Ages 65-79 n=4,132 | All Ages 80+ n=9,636 | All Ages 65+ Urban n=7,819 | All Ages 65+ Rural n=5,949 |
|---|---|---|---|---|---|---|---|
| *Having daughter(s) only versus having son(s) only* | 0.91* | 0.87* | 0.98 | 1.04 | 0.90* | 0.95 | 0.87* |
| *Having daughter(s) only versus having both daughter(s) & son(s)* | 1.06 | 1.05 | 1.04 | 1.20 | 1.05 | 1.05 | 1.07 |

Notes: (1) All estimates are controlled for gender, single year of age, number of living children, proximity to children, urban/rural residence, ethnicity, SES, marital status, health practice and health conditions. Notes (2) and (3) are the same as the notes (2) and (3) in Table 1.

Figure 1. Odds ratios of ADL disabled elderly parents' satisfaction for care provided by the primary care-giver who is a daughter *versus* a son, based on the 2005 CLHLS data
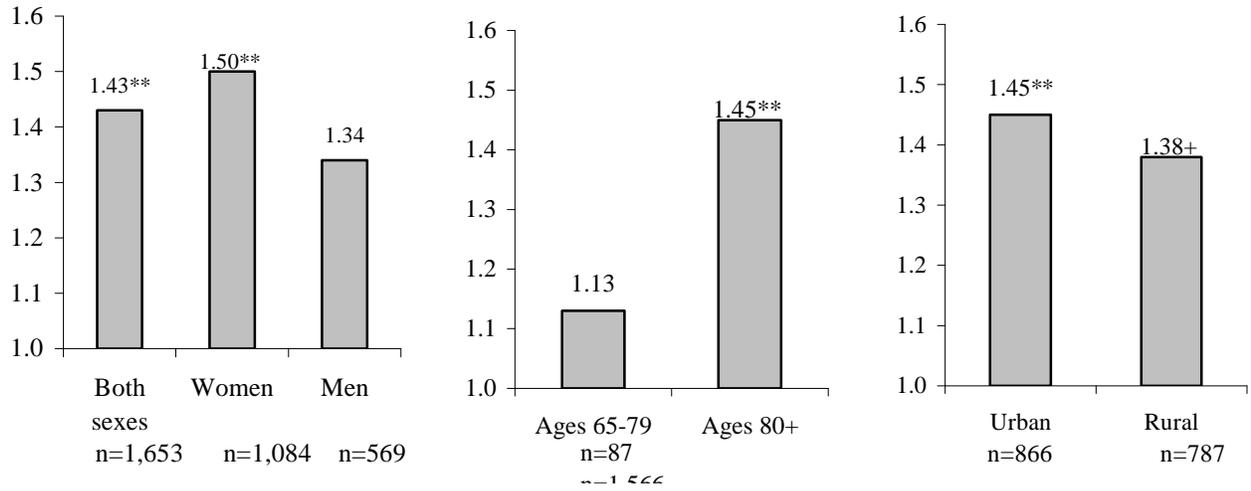


Notes: (1) All estimates are controlled for gender, single year of age, number of living children, proximity to children, urban/rural residence, ethnicity, SES, marital status. Notes (2) and (3): the same as notes (2) and (3) in Table 1.

Figure 2. Odds ratios of follow-up declining cognitive capacity among those elderly who most frequently talked to a daughter & son-in-law in daily life *versus* those elderly who most frequently talked to a son & daughter-in-law, based on the 2002-2005 CLHLS data
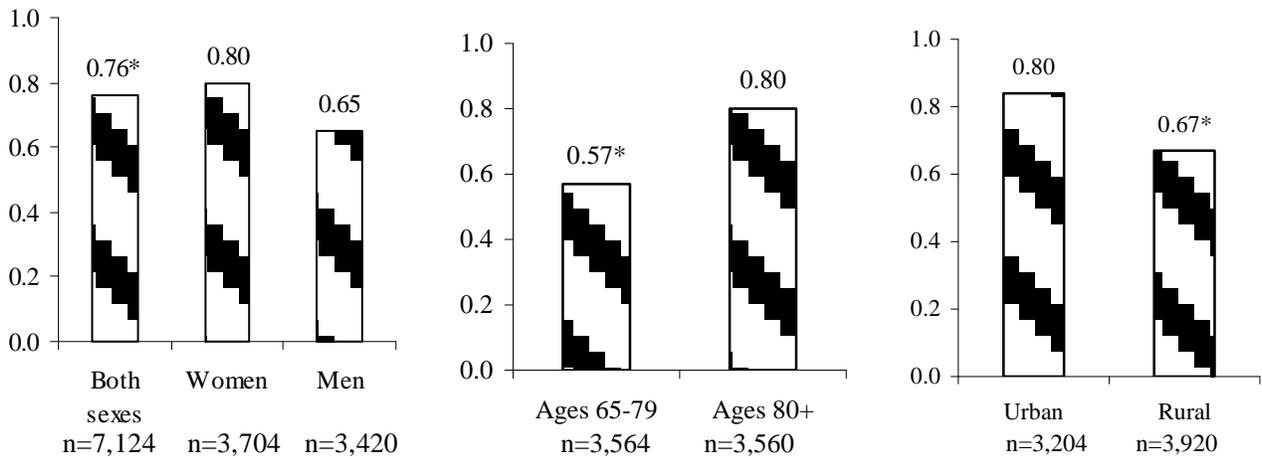


Notes: (1) Cognitive change in 2005 was measured by MMSE score among those whose MMSE score was 18 or higher in the 2002 wave. The MMSE scores in 2005 were classified into four categories: 0-9, 10-17, 18-23, and 24-30. All estimates are controlled for gender, single year of age, number of living children, proximity to children, urban/rural residence, ethnicity, SES, marital status, and health practice. Notes (2) and (3): the same as notes (2) and (3) in Table 1.