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# **Analysis of Health and Longevity in Oldest-Old Population: A Health Capital Approach**

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## **ABSTRACT**

### **Analysis of Health and Longevity in Oldest-Old Population: A Health Capital Approach<sup>\*</sup>**

Using 2002 cross-sectional data and 1998, 2000, 2002 three waves of panel data from the Chinese Longitudinal Healthy Longevity Survey, we study health in oldest old population. We measure health using the Katz Index of Activities of Daily Living (ADL) and in term of mortality. Our results suggest that besides aging, there are other important factors contributing to bad health both in term of the Index of ADL and mortality. Effects of gender on the Index of ADL and on mortality are different. Female tends to be more dependent in daily living, but has higher probability to survive. Oldest-olds living in urban area are also more dependent, but are less likely to die. Socioeconomic status such as financial resources, education level of the oldest-old and of his/her spouse and etc. plays insignificant role in the health of oldest-old. Oldest-olds still in marriage are more independent in daily living and are more likely to survive. There exists reverse causality between health and risky behaviors. After controlled for simultaneity bias by instrumental variable method, the coefficients of risk behaviors are consistent with theory and common wisdom.

JEL Classification: I12, J14, I18

Keywords: oldest-old, mortality, Katz index of ADL, Grossman model

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## **1. Introduction**

Research on the relationship between socioeconomic status and health is an important and active research area in social science, including economics. The gradient in health, the phenomenon that wealthier people is healthier, attracts much attentions from the researchers.

In economics, health is widely considered as an important component of human capital. Since the seminal work of Grossman (1972), Grossman model has become standard model to study health demand and health determinants. Treating health as capital is the key insight of Grossman (1972). The health status – the stock of health – depends on two key factors: investing in health and depreciation of health.

Applying Grossman model, economists have carried out numerous empirical studies, for examples: Wagstaff (1986, 1993), Erbsland et al. (1995), Sickles and Yazbeck (1998), and Dustmann and Windmeiher (2000) among many others. These studies shed light on the gradient for the working adults.

Recently, Two studies by economists, Case, Darren and Paxson (2002) and Currie and Stabile (2003), have made important contribution to understand the relationship between socioeconomic status and health in childhood. Both studies find that the gradient in adulthood can be traced back to childhood. The positive association between socioeconomic status and health becomes stronger as children age.

Under Grossman health capital framework, the findings in Case, Darren and Paxson (2002) and Currie and Stabile (2003) are not surprising. The net flow

of health capital, investment minus depreciation, determines the health status of the children. Wealthier family is able to invest more in their children's health; also can take more effective measures to slowdown the depreciation process of the health capital. Even if rich and poor children have same amount of genetic health endowment, rich children will accumulate more health capital as they grow up.

In this paper, we study health in the old population, more specifically, we investigate the health in oldest-old, i.e. people who are older than 80. Though there are many studies on the aging population and on their health see Smith and Kington (1997) for a survey, the studies focused on oldest-old are much less, as noted by Zeng et al. (2001). One of the main reasons for the limited studies on the oldest-old population is lack of data. Luckily, the Chinese Longitudinal Healthy Longevity Survey (CLHLS), which is one of the largest surveys on oldest-old population in the world (Koenig 2001), affords us a unique opportunity.

This paper supplements previous studies on health in children, working adults, and old population.

Studying longevity is an intriguing topic. Vaupel (1998) summarizes studies on mortality in advanced ages. He dismisses the agnostic view and argues that besides the biological limits, other demographic factors also play significant roles to the mortality at older ages, "however, little is yet known about why mortality among the oldest-old has been so plastic since 1950."

Understanding health in old population also has important policy implications. According to the recent three Chinese censuses, the percentages of

the population above 65-year old are 4.91%, 5.57% and 6.96% in 1982, 1990 and 2000, respectively. China was entering the aging society in 2000.

Further more, one-child policy has put Chinese population on a fast track of aging.<sup>1</sup> The aging issue is becoming an important topic in academia as well as in policy circle in China. Many resources have already been spent on the old population, and more will be needed. Oldest-old population certain claims a large share of these resources.<sup>2</sup>

It is not surprising that we find aging is a major contributor to bad health both in term of dependence in activities of daily living (ADL) and in term of mortality in this paper. However, other factors also play important roles in determine the health in oldest-old population.

Effects of gender on independence in ADL and on mortality are different. Female tends to be more dependent in daily living, but has higher probability to survive. Oldest-olds living in urban area are also more dependent in daily living, but are less likely to die.

Oldest-olds still in marriage are more independent in daily living and are more likely to survive.

Socioeconomic status, such as financial resources, education level of the oldest-old and of his/her spouse, etc., plays insignificant role in the health of oldest old.

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<sup>1</sup> One child policy is the family planning policy adopted by Chinese government since the early 1980s. Loosely speaking, it means one couple can only have one child legally.

<sup>2</sup> In 1988, oldest-old spent 25% of Medicare budget in New York City, see Zeng (2001). This percentage is very likely growing along with the increase of life expectancy.

There exists reverse causality between health and risky behaviors, such as smoking and drinking. Without controlling for endogeneity, the coefficients of smoking and drinking have wrong sign. After corrected for simultaneity bias by instrumental variable (IV) methods, the coefficients of risky behaviors are consistent with theory and common wisdom.

We organize the remaining paper as follows: Section 2 outlines the analytical framework based on Grossman model, Section 3 describes the data set and descriptive statistics, Section 4 presents empirical results, and Section 5 concludes the paper.

## **2. Theory**

Economist considers health as human capital for a long time. Mushkin (1962) thinks that health and education are two important component of human capital. Becker (1964) regards human capital as consequence of long-term education, good health and good nutrition. Fuchs (1966) holds similar view.

Building on the human capital theory, Grossman (1972) formulates a formal model to analyze health capital. Grossman (2000) surveys the development of Grossman model and related empirical studies. The conceptual contribution of Grossman (1972) is to treat health as capital. The health status reflects the stock of health capital. Two key factors: investment factor, investing in health, and depreciation factor, depreciation of health capital, determine the



stock of health, hence the health status. When the stock of health falls below certain minimum level, people die.<sup>3</sup>

However, unlike market goods or standard investment which can be bought from store or stock market, it is impossible to purchase a unit of health from market. Conceptually, since the work of Grossman (1972), economist models health as an output of the household production of Becker (1965). In this model, households “combine time and market goods to produce more basic commodities that directly enter their utility functions” as stated in Becker (1965). Main market goods used to produce health is health care service. This provides theoretical foundation for the positive relationship between socioeconomic status and health because wealth and income determine the budget constraint. People with higher socioeconomic status can afford to purchase more health service, and produce more health capital.

Education is complementary to health, and it can improve household technology. Characteristics of other family member may also enter into the household technology. For example, more educated family member may be able to choose more qualified doctors, and is more knowledgeable to the harmful effect of risky behaviors. She/he can give advice to other family members. In theory, the education levels of all family members have a positive effect on health.

Life style, which is regarded as a key aspect in studying health in sociology, can be accommodated in Grossman framework. Life style, such smoking, drinking, and going to gym regularly, etc., affects health through two

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<sup>3</sup>Vaupel (1998) notes living organisms and complicated equipment, e.g. car, share similarity in their trajectories of mortality at their advanced ages, which provides an interesting evidence for health capital theory.

channels. One channel is the household technology. This channel captures the effect in health production process. Good/bad behavior will make the production of health more/less efficient. The other channel is the rate of depreciation. Good/bad behavior will decrease/increase the rate of depreciation, so will deplete the already in stocked health capital slower/faster. This channel captures the effect in consumption of health.

It is important to note that one of the fundamental implications of Grossman model is that what really matters is stock. Current inputs to health production function and contemporary change of behavior and life style will have an incremental effect on the stock of health capital, which is determined by the entire history of past, but unlikely will change the stock of health significantly.

Though Grossman model is formulated based on working adults, it is a powerful tool to understand and to analyze health of other age groups as well. Nonetheless, the model has different implication for younger population and older population.

Childhood is a period to accumulate health capital. In this period, investing factor dominates depreciation factor. Education level and life style are still under development, and their relationship with health should not be significant. More income and higher socioeconomic status (of the parents) imply more investment in health; hence current socioeconomic status (of the parents) has big impact on the children's health.

For the old population, especially the oldest-old population under study here, depreciation factor dominates investment factor. Their health statuses are

mainly dictated by the stock of health capital and the rate of depreciation. Factors on health investment will likely have smaller impact than factors on health stock and factors on health depreciation do. Current factors, such as current income, changing of risky behavior very recently, are unlikely to have big influence, but historical factors, such as life style in the past, permanent income, education level, etc., will exhibits larger effect.

### **3. Data**

#### **3.1 Data Set**

Data set used in this paper is the Chinese Longitudinal Healthy Longevity Survey (CLHLS). The CLHLS is a national representative panel data with 1998, 2000 and 2002 three waves. It covers 22 out of the 31 provinces in China.<sup>4</sup> In these 22 provinces, half of the counties and cities were randomly selected. All centenarians who agreed to interview were included in the sample. For each centenarian, one octogenarian and one nonagenarian living nearby were matched by sex and interviewed. In 1998 and 2000, only people with age 80 or above were included in the sample except very rare cases. In 2002, additional observations with age from 65 to 80 were added to the survey. Zeng et al. (2001) describes the data set and survey design in detail. Their paper also assesses the quality of the data, especially age-reporting, and concludes that “age-reporting in our 1998

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<sup>4</sup> Xinjiang, Qinghai, Ningxia, Inner Mongolia, Tibet, Gansu, Guizhou, and Hainan are the 9 provinces not in the sample. Exclusion them from the survey is mainly due to the potential inaccurate age-reporting, since all of these 9 provinces have a large proportion of minority population, see Zeng et al. (2001).

survey is generally good” after comparing the CLHLS with Swedish oldest-old data.

We use 1998-2000-2002 panel data and 2002 cross-sectional data in our analysis. The 2002 cross-sectional data contains 16,064 observations. Among these 16,064 observations, 2,642 of them were interviewed in 1998 and 2000, 3,674 of them were interviewed in 2000 only, and 9,748 of them were newly interviewed in 2002. Among the 9,748 new addition observations, 4,889 were 65 to 79 years old in 2002.

The numbers of observation in the panel data are shown in Figure 1. The 1998 data has 9,093 observations. Among them, 4,831 were re-interviewed in the 2000 survey, 3,368 deceased before 2000 interview and information on them was collected, and the rest observations (894) were lost to follow-up. In 2002, among the 4,831 interviewed in 2000, 2,642 survived and were re-interviewed, 1,604 deceased and their information was collected, and 585 were lost to follow-up.

We restrict our analysis on Han nationality to avoid possible inaccurate age-reporting of other ethnic groups. We also exclude oldest-old living in a nursing home to circumvent potential systematic different between oldest-old living at home and oldest-old living in a nursing home. There are 5.5% non-Han oldest-old and 4.6% oldest-old living in a nursing home.

### **3.2 Health Outcome Variables**

One of the major difficulties to study health is how to measure the health. In the literature, there are many measurements, like Quality-adjusted Life Years (e.g. Cutler and Richardson, 1997), Disability-adjusted Life Years (e.g. World

Bank, 1993) and Quality of Well-being Scale (e.g. Kaplan and Anderson, 1988), among others. Field and Gold (1998) provide an excellent survey.

One of the most popular and proved useful health measurements for the old population is the Katz Index of Activities of Daily Living (Index of ADL) (see Katz et al., 1970). The CLHLS survey administrated same questionnaire as Table 1 in Katz et al. (1970), and asked questions on six categories of daily living activities: bathing, dressing, toileting, transferring, continence and feeding.<sup>5</sup> Given the available information in the data set and the good reputation of the Index of ADL, we construct and use the Index of ADL as one measurement for health. Table 1 (reproduced from Table 2 in Katz et al. 1970) summarizes how to construct the Index of ADL. The Index of ADL is from category A to category G with decreasing degree of independence in ADL.

Please note that these six categories do not exhaust all possible combinations. There is “other” category, which is more dependent in daily living than category A and category B are, and less dependent than category G is, but it is incomparable with category C and category D.<sup>6</sup>

Figure 2 shows the Index of ADL calculated from 2002 cross-sectional data by age-gender group. For old population (age 65 to 79), 97% of their indices of ADL are “A”. This percentage decreases to 76% for oldest-old population (age 80 and above). The Index of ADL is not significantly different across gender for

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<sup>5</sup> The only different between Table 1 in Katz et al. (1970) and the questionnaire in the CLHLS is item 2 in feeding. The CLHLS uses “feeds self, with some help” instead of “feeds self, except for getting assistance in cutting meat or buttering bread”, which is more consistent with Chinese eating habit.

<sup>6</sup> Katz et al. (1970) states there are usually less than 5% belonging to “Other”. In our calculation based on 2002 cross-sectional data, we do not find any observation belonging to category “Other” in the CLHLS.

old population, but for oldest-old population, female is more dependent in daily living than male is. 81% of male oldest-old has “A” in the Index of ADL, but this number for female is only 70%. Nonetheless, it is remarkable that majority (76%) of oldest-old are still totally independence in their daily living.

Old population becomes more dependent in activities of daily living with aging (Figure 3). At age 65, male and female have almost identical degree of independence, as measured by the Index of ADL; however, female is becoming more dependent than male is along with aging (Figure 4).

The Index of ADL is a good indicator for mortality. At each age group, the survived group has better status measured by the Index of ADL (Figure 5).

Another health outcome variable used in this paper is mortality. To measure mortality, we use panel data. Our focus is 2000 wave. From 2002 wave, we create survival status for observations in 2000. Information in the wave of 1998 allows us to control for historical factors.

### **3.3 Explanatory Variables**

Table 2 compares characteristics of old population and oldest-old population. The average age of old population is 72 and of oldest-old is 92. The distributions of self-reported quality of life and self-reported health status are very similar for these two groups, but oldest-olds feel lonelier, unhappier and more useless than old population do.

Compared with old population, oldest-olds are also less likely to smoke, drink, exercise, and to participate social activities currently. In their past time, their drinking rate and exercising rate are similar to the ones of the old population.

Oldest-olds are less educated, are less likely to have a white collar job during their careers, have lower pension coverage rate, are less self-sufficient in finance, and have less family income.

However, oldest-olds share comparable characteristics with old population on whether they live in urban area, drink boiled water, use tap water, have enough money to cover the expenses, had enough medical services at childhood, and often went to bed hungry in childhood.

Table 3 is explanatory variables by gender for the oldest-old population. The average age of female is 94, and the average age of male is 90. Female is less educated, less likely to have a white collar job during their careers, has lower pension coverage rate. The percentages of female, who smoke now, smoked in the past, drink now, drank in the past, exercise now, and exercised in the past, are all lower compared with male population.

Table 4 summarizes characteristics of oldest-olds in 2000 by their survival status in 2002. Deceased observations are 4.5 years older than survived ones on average. Aging is an important factor causing death. Survived oldest-olds self-report higher quality of life and better health status. Life style and behaviors, e.g. smoking, drinking and exercising, are different for these two groups of people.

#### **4. Results**

In this section, we analyze the relationship between socioeconomic status, life style, risky behaviors, and health. The health is measured by the Index of ADL

and by mortality. We use ordered probit model to study the Index of ADL and apply binary probit model to study mortality.

Besides socioeconomic status, we also control for psychological factors, life style variables, and environmental variables.

We address genetic difference in health endowment by including dummy variables on if the oldest-old has mother, father or a sibling living longer than 80-year old. We use IV approach to control for simultaneity bias arose from potential reverse causality between health and choice of life style.

#### **4.1 The Katz Index of ADL**

The Katz Index of ADL divides people into six-category from most independent to least independent in daily living. We use the Index of ADL as measurement of health, and apply ordered probit model to investigate the determinants of the independence in ADL in oldest-old.<sup>7</sup>

Table 5 presents estimates from different model specifications based on 2002 cross-sectional data. Aging is one of the main factors which have caused the health deteriorated. Female negatively correlates with independence in ADL, but the gender effect has disappeared when we control for more covariates.

Current family income plays insignificant role. Whether the old-old has a pension or not, is income enough to meet expenditure, and whether oldest-old is his/her main financial source, are not important factors.

Nonetheless, the oldest-old will have better health if he has his own bedroom. One interpretation is that having an own bedroom or not captures the

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<sup>7</sup> We use scale from 1 to 6 to represent the oldest-old from least independent to most independent. A positive coefficient means a positive relationship between the explanatory variable and the health status.



permanent income and the financial capacity of the whole family better. From the health capital theory, permanent income instead of current or transitory income affects stock of health capital more. The family resources, not the personal recourses, constrain the household production.

Education level of the oldest-old and of her/his spouse has an insignificant albeit positive effect on health.

The effects of current medical care services and of medical care services at age 60 are insignificant, but the significant positive effect of the medical care services at childhood has been persisted into late-life.

The oldest olds, who are still in marriage or who are taken cared by their close relatives, such by spouse, by their own children and in-laws, have better health.

Among the feelings of loneliness, happiness and uselessness, the feeling of uselessness is a good predictor for bad health. Whereas self-reported quality of life is insignificant in the whole sample, but it becomes significant when we run the model separately for male and for female. For male, higher quality of life relates with better health, but the relationship for female is totally reserved. We do not have an explanation for this (see Table 5, Table 1a and Table 2a).

At first sight, the life style and environmental variables seems having wrong signs. The coefficients of having tap-water now and having at ago 60 both significantly negative. Though the coefficients of smoking and drinking in the past are negative, the coefficients of smoking and drinking now are both significantly positive.

For the coefficients of tab-water, it is worth noting that the coefficient of whether living in an urban area is also significantly negative. This is consistent with the finding in Xu and Gu (2001), which shows that urban oldest-olds are more dependent than their rural counterpart in daily living. So the coefficients of tab-water maybe are biased by the confounded effect that oldest-olds in urban area are also more likely to have tab water.

The mysterious positive sign of current smoking and drinking status, i.e. the paradox of smoking is good for health, is probably caused by reverse causality, i.e. the current status of smoking and drinking are consequences of poor health in the past. It is well know that reserve causality will cause simultaneity bias. We address this issue by IV approach.

Table 6 is estimates from ordinary least squares (OLS) regression and from IV estimation. The results for current smoking and drinking status from OLS are similar to the ones from ordered probit model. After we instrument the status of smoking and drinking, control for endogeneity of these two variables, their coefficients become negative though insignificant (Column 3 in Table 6),<sup>8</sup> which are consistent with theory and common wisdom.

Another reverse causality which worries economist most is bad health leads to low socioeconomic status. For example, poor health may cause missing school days in childhood, lows human capital consequently, and leads to lower income afterwards. For those who are lucky enough to join the oldest-old club, it is very unlikely that their health in their childhood and adulthood were poor enough to significantly negatively affect their socioeconomic status.

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<sup>8</sup> We use past status of smoking, drinking and exercising as instrumental variables.

We also present results for male and for female separately in the appendix Table 1a and Table 2a. There are some difference between male and female. The coefficients of having her own bedroom and having enough medical care services in her childhood become insignificant for female population. Other findings are similar to the ones we discussed above.

#### **4.2 Mortality**

Another health outcome variable analyzed is mortality. To measure mortality, we use 1998-2000-2002 panel data. Our focus is on 2000 wave. From 2002 wave, we create survival status for the observations in 2000. Information in the 1998 wave is used to control for historical factors.

We use probit model to study mortality. A positive coefficient indicates a positive relationship between the explanatory variable and probability of death.

Table 7 summarizes results from the models. Like its effect on independence in ADL, aging is an important factor causing death. The gender has different effects on mortality and on the Index of ADL. Female tends to have positive effect on the probability of survival, but negative effect on the independence in daily living (see Table 5).

Similar to the finding in the independence in ADL, all coefficients of current family income, having enough income to cover expenditure or not, whether oldest-old is his/her main financial source or not, are not significant. Unfortunately, we do not have information on whether the oldest-old has its own bedroom in 2000 survey, and cannot compare the effect of this variable on the independence in ADL to its effect on mortality.

Education level of the oldest-old and of her/his spouse has an insignificant effect on mortality.<sup>9</sup> For female oldest-old, having a white collar job or having a husband with a white collar job will significantly reduce the mortality. For male, his own occupation is not important, but the occupation of his wife is.

The effect of current medical care services can do little to extend the life of the oldest-old.<sup>10</sup>

The oldest-olds still in marriage are not only more independent in daily living, but also have higher probability to survive.

At first, we find that unlike finding for the independence in ADL, the oldest-olds taken cared by their close relatives have higher risk of death. Since the oldest-olds in their final stage of life are more likely to be taken cared by their love ones, reverse causality may also bias this estimates. Again we use IV to correct possible simultaneity bias. After correction, the coefficient becomes insignificant (see Column 3 in Table 8).

Whereas uselessness is a good predictor for the dependence in ADL, it is not for mortality. Self-reported quality of life is good predictor for mortality of male population, but is not for female population.

The coefficients of life style variables are insignificant but have wrong sign. There also exists reverse causality. Controlling for endogeneity makes the signs of these variables more in-line with common wisdom (see Column 3 in

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<sup>9</sup> The finding that education is not important for the Index of ADL and mortality is probability due to the small variation in the CLHLS. The average years of education are only 3.3 and 0.6 for male and for female, respectively.

<sup>10</sup> The effects of medical care services at age 60 and in childhood are also insignificant (results are not reported here). There is a very large portion of sample with missing values on these two variables.

Table 8). For example, the coefficient of smoking now changes from negative to positive.

While oldest-olds in the rural area are less dependent in daily living, they face higher probability of death.

## **5. Conclusions**

We use 1998-2000-2002 panel data and 2002 cross-sectional data to study health in oldest old. Our measurements for health are the Katz Index of ADL and mortality.

We find that aging is a major contributor to bad health both in term of independence in ADL and in term of mortality, but there are other important factors.

Gender has different effects on the independence in ADL and on mortality. Female tends to be more dependent in daily living, but has higher probability to survive. Oldest-olds living in urban area are also more dependent in daily living, but are less likely to die. Oldest-olds still in marriage are more independent in daily living and are more likely to survive.

Socioeconomic status such as financial resources, education level of the oldest-old and his/her spouse and etc. plays insignificant role in the health of oldest old.

There exists reverse causality between health and choice of life style. After controlled for simultaneity bias by IV methods, the coefficients of risk behaviors are consistent with theory and common wisdom.

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**Figure 1: Observations in 1998-2000-2002 Panel Data**

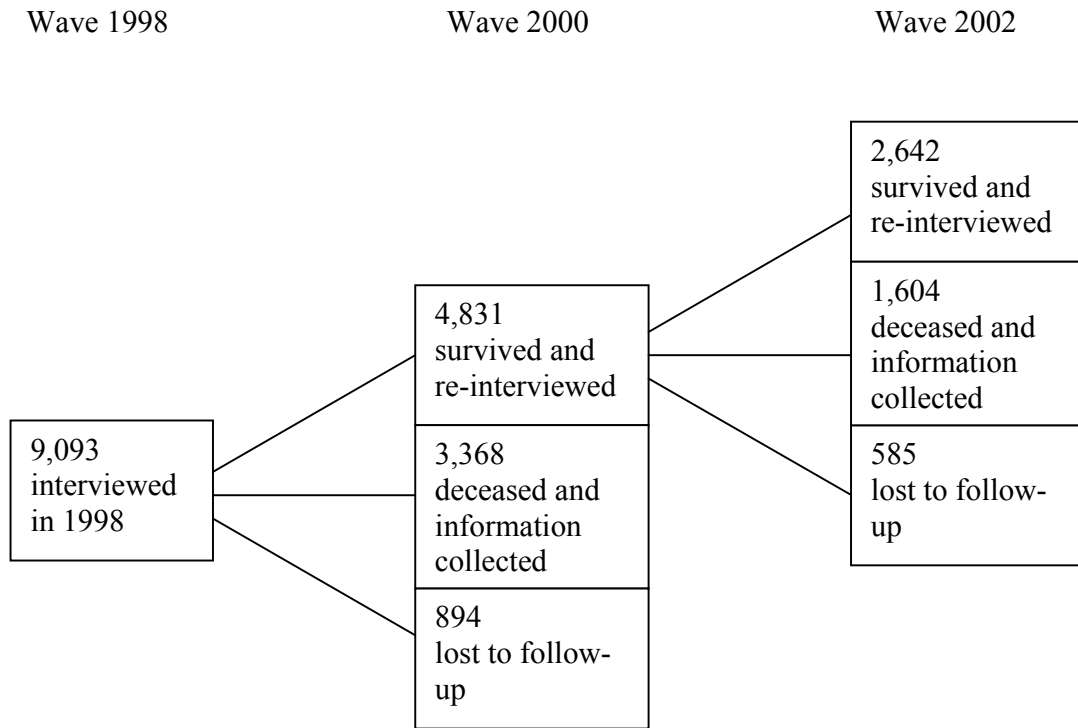


Figure 2: Katz ADL Index by Gender-Age Group

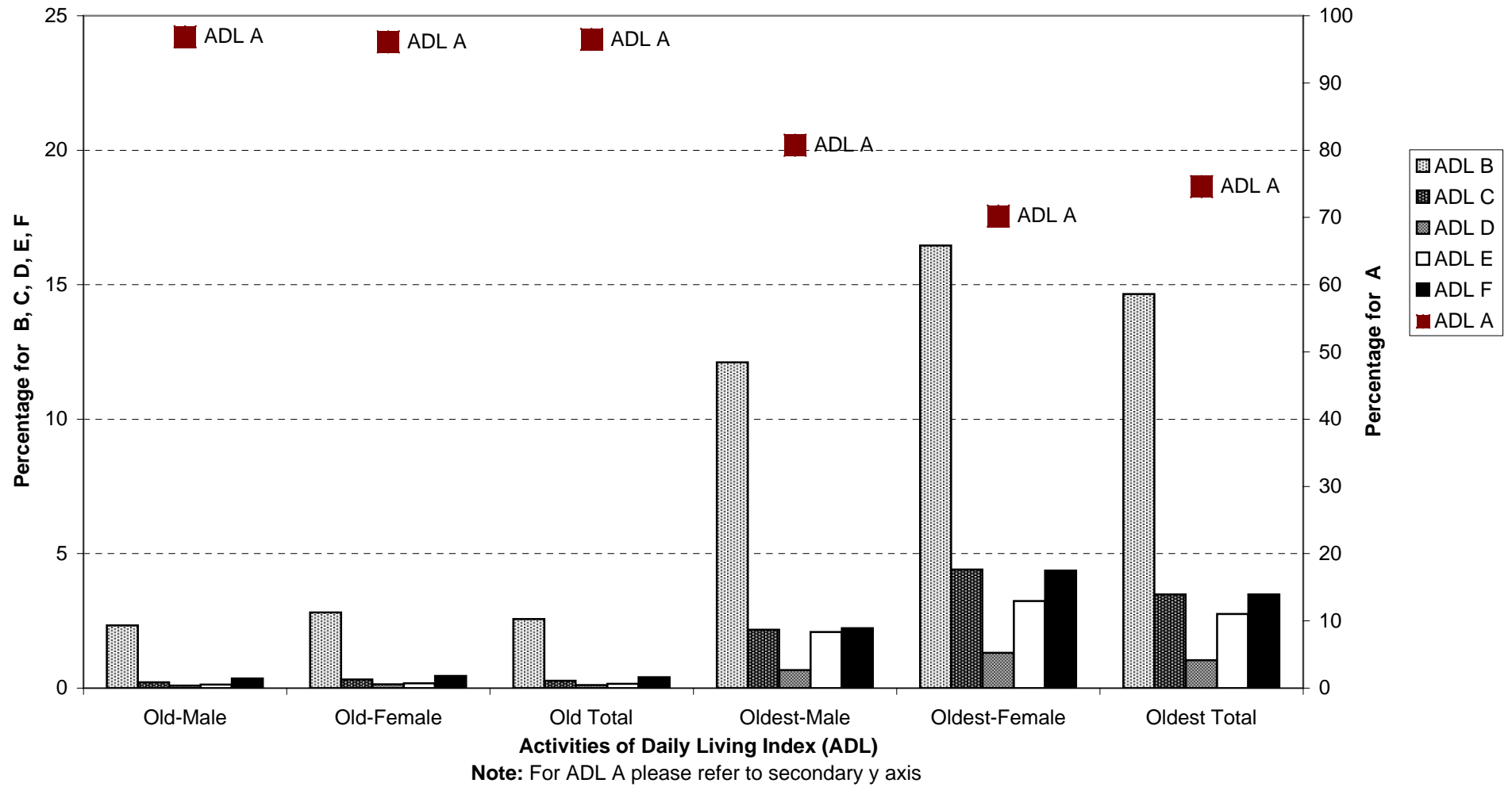


Figure 3: Age Trend of Katz ALD Index

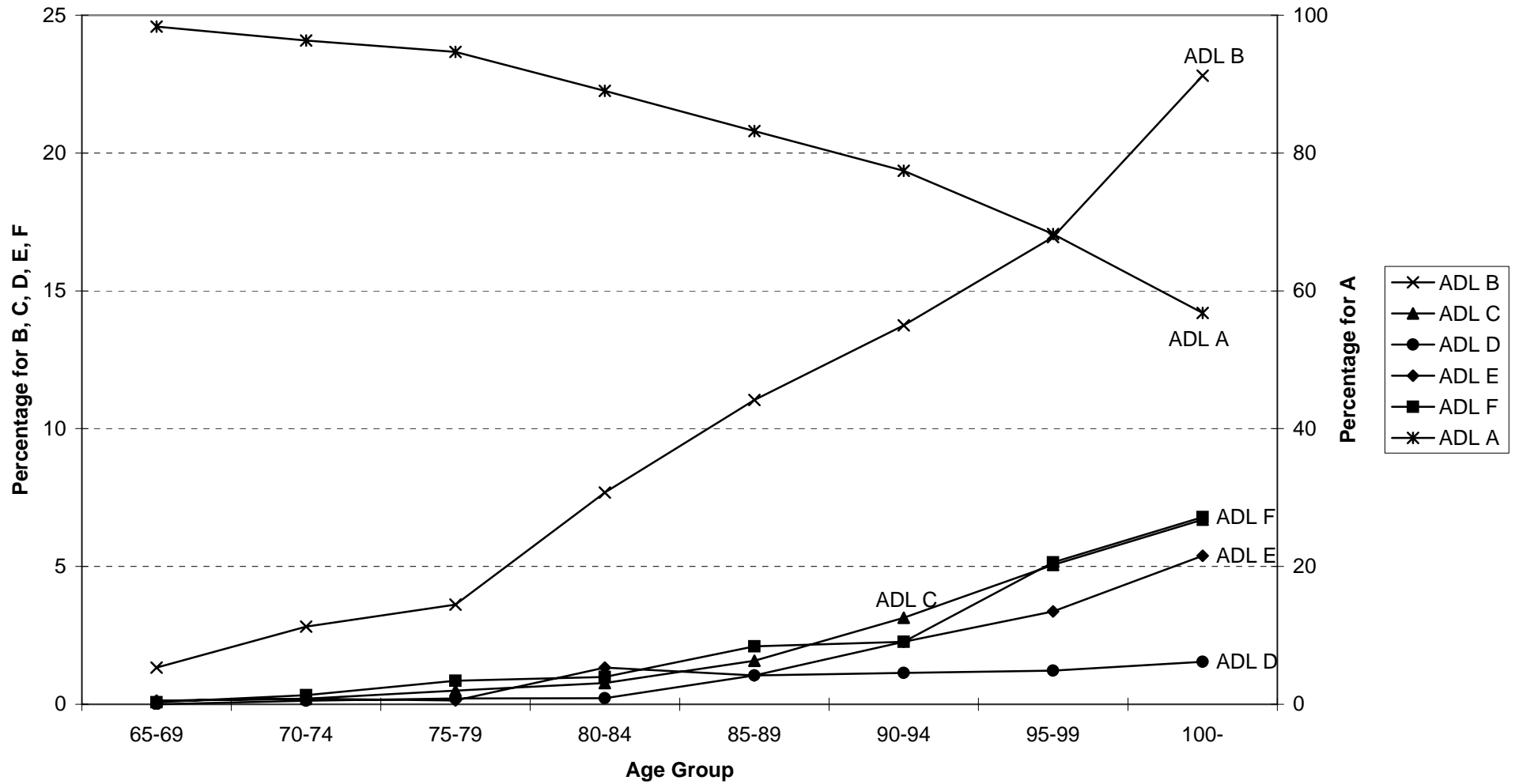


Figure 4: Age Trend of Katz ADL Index by Gender

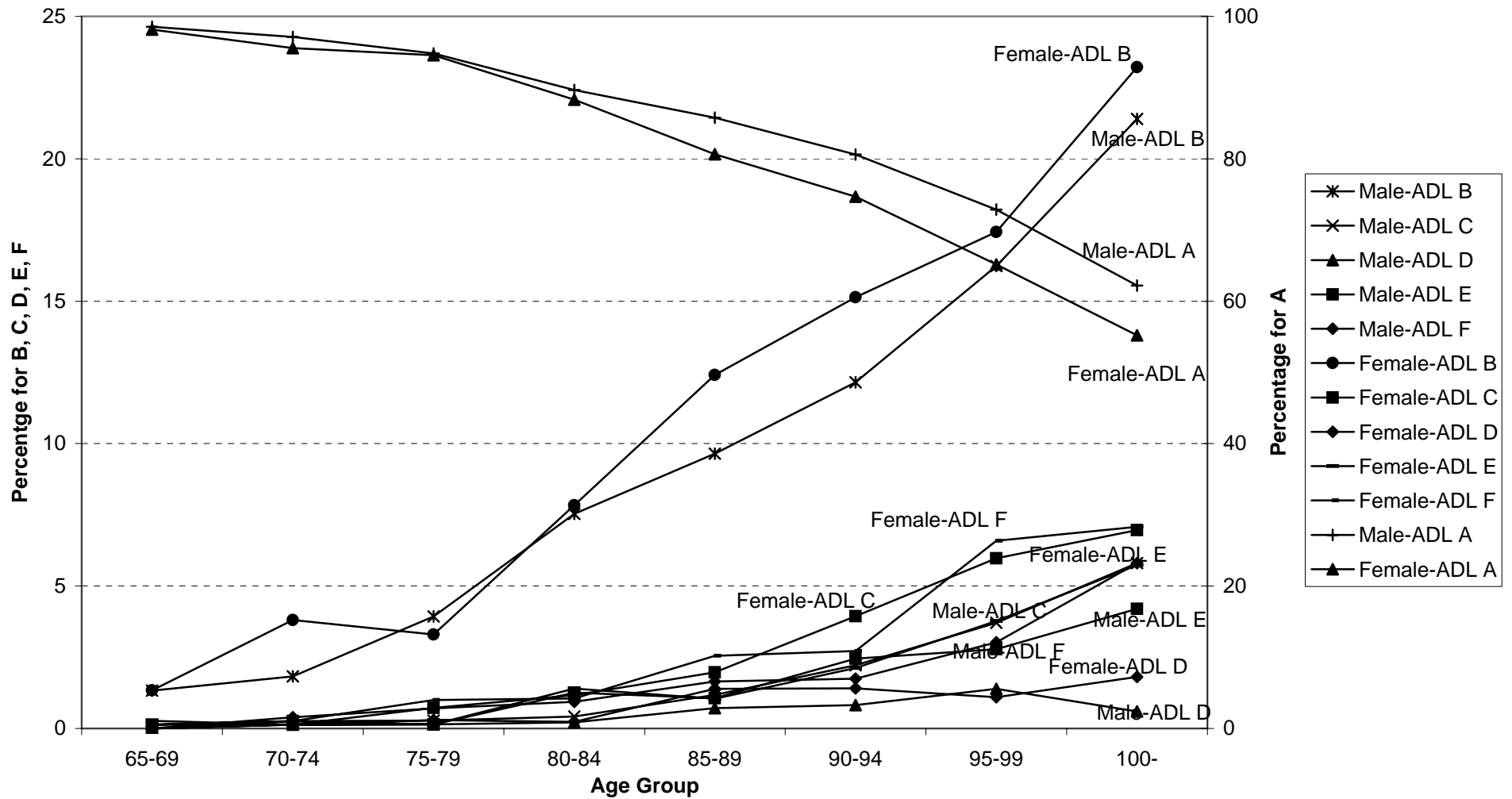
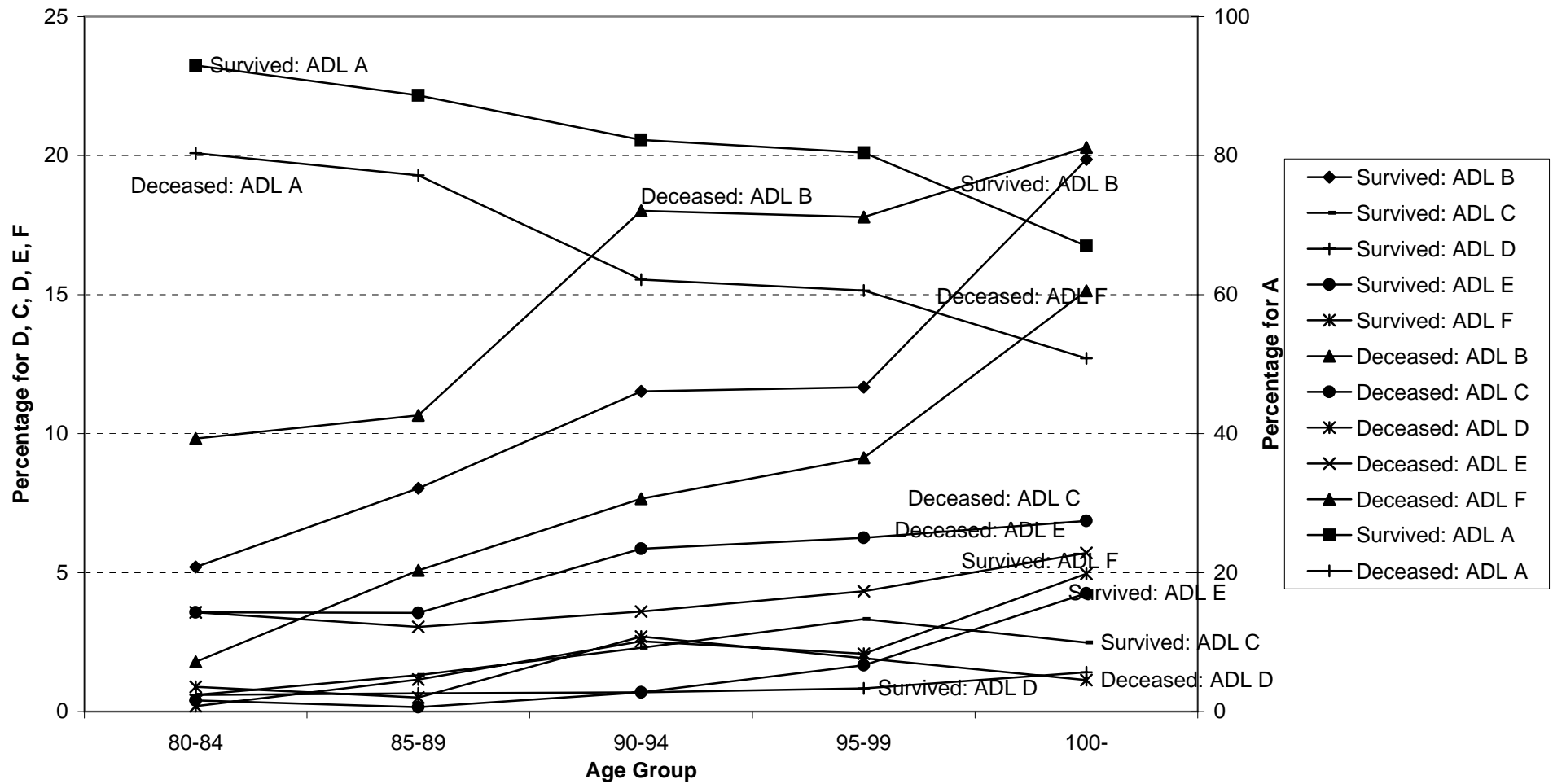


Figure 5: Katz ADL Index in 2000 by Survival Status in 2002



Note: For survived and deceased ADL A please refer to secondary y axis

**Table 1: Katz Index of Independence in Activities of Daily Living**

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The Index of Independence in Activities of Daily Living is based on an evaluation of the functional independence or dependence of patients in bathing, dressing, going to toilet, transferring, continence and feeding. Specific definitions of functional independence and dependence appear below in the index

- A - Independent in feeding, continence, transferring, going to toilet, dressing, and bathing.
- B - Independent in all but one of these functions.
- C - Independent in all but bathing and one additional function.
- D - Independent in all but bathing, dressing, and one additional function.
- E - Independent in all but bathing, dressing, going to toilet, and one additional function.
- F - Independence in all but bathing, dressing, going to toilet, transferring, and one additional function.
- G - Dependent in all six functions

Other- Dependent in at least two functions, but not classifiable as C, D, E, F.

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**Source:** Table 2 in Katz, Downs, Cash and Grotz (1970).

**Table 2: Characteristics of Old and Oldest-Old in 2002**

Variable	Label	All		Age: 65-79		Age: 80-105	
		Mean	St. Er.	Mean	St. Er.	Mean	St. Er.
age	Age	85.98	11.56	71.90	4.28	92.44	7.34
urban	Urban	0.46	0.50	0.45	0.50	0.46	0.50
urbanb	Born in urban	0.15	0.36	0.17	0.38	0.15	0.35
female	Female	0.57	0.50	0.50	0.50	0.60	0.49
bedroom	Have own bedroom	0.87	0.33	0.90	0.30	0.86	0.35
alone	Live alone	0.14	0.35	0.13	0.34	0.15	0.36
lexcel	Self-reported quality of life: excellent	0.14	0.35	0.14	0.35	0.14	0.35
lgood	Self-reported quality of life: good	0.46	0.50	0.44	0.50	0.47	0.50
lfair	Self-reported quality of life: so so	0.33	0.47	0.35	0.48	0.31	0.46
lpoor	Self-reported quality of life: bad	0.06	0.24	0.06	0.23	0.07	0.25
lbad	Self-reported quality of life: very bad	0.01	0.10	0.01	0.08	0.01	0.10
hexcel	Self-reported health status: excellent	0.11	0.31	0.13	0.34	0.10	0.30
hgood	Self-reported health status: good	0.37	0.48	0.37	0.48	0.38	0.48
hfair	Self-reported health status: so so	0.35	0.48	0.35	0.48	0.35	0.48
hpoor	Self-reported health status: bad	0.15	0.36	0.14	0.35	0.16	0.37
hbad	Self-reported health status: very bad	0.01	0.12	0.01	0.10	0.02	0.13
better	Self-reported change of health: better	0.11	0.31	0.13	0.34	0.10	0.30
same	Self-reported change of health: same	0.49	0.50	0.54	0.50	0.46	0.50
worse	Self-reported change of health: worse	0.40	0.49	0.33	0.47	0.44	0.50
bright	Looking on the bright side	0.77	0.42	0.78	0.41	0.77	0.42
fear	Feel fearful or anxious	0.05	0.22	0.05	0.21	0.06	0.23
lonely	Feel lonely and isolated	0.08	0.28	0.06	0.24	0.10	0.29
happy	Be happy as younger	0.43	0.49	0.46	0.50	0.41	0.49
useless	Feel useless with age	0.26	0.44	0.21	0.41	0.29	0.45
food	Eat meat/fish/egg often	0.69	0.46	0.71	0.46	0.69	0.46
boiled	Drink boiled water	0.96	0.19	0.96	0.20	0.96	0.19
tab60	Use tab water at age 60	0.28	0.45	0.39	0.49	0.23	0.42
tabnow	Use tab water now	0.60	0.49	0.60	0.49	0.59	0.49
smoken	Smoke now	0.19	0.39	0.27	0.44	0.15	0.36
smokep	Smoke before	0.34	0.47	0.40	0.49	0.32	0.47
drinkn	Drink now	0.20	0.40	0.24	0.43	0.19	0.39
drinkp	Drink before	0.31	0.46	0.31	0.46	0.31	0.46
Table 9: P	Exercise now	0.32	0.47	0.41	0.49	0.28	0.45
excerp	Exercise before	0.37	0.48	0.35	0.48	0.38	0.49
social	Engage in social activities	0.13	0.34	0.23	0.42	0.09	0.29
edu	Years of education	2.06	3.52	2.92	3.88	1.66	3.26
white	White collar	0.10	0.29	0.14	0.35	0.07	0.26
pension	Have pension	0.21	0.41	0.31	0.46	0.16	0.37
enough	Money is enough for expenses	0.81	0.39	0.82	0.38	0.81	0.39
mainown	Main financial resource is self	0.29	0.46	0.54	0.50	0.18	0.38
fincom	Family income	3441.05	3618.27	3620.63	3704.70	3357.07	3574.24
marriage	Present marriage status	0.31	0.46	0.62	0.49	0.18	0.38
edus	Years of education, spouse	2.09	3.45	2.79	3.76	1.77	3.24
whites	White collar, spouse	0.07	0.26	0.12	0.32	0.05	0.22
takecare	Take care by close relatives	0.93	0.25	0.95	0.21	0.93	0.26
medic60	Have enough medical care at age 60	0.86	0.34	0.90	0.30	0.84	0.36
medicc	Have enough medical care at childhood	0.41	0.49	0.41	0.49	0.42	0.49
pubpay	Medical cost paid by government	0.12	0.33	0.19	0.39	0.09	0.29
hungry	Often go to bed hungry as child	0.65	0.48	0.65	0.48	0.65	0.48
mother	Mother lives longer than 80	0.26	0.44	0.32	0.47	0.24	0.43
father	Father live longer than 80	0.16	0.36	0.19	0.39	0.14	0.35
sibling	Sibling live longer than 80	0.37	0.48	0.19	0.39	0.45	0.50

**Source:** Author's calculation from 2002 cross-sectional data of CLHLS.

**Table 3: Characteristics of Male and Female Oldest-Old in 2002**

Variable	Label	All		Male		Female	
		Mean	St. Er.	Mean	St. Er.	Mean	St. Er.
age	Age	92.44	7.34	90.29	6.77	93.86	7.36
urban	Urban	0.46	0.50	0.47	0.50	0.46	0.50
urbanb	Born in urban	0.15	0.35	0.15	0.36	0.14	0.35
female	Female	0.60	0.49	0.00	0.00	1.00	0.00
bedroom	Have own bedroom	0.86	0.35	0.90	0.30	0.83	0.37
alone	Live alone	0.15	0.36	0.15	0.35	0.15	0.36
lexcel	Self-reported quality of life: excellent	0.14	0.35	0.15	0.35	0.13	0.34
lgood	Self-reported quality of life: good	0.47	0.50	0.46	0.50	0.48	0.50
lfair	Self-reported quality of life: so so	0.31	0.46	0.33	0.47	0.30	0.46
lpoor	Self-reported quality of life: bad	0.07	0.25	0.06	0.23	0.07	0.26
lbad	Self-reported quality of life: very bad	0.01	0.10	0.01	0.09	0.01	0.10
hexcel	Self-reported health status: excellent	0.10	0.30	0.10	0.31	0.09	0.29
hgood	Self-reported health status: good	0.38	0.48	0.40	0.49	0.36	0.48
hfair	Self-reported health status: so so	0.35	0.48	0.34	0.47	0.36	0.48
hpoor	Self-reported health status: bad	0.16	0.37	0.14	0.35	0.17	0.38
hbad	Self-reported health status: very bad	0.02	0.13	0.01	0.11	0.02	0.14
better	Self-reported change of health: better	0.10	0.30	0.10	0.30	0.10	0.30
same	Self-reported change of health: same	0.46	0.50	0.47	0.50	0.45	0.50
worse	Self-reported change of health: worse	0.44	0.50	0.43	0.49	0.45	0.50
bright	Looking on the bright side	0.77	0.42	0.81	0.39	0.74	0.44
fear	Feel fearful or anxious	0.06	0.23	0.04	0.19	0.07	0.25
lonely	Feel lonely and isolated	0.10	0.29	0.08	0.28	0.11	0.31
happy	Be happy as younger	0.41	0.49	0.43	0.50	0.39	0.49
useless	Feel useless with age	0.29	0.45	0.24	0.43	0.33	0.47
food	Eat meat/fish/egg often	0.69	0.46	0.71	0.45	0.67	0.47
boiled	Drink boiled water	0.96	0.19	0.97	0.18	0.96	0.19
tab60	Use tab water at age 60	0.23	0.42	0.26	0.44	0.21	0.41
tabnow	Use tab water now	0.59	0.49	0.61	0.49	0.58	0.49
smoken	Smoke now	0.15	0.36	0.28	0.45	0.07	0.25
smokep	Smoke before	0.32	0.47	0.57	0.50	0.15	0.36
drinkn	Drink now	0.19	0.39	0.29	0.45	0.13	0.33
drinkp	Drink before	0.31	0.46	0.49	0.50	0.20	0.40
Table 9: P	Exercise now	0.28	0.45	0.39	0.49	0.20	0.40
excerp	Exercise before	0.38	0.49	0.49	0.50	0.31	0.46
social	Engage in social activities	0.09	0.29	0.15	0.36	0.05	0.22
edu	Years of education	1.66	3.26	3.26	4.00	0.61	2.05
white	White collar	0.07	0.26	0.15	0.36	0.02	0.15
pension	Have pension	0.16	0.37	0.31	0.46	0.06	0.24
enough	Money is enough for expenses	0.81	0.39	0.83	0.38	0.80	0.40
mainown	Main financial resource is self	0.18	0.38	0.33	0.47	0.08	0.27
fincom	Family income	3357.07	3574.24	3613.66	3747.46	3188.71	3445.84
marriage	Present marriage status	0.18	0.38	0.35	0.48	0.06	0.24
edus	Years of education, spouse	1.77	3.24	1.00	2.64	2.28	3.50
whites	White collar, spouse	0.05	0.22	0.03	0.17	0.06	0.24
takecare	Take care by close relatives	0.93	0.26	0.93	0.26	0.92	0.27
medic60	Have enough medical care at age 60	0.84	0.36	0.88	0.33	0.82	0.38
medicc	Have enough medical care at childhood	0.42	0.49	0.45	0.50	0.40	0.49
pubpay	Medical cost paid by government	0.09	0.29	0.17	0.38	0.04	0.19
hungry	Often go to bed hungry as child	0.65	0.48	0.63	0.48	0.66	0.47
mother	Mother lives longer than 80	0.24	0.43	0.26	0.44	0.23	0.42
father	Father live longer than 80	0.14	0.35	0.17	0.37	0.13	0.33
sibling	Sibling live longer than 80	0.45	0.50	0.49	0.50	0.43	0.50

**Source:** Author's calculation from 2002 cross-sectional data of CLHLS.



**Table 4: Characteristics of Survived and Deceased Oldest-Old in 2000**

Variable	Label	All		Survived in 2002		Deceased in 2002	
		Mean	St. Er.	Mean	St. Er.	Mean	St. Er.
adl00	Katz Index of ADL in 2000	5.48	1.23	5.71	0.89	5.04	1.62
adl98	Katz Index of ADL in 1998	5.74	0.85	5.83	0.63	5.56	1.11
age	Age	92.15	7.15	90.48	6.73	94.95	6.96
urban	Urban	0.59	0.49	0.62	0.49	0.55	0.50
urbanb	Born in urban	0.15	0.36	0.17	0.38	0.12	0.32
female	Female	0.58	0.49	0.56	0.50	0.60	0.49
alone	Live alone	0.13	0.33	0.14	0.35	0.11	0.31
lexcel	Self-reported quality of life: excellent	0.21	0.41	0.23	0.42	0.18	0.38
lgood	Self-reported quality of life: good	0.45	0.50	0.43	0.50	0.49	0.50
lfair	Self-reported quality of life: so so	0.29	0.45	0.30	0.46	0.28	0.45
lpoor	Self-reported quality of life: bad	0.04	0.20	0.04	0.19	0.05	0.21
lbad	Self-reported quality of life: very bad	0.01	0.08	0.01	0.08	0.01	0.08
hexcel	Self-reported health status: excellent	0.15	0.36	0.16	0.37	0.13	0.33
hgood	Self-reported health status: good	0.39	0.49	0.42	0.49	0.33	0.47
hfair	Self-reported health status: so so	0.33	0.47	0.31	0.46	0.37	0.48
hpoor	Self-reported health status: bad	0.12	0.32	0.09	0.29	0.16	0.37
hbad	Self-reported health status: very bad	0.01	0.11	0.01	0.10	0.02	0.13
bright	Looking on the bright side	0.78	0.41	0.81	0.39	0.73	0.44
fear	Feel fearful or anxious	0.04	0.20	0.03	0.18	0.05	0.23
lonely	Feel lonely and isolated	0.07	0.26	0.06	0.24	0.08	0.28
happy	Be happy as younger	0.39	0.49	0.43	0.49	0.33	0.47
useless	Feel useless with age	0.20	0.40	0.18	0.39	0.24	0.43
food	Eat meat/fish/egg often	0.55	0.50	0.57	0.50	0.51	0.50
boiled	Drink boiled water	0.96	0.21	0.96	0.20	0.95	0.22
tab60	Use tab water at age 60	0.20	0.40	0.23	0.42	0.16	0.36
tabnow	Use tab water now	0.50	0.50	0.53	0.50	0.46	0.50
smoken	Smoke now	0.16	0.37	0.18	0.38	0.13	0.34
smokep	Smoke before	0.33	0.47	0.33	0.47	0.34	0.48
drinkn	Drink now	0.21	0.40	0.21	0.41	0.20	0.40
drinkp	Drink before	0.32	0.47	0.35	0.48	0.27	0.44
excern	Exercise now	0.35	0.48	0.41	0.49	0.25	0.43
excerp	Exercise before	0.32	0.47	0.35	0.48	0.27	0.44
Table 9: P	Years of education	1.84	3.41	2.11	3.64	1.38	2.92
white	White collar	0.09	0.29	0.12	0.32	0.05	0.22
enough	Money is enough for expenses	0.84	0.36	0.84	0.36	0.85	0.36
mainown	Main financial resource is self	0.20	0.40	0.24	0.43	0.14	0.35
fincom	Family income	3578.96	4233.75	3689.85	3855.48	3392.67	4798.51
marriage	Present marriage status	0.19	0.39	0.23	0.42	0.10	0.31
edus	Years of education, spouse	1.95	3.35	2.20	3.63	1.54	2.78
whites	White collar, spouse	0.08	0.26	0.10	0.30	0.04	0.19
takecare	Take care by close relatives	0.92	0.28	0.91	0.29	0.93	0.26
medic60	Have enough medical care at age 60	0.95	0.22	0.95	0.22	0.95	0.23
medicc	Have enough medical care at childhood	0.66	0.47	0.66	0.47	0.66	0.47
pubpay	Medical cost paid by government	0.11	0.32	0.14	0.35	0.07	0.25
hungry	Often go to bed hungry as child	0.55	0.50	0.55	0.50	0.56	0.50
mother	Mother lives longer than 80	0.33	0.47	0.32	0.47	0.35	0.48
father	Father live longer than 80	0.19	0.39	0.19	0.39	0.19	0.39
sibling	Sibling live longer than 80	0.39	0.49	0.39	0.49	0.38	0.49

**Source:** Author's calculation from 1998 and 2000 waves of longitudinal data of CLHLS.

**Note:** We use (6, 5, 4, 3, 2, 1) to represent (A, B, C, D, E, F) in the Index of ADL

**Table 5: Ordered Probit Model for Katz Index of ADL**

Variable	Label	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
		(1)		(2)		(3)		(4)		(5)	
age	Age	-0.047	0.000	-0.046	0.000	-0.047	0.000	-0.048	0.000	-0.044	0.000
urban	Urban	-0.169	0.000	-0.166	0.001	-0.170	0.001	-0.169	0.001	-0.183	0.002
urbanb	Born in urban	0.079	0.103	0.066	0.313	0.056	0.400	0.056	0.399	0.076	0.319
female	Female	-0.094	0.022	-0.049	0.368	-0.029	0.621	-0.026	0.657	-0.056	0.412
bedroom	Have own bedroom			0.167	0.003	0.163	0.004	0.165	0.004	0.142	0.032
lexcel	Self-reported quality of life: excellent									0.002	0.996
lgood	Self-reported quality of life: good									-0.070	0.831
lfair	Self-reported quality of life: so so									-0.094	0.771
lpoor	Self-reported quality of life: bad									-0.081	0.809
better	Self-reported change of health: better									0.145	0.080
same	Self-reported change of health: same									0.292	0.000
bright	Looking on the bright side									-0.054	0.383
fear	Feel fearful or anxious									-0.098	0.400
lonely	Feel lonely and isolated									0.053	0.600
happy	Be happy as younger									0.003	0.946
useful	Feel useless with age									-0.268	0.000
food	Eat meat/fish/egg often			-0.007	0.884	0.001	0.984	-0.001	0.976	-0.034	0.540
boiled	Drink boiled water	-0.047	0.569	-0.106	0.327	-0.116	0.292	-0.120	0.278	-0.225	0.111
tab60	Use tab water at age 60	-0.249	0.000	-0.207	0.000	-0.202	0.001	-0.200	0.001	-0.165	0.015
tabnow	Use tab water now	-0.039	0.301	-0.050	0.308	-0.040	0.415	-0.040	0.416	-0.121	0.036
smoken	Smoke now	0.113	0.040	0.177	0.017	0.170	0.024	0.170	0.023	0.161	0.060
smokep	Smoke before	-0.116	0.008	-0.113	0.049	-0.118	0.042	-0.120	0.040	-0.148	0.027
drinkn	Drink now	0.231	0.000	0.346	0.000	0.346	0.000	0.345	0.000	0.249	0.002
drinkp	Drink before	-0.105	0.017	-0.188	0.001	-0.198	0.001	-0.199	0.001	-0.134	0.051
excern	Exercise now	0.594	0.000	0.548	0.000	0.559	0.000	0.558	0.000	0.487	0.000
excerp	Exercise before	-0.122	0.002	-0.116	0.028	-0.114	0.034	-0.111	0.038	-0.134	0.028
social	Engage in social activities			0.376	0.000	0.367	0.000	0.369	0.000	0.342	0.000
edu	Years of education	-0.001	0.893	0.003	0.690	0.006	0.538	0.006	0.526	0.000	0.968
white	White collar	-0.093	0.211	-0.181	0.079	-0.162	0.124	-0.166	0.116	-0.133	0.239
pension	Have pension			-0.013	0.919	-0.024	0.848	-0.024	0.851	-0.052	0.716
enough	Money is enough for expenses	0.029	0.493	0.028	0.627	0.034	0.565	0.032	0.588	-0.030	0.672
mainown	Main financial resource is self	0.139	0.019	0.058	0.623	0.064	0.586	0.064	0.585	0.100	0.447

**Table 5: Ordered Probit Model for Katz Index of ADL (Cont.)**

Variable	Label	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
		(1)		(2)		(3)		(4)		(5)	
fincom	Family income	0.000	0.801	0.000	0.750	0.000	0.790	0.000	0.801	0.000	0.541
marriage	Present marriage status	0.102	0.042	0.222	0.001	0.226	0.001	0.225	0.001	0.191	0.009
edus	Years of education, spouse					0.001	0.921	0.001	0.942	0.006	0.520
whites	White collar, spouse					-0.175	0.086	-0.180	0.078	-0.234	0.037
takecare	Take care by close relatives	0.155	0.012	0.291	0.006	0.313	0.003	0.314	0.003	0.310	0.008
medic	Have enough medical care now	0.090	0.074	0.126	0.070	0.131	0.063	0.130	0.065	0.055	0.516
medic60	Have enough medical care at age 60			0.103	0.068	0.105	0.068	0.100	0.083	0.044	0.522
medicc	Have enough medical care at childhood			0.070	0.135	0.073	0.124	0.076	0.110	0.115	0.036
pubpay	Medical cost paid by government	-0.098	0.182	-0.058	0.571	-0.048	0.646	-0.047	0.651	-0.032	0.777
hungry	Often go to bed hungry as child	-0.013	0.692	0.037	0.437	0.044	0.364	0.047	0.334	0.091	0.100
mother	Mother lives longer than 80							0.064	0.186	0.061	0.265
father	Father live longer than 80							-0.028	0.629	-0.053	0.417
sibling	Sibling live longer than 80	0.041	0.179					0.041	0.317	-0.004	0.941
/cut1	Cut-off point	-6.229		-5.658		-5.738		-5.734		-5.993	
/cut2	Cut-off point	-5.922		-5.367		-5.449		-5.444		-5.699	
/cut3	Cut-off point	-5.833		-5.270		-5.353		-5.348		-5.600	
/cut4	Cut-off point	-5.593		-5.023		-5.102		-5.096		-5.349	
/cut5	Cut-off point	-4.938		-4.367		-4.443		-4.437		-4.668	
Pseudo R2	Pseudo R2	0.074		0.087		0.090		0.090		0.098	
N	Number of Observation	7820		4560		4441		4441		3721	

**Note:** Estimation based on 2002 cross-sectional data of CLHLS.

We use (6, 5, 4, 3, 2, 1) to represent (A, B, C, D, E, F) in the Index of ADL

**Table 6: Ordinary Least Squares and Instrumental Variable Regressions for Katz Index of ADL**

Variable	Label	OLS		OLS		IV	
		Coef.	P> z	Coef.	P> z	Coef.	P> z
		(1)		(2)		(3)	
age	Age	-0.028	0.000	-0.028	0.000	-0.029	0.000
urban	Urban	-0.105	0.010	-0.100	0.015	-0.102	0.013
urbanb	Born in urban	-0.006	0.906	-0.003	0.951	-0.008	0.886
female	Female	0.015	0.741	-0.023	0.634	-0.033	0.496
bedroom	Have own bedroom	0.110	0.029	0.109	0.031	0.114	0.025
lexcel	Self-reported quality of life: excellent	0.085	0.713	0.093	0.688	0.112	0.630
lgood	Self-reported quality of life: good	0.038	0.869	0.046	0.840	0.055	0.811
lfair	Self-reported quality of life: so so	-0.002	0.994	0.009	0.967	0.022	0.924
lpoor	Self-reported quality of life: bad	-0.035	0.881	-0.027	0.908	-0.016	0.946
better	Self-reported change of health: better	0.089	0.129	0.086	0.140	0.096	0.104
same	Self-reported change of health: same	0.215	0.000	0.212	0.000	0.227	0.000
bright	Looking on the bright side	-0.051	0.258	-0.054	0.233	-0.040	0.381
fear	Feel fearful or anxious	-0.024	0.784	-0.025	0.783	-0.023	0.798
lonely	Feel lonely and isolated	0.007	0.926	0.009	0.904	0.006	0.936
happy	Be happy as younger	-0.022	0.535	-0.017	0.640	-0.012	0.744
useful	Feel useless with age	-0.204	0.000	-0.203	0.000	-0.209	0.000
food	Eat meat/fish/egg often	-0.036	0.367	-0.033	0.403	-0.025	0.527
boiled	Drink boiled water	-0.121	0.181	-0.122	0.177	-0.135	0.137
tab60	Use tab water at age 60	-0.087	0.074	-0.086	0.079	-0.082	0.097
tabnow	Use tab water now	-0.057	0.155	-0.059	0.141	-0.068	0.092
social	Engage in social activities	0.127	0.024	0.121	0.032	0.155	0.008
edu	Years of education	-0.004	0.595	-0.004	0.547	-0.003	0.666
white	White collar	-0.043	0.576	-0.040	0.599	-0.053	0.494
pension	Have pension	0.046	0.620	0.040	0.660	0.032	0.733
enough	Money is enough for expenses	-0.044	0.395	-0.041	0.429	-0.047	0.366
mainown	Main financial resource is self	0.019	0.809	0.026	0.743	0.027	0.732
fincom	Family income	0.000	0.117	0.000	0.123	0.000	0.089
marriage	Present marriage status	0.055	0.229	0.053	0.244	0.050	0.275
edus	Years of education, spouse	0.004	0.590	0.005	0.487	0.004	0.551
whites	White collar, spouse	-0.202	0.018	-0.211	0.013	-0.212	0.013
Table 9: P	Take care by close relatives	0.338	0.000	0.334	0.000	0.325	0.000
medic	Have enough medical care now	0.095	0.132	0.088	0.163	0.091	0.149
medic60	Have enough medical care at age 60	0.007	0.890	0.011	0.825	0.007	0.890
medicc	Have enough medical care at childhood	0.062	0.102	0.067	0.079	0.067	0.080
pubpay	Medical cost paid by government	-0.003	0.973	-0.002	0.984	-0.011	0.887
hungry	Often go to bed hungry as child	0.032	0.411	0.033	0.401	0.032	0.405
mother	Mother lives longer than 80	0.049	0.202	0.049	0.199	0.048	0.213
father	Father live longer than 80	-0.032	0.486	-0.035	0.445	-0.033	0.477
sibling	Sibling live longer than 80	0.005	0.882	0.005	0.883	0.011	0.740
smoken	Smoke now	0.055	0.257	0.097	0.088	-0.063	0.506
drinkn	Drink now	0.068	0.115	0.126	0.022	-0.020	0.777
excern	Exercise now	0.290	0.000	0.332	0.000	0.208	0.001
smokep	Smoke past			-0.067	0.160		
drinkp	Drink past			-0.080	0.106		
excerp	Exercise past			-0.067	0.136		
_cons	Constant	7.665	0.000	7.719	0.000	7.827	0.000
Adj. R2	Adjusted R2	0.105		0.107		0.101	
N	Number of Observation	3728		3721		3721	

**Note:** Estimation based on 2002 cross-sectional data of CLHLS.

We use (6, 5, 4, 3, 2, 1) to represent (A, B, C, D, E, F) in the Index of ADL

Table 7: Probit Model for Deceased Status in 2002

Variable	Label	All			Male			Female		
		Coef.	P> z	dF/dx	Coef.	P> z	dF/dx	Coef.	P> z	dF/dx
		(1)			(2)			(3)		
adl002	Index of ADL=E (Dependent)	0.273	0.295	0.101	-0.348	0.409	-0.104	0.632	0.078	0.244
adl003	Index of ADL=D	-0.192	0.529	-0.064	-0.145	0.775	-0.047	-0.226	0.562	-0.076
adl004	Index of ADL=C	0.019	0.933	0.007	-0.033	0.926	-0.011	0.094	0.754	0.034
adl005	Index of ADL=B	-0.249	0.054	-0.082	-0.505	0.026	-0.146	-0.175	0.279	-0.060
adl006	Index of ADL=A (Independent)	-0.565	0.000	-0.208	-0.727	0.000	-0.265	-0.509	0.000	-0.187
age	Age	0.042	0.000	0.015	0.029	0.000	0.010	0.054	0.000	0.019
urban	Urban	-0.089	0.226	-0.031	-0.119	0.304	-0.040	-0.028	0.776	-0.010
urbanb	Born in urban	0.046	0.638	0.016	0.129	0.395	0.044	0.053	0.692	0.019
female	Female	-0.279	0.001	-0.098						
alone	Live alone	-0.076	0.453	-0.026	-0.115	0.500	-0.038	-0.040	0.752	-0.014
lexcel	Self-reported quality of life: excellent	0.615	0.232	0.229	4.730	0.000	0.952	0.602	0.286	0.226
lgood	Self-reported quality of life: good	0.842	0.099	0.294	4.914	0.000	0.981	0.880	0.114	0.311
lfair	Self-reported quality of life: so so	0.656	0.197	0.241	4.712	0.000	0.971	0.683	0.217	0.254
lpoor	Self-reported quality of life: bad	0.867	0.095	0.334	5.326	0.000	0.780	0.572	0.321	0.220
bright	Looking on the bright side	-0.087	0.279	-0.031	0.020	0.875	0.007	-0.150	0.156	-0.054
fear	Feel fearful or anxious	0.198	0.250	0.072	0.180	0.535	0.063	0.235	0.294	0.087
lonely	Feel lonely and isolated	0.033	0.806	0.012	0.086	0.698	0.029	0.032	0.853	0.012
happy	Be happy as younger	-0.074	0.298	-0.026	-0.143	0.175	-0.048	-0.028	0.781	-0.010
useful	Feel useless with age	0.016	0.845	0.005	0.118	0.340	0.040	-0.064	0.557	-0.022
food	Eat meat/fish/egg often	-0.166	0.013	-0.059	-0.195	0.058	-0.066	-0.195	0.032	-0.070
boiled	Drink boiled water	0.147	0.353	0.050	0.285	0.280	0.088	0.093	0.652	0.032
tab60	Use tab water at age 60	-0.174	0.082	-0.059	-0.218	0.155	-0.071	-0.166	0.226	-0.058
tabnow	Use tab water now	0.037	0.628	0.013	0.017	0.887	0.006	0.031	0.766	0.011
smoken	Smoke now	-0.074	0.412	-0.025	-0.174	0.121	-0.057	0.146	0.353	0.053
smokep	Smoke before	0.084	0.260	0.030	0.097	0.367	0.033	0.032	0.767	0.012
drinkn	Drink now	0.023	0.795	0.008	0.155	0.195	0.053	-0.146	0.276	-0.050
drinkp	Drink before	-0.094	0.202	-0.033	-0.028	0.787	-0.009	-0.164	0.133	-0.057
excern	Exercise now	-0.131	0.066	-0.045	-0.147	0.146	-0.050	-0.080	0.437	-0.028
edu	Years of education	-0.002	0.850	-0.001	-0.004	0.776	-0.001	0.021	0.488	0.007
white	White collar	-0.258	0.069	-0.085	-0.084	0.590	-0.028	-1.049	0.023	-0.261
enough	Money is enough for expenses	0.101	0.297	0.035	0.024	0.869	0.008	0.181	0.181	0.062

**Table 7: Probit Model for Deceased Status in 2002 (Cont.)**

Variable	Label	All			Male			Female		
		Coef.	P> z	dF/dx	Coef.	P> z	dF/dx	Coef.	P> z	dF/dx
		(1)			(2)			(3)		
mainown	Main financial resource is self	0.203	0.059	0.073	0.210	0.140	0.071	0.221	0.223	0.081
fincom	Family income	0.000	0.354	0.000	0.000	0.802	0.000	0.000	0.234	0.000
marriage	Present marriage status	-0.454	0.000	-0.147	-0.555	0.000	-0.179	-0.218	0.285	-0.074
edus	Years of education, spouse	-0.004	0.788	-0.001	-0.029	0.287	-0.010	0.000	0.983	0.000
whites	White collar, spouse	-0.589	0.000	-0.175	-0.828	0.023	-0.208	-0.534	0.007	-0.166
takecare	Take care by close relatives	0.328	0.015	0.106	0.474	0.027	0.138	0.303	0.090	0.100
medic	Have enough medical care now	0.027	0.862	0.009	-0.015	0.950	-0.005	0.028	0.898	0.010
pubpay	Medical cost paid by government	-0.209	0.138	-0.070	-0.236	0.167	-0.076	0.132	0.643	0.048
hungry	Often go to bed hungry as child	-0.171	0.008	-0.060	-0.308	0.002	-0.104	-0.040	0.654	-0.014
sibling	Sibling live longer than 80	0.017	0.794	0.006	0.156	0.110	0.053	-0.072	0.424	-0.025
_cons	Constant	-4.498	0.000		-7.471	0.000		-5.991	0.000	
Pseudo R2	Pseudo R2	0.145			0.163			0.158		
N	Number of Observation	2001			908			1093		

**Note:** Estimation based on 98-00-22 longitudinal data of CLHLS.  
Dependent variable=1 means the observation died in 2002.

**Table 8: Linear Probability Model with Instrumental Variable Correction for Deceased Status in 2002**

Variable	Label	LPM		LPM		IV	
		Coef.	P> z	Coef.	P> z	Coef.	P> z
		(1)		(2)		(3)	
adl002	Index of ADL=E (Dependent) in 2000	0.096	0.263	0.076	0.378	0.102	0.320
adl003	Index of ADL=D in 2000	-0.098	0.341	-0.060	0.556	-0.042	0.778
adl004	Index of ADL=C in 2000	0.007	0.923	0.018	0.805	0.056	0.617
adl005	Index of ADL=B in 2000	-0.097	0.023	-0.066	0.130	-0.022	0.812
adl006	Index of ADL=A (Independent) in 2000	-0.203	0.000	-0.164	0.000	-0.082	0.558
age	Age	0.014	0.000	0.013	0.000	0.013	0.000
urban	Urban	-0.032	0.168	-0.030	0.208	-0.033	0.332
urbanb	Born in urban	0.006	0.831	0.007	0.811	0.028	0.470
female	Female	-0.082	0.002	-0.089	0.001	-0.118	0.277
alone	Live alone	-0.028	0.389	-0.029	0.358	-0.044	0.456
lexcel	Self-reported quality of life: excellent	0.156	0.264	0.169	0.226	0.151	0.314
lgood	Self-reported quality of life: good	0.229	0.097	0.243	0.078	0.201	0.192
lfair	Self-reported quality of life: so so	0.170	0.216	0.193	0.160	0.151	0.328
lpoor	Self-reported quality of life: bad	0.243	0.088	0.260	0.067	0.221	0.181
bright	Looking on the bright side	-0.032	0.211	-0.024	0.358	-0.021	0.521
fear	Feel fearful or anxious	0.061	0.278	0.058	0.299	0.048	0.430
lonely	Feel lonely and isolated	0.014	0.735	0.014	0.737	0.025	0.594
happy	Be happy as younger	-0.025	0.257	-0.022	0.310	0.004	0.930
useful	Feel useless with age	0.003	0.912	0.007	0.798	-0.024	0.549
food	Eat meat/fish/egg often	-0.054	0.012	-0.054	0.011	-0.035	0.367
boiled	Drink boiled water	0.054	0.278	0.043	0.384	0.067	0.266
tab60	Use tab water at age 60	-0.047	0.116	-0.047	0.122	-0.045	0.184
tabnow	Use tab water now	0.011	0.652	0.009	0.699	0.013	0.656
edu	Years of education	-0.001	0.810	-0.001	0.818	0.001	0.838
white	White collar	-0.062	0.128	-0.059	0.150	-0.062	0.190
enough	Money is enough for expenses	0.037	0.223	0.031	0.307	0.047	0.230
mainown	Main financial resource is self	0.049	0.139	0.057	0.087	0.077	0.076
fincom	Family income	0.000	0.390	0.000	0.338	0.000	0.398
marriage	Present marriage status	-0.125	0.000	-0.130	0.000	-0.158	0.000
edus	Years of education, spouse	0.000	0.911	0.000	0.967	0.001	0.869
whites	White collar, spouse	-0.132	0.003	-0.131	0.003	-0.128	0.008
takecare	Take care by close relatives	0.095	0.017	0.097	0.016	0.154	0.352
medic	Have enough medical care now	0.012	0.801	0.016	0.748	0.029	0.627
pubpay	Medical cost paid by government	-0.037	0.378	-0.042	0.308	-0.011	0.868
hungry	Often go to bed hungry as child	-0.055	0.007	-0.053	0.009	-0.062	0.013
sibling	Sibling live longer than 80	0.000	0.989	0.002	0.921	0.001	0.984
smoken	Smoke now	-0.026	0.343	-0.027	0.332	0.058	0.922
drinkn	Drink now	0.025	0.313	0.008	0.776	0.068	0.675
exercn	Exercise now	-0.039	0.076	-0.036	0.100	-0.413	0.303
adl982	Index of ADL=E (Dependent) in 1998			0.094	0.345		
adl983	Index of ADL=D in 1998			0.079	0.646		
adl984	Index of ADL=C in 1998			-0.072	0.528		
adl985	Index of ADL=B in 1998			-0.114	0.039		
adl986	Index of ADL=A (Independent) in 1998			-0.123	0.009		
smokep	Smoke before			0.027	0.255		
drinkp	Drink before			-0.026	0.259		
_cons	Constant	-0.909	0.000	-0.785	0.000	-0.904	0.087
Pseudo R2	Pseudo R2	0.150		0.154		0.019	
N	Number of Observation	2009		2001		1994	

**Note:** Estimation based on 98-00-22 longitudinal data of CLHLS.  
Dependent variable=1 means the observation died in 2002.

Appendix Table 1a: Ordered Probit Model for Katz Index of ADL for Female

Variable	Label	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
		(1)		(2)		(3)		(4)		(5)	
age	Age	-0.047	0.000	-0.047	0.000	-0.048	0.000	-0.049	0.000	-0.046	0.000
urban	Urban	-0.150	0.001	-0.102	0.094	-0.106	0.089	-0.102	0.102	-0.091	0.212
urbanb	Born in urban	0.117	0.064	0.055	0.519	0.041	0.635	0.045	0.606	0.025	0.805
bedroom	Have own bedroom			0.105	0.114	0.095	0.158	0.098	0.145	0.044	0.579
lexcel	Self-reported quality of life: excellent									-1.007	0.056
lgood	Self-reported quality of life: good									-0.969	0.063
lfair	Self-reported quality of life: so so									-1.031	0.048
lpoor	Self-reported quality of life: bad									-0.777	0.146
better	Self-reported change of health: better									0.205	0.054
same	Self-reported change of health: same									0.380	0.000
bright	Looking on the bright side									-0.122	0.117
fear	Feel fearful or anxious									-0.073	0.592
lonely	Feel lonely and isolated									0.003	0.979
happy	Be happy as younger									-0.038	0.553
useful	Feel useless with age									-0.314	0.000
food	Eat meat/fish/egg often			-0.068	0.241	-0.063	0.288	-0.066	0.269	-0.107	0.133
boiled	Drink boiled water	-0.112	0.269	-0.170	0.204	-0.209	0.124	-0.216	0.114	-0.301	0.079
tab60	Use tab water at age 60	-0.274	0.000	-0.241	0.001	-0.228	0.003	-0.226	0.003	-0.199	0.023
tabnow	Use tab water now	-0.015	0.737	-0.037	0.537	-0.018	0.767	-0.018	0.762	-0.117	0.103
smoken	Smoke now	0.075	0.409	0.037	0.750	0.027	0.824	0.026	0.830	0.049	0.727
smokep	Smoke before	-0.212	0.001	-0.105	0.207	-0.119	0.160	-0.120	0.155	-0.123	0.221
drinkn	Drink now	0.215	0.004	0.322	0.001	0.300	0.003	0.301	0.003	0.139	0.242
drinkp	Drink before	-0.126	0.042	-0.255	0.002	-0.250	0.004	-0.251	0.004	-0.186	0.070
excern	Exercise now	0.558	0.000	0.533	0.000	0.565	0.000	0.563	0.000	0.484	0.000
excerp	Exercise before	-0.118	0.022	-0.096	0.164	-0.104	0.142	-0.102	0.150	-0.117	0.155
social	Engage in social activities			0.321	0.021	0.323	0.025	0.325	0.024	0.293	0.058
edu	Years of education	-0.008	0.509	0.007	0.699	0.013	0.488	0.013	0.471	0.007	0.746
white	White collar	-0.009	0.952	-0.190	0.418	-0.218	0.362	-0.222	0.353	-0.215	0.401
pension	Have pension			0.344	0.115	0.305	0.165	0.303	0.167	0.430	0.099
enough	Money is enough for expenses	0.025	0.633	0.058	0.417	0.067	0.354	0.064	0.374	0.092	0.290
mainown	Main financial resource is self	0.144	0.124	-0.202	0.268	-0.189	0.300	-0.190	0.299	-0.222	0.277



**Appendix Table 1a: Ordered Probit Model for Katz Index of ADL for Female (Cont.)**

Variable	Label	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
		(1)		(2)		(3)		(4)		(5)	
fincom	Family income	0.000	0.725	0.000	0.768	0.000	0.811	0.000	0.805	0.000	0.366
marriage	Present marriage status	0.326	0.002	0.414	0.002	0.402	0.003	0.404	0.002	0.317	0.026
edus	Years of education, spouse					-0.002	0.802	-0.003	0.762	0.005	0.641
whites	White collar, spouse					-0.155	0.177	-0.156	0.177	-0.199	0.124
takecare	Take care by close relatives	0.231	0.003	0.359	0.007	0.385	0.005	0.388	0.004	0.337	0.029
medic	Have enough medical care now	0.005	0.937	0.067	0.429	0.079	0.355	0.079	0.353	0.097	0.349
medic60	Have enough medical care at age 60			0.065	0.347	0.071	0.317	0.065	0.357	-0.078	0.369
medicc	Have enough medical care at childhood			0.043	0.470	0.037	0.541	0.040	0.506	0.082	0.251
pubpay	Medical cost paid by government	0.039	0.758	0.106	0.572	0.186	0.340	0.187	0.336	0.125	0.575
hungry	Often go to bed hungry as child	-0.033	0.428	-0.002	0.971	-0.004	0.952	-0.001	0.988	0.012	0.868
mother	Mother lives longer than 80							0.030	0.625	-0.015	0.828
father	Father live longer than 80							-0.030	0.695	-0.057	0.513
sibling	Sibling live longer than 80	0.036	0.356					0.056	0.283	0.030	0.619
/cut1	Cut-off point	-6.209		-5.844		-6.007		-5.995		-7.270	
/cut2	Cut-off point	-5.918		-5.571		-5.729		-5.717		-6.985	
/cut3	Cut-off point	-5.823		-5.466		-5.627		-5.615		-6.875	
/cut4	Cut-off point	-5.571		-5.205		-5.359		-5.347		-6.612	
/cut5	Cut-off point	-4.918		-4.558		-4.712		-4.699		-5.945	
Pseudo R2	Pseudo R2	0.063		0.069		0.073		0.073		0.089	
N	Number of Observation	4568		2674		2586		2586		2093	

**Note:** Estimation based on 2002 cross-sectional data of CLHLS.

We use (6, 5, 4, 3, 2, 1) to represent (A, B, C, D, E, F) in the Index of ADL

Appendix Table 2a: Ordered Probit Model for Katz Index of ADL for Male

Variable	Label	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
		(1)		(2)		(3)		(4)		(5)	
age	Age	-0.045	0.000	-0.042	0.000	-0.043	0.000	-0.043	0.000	-0.041	0.000
urban	Urban	-0.188	0.004	-0.301	0.001	-0.313	0.000	-0.318	0.000	-0.339	0.001
urbanb	Born in urban	0.015	0.844	0.074	0.483	0.068	0.521	0.065	0.541	0.105	0.374
bedroom	Have own bedroom			0.334	0.002	0.355	0.001	0.352	0.001	0.406	0.001
lexcel	Self-reported quality of life: excellent									1.172	0.021
lgood	Self-reported quality of life: good									0.866	0.081
lfair	Self-reported quality of life: so so									0.889	0.073
lpoor	Self-reported quality of life: bad									0.562	0.274
better	Self-reported change of health: better									0.062	0.658
same	Self-reported change of health: same									0.168	0.051
bright	Looking on the bright side									0.066	0.549
fear	Feel fearful or anxious									-0.248	0.304
lonely	Feel lonely and isolated									0.057	0.742
happy	Be happy as younger									0.040	0.643
useful	Feel useless with age									-0.215	0.026
food	Eat meat/fish/egg often			0.125	0.124	0.142	0.083	0.137	0.096	0.137	0.151
boiled	Drink boiled water	0.067	0.638	0.008	0.966	0.045	0.814	0.042	0.823	-0.203	0.437
tab60	Use tab water at age 60	-0.185	0.010	-0.153	0.119	-0.163	0.100	-0.161	0.104	-0.124	0.254
tabnow	Use tab water now	-0.086	0.185	-0.075	0.392	-0.079	0.374	-0.078	0.380	-0.140	0.171
smoken	Smoke now	0.121	0.085	0.243	0.013	0.232	0.019	0.236	0.017	0.189	0.089
smokep	Smoke before	-0.003	0.956	-0.103	0.205	-0.107	0.195	-0.108	0.190	-0.150	0.106
drinkn	Drink now	0.257	0.000	0.381	0.000	0.406	0.000	0.404	0.000	0.371	0.001
drinkp	Drink before	-0.092	0.150	-0.097	0.245	-0.118	0.162	-0.122	0.151	-0.052	0.586
excern	Exercise now	0.638	0.000	0.569	0.000	0.557	0.000	0.560	0.000	0.472	0.000
excerp	Exercise before	-0.122	0.048	-0.144	0.085	-0.129	0.127	-0.128	0.129	-0.136	0.152
social	Engage in social activities			0.422	0.000	0.404	0.001	0.403	0.001	0.389	0.003
edu	Years of education	0.003	0.741	0.000	0.963	0.001	0.945	0.001	0.948	-0.007	0.613
white	White collar	-0.118	0.171	-0.151	0.200	-0.112	0.354	-0.119	0.326	-0.031	0.816
pension	Have pension			-0.166	0.317	-0.155	0.353	-0.148	0.378	-0.285	0.140
enough	Money is enough for expenses	0.030	0.689	-0.042	0.693	-0.047	0.665	-0.048	0.652	-0.293	0.031
mainown	Main financial resource is self	0.127	0.113	0.233	0.149	0.240	0.140	0.237	0.146	0.338	0.074

**Appendix Table 2a: Ordered Probit Model for Katz Index of ADL for Male (Cont.)**

Variable	Label	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
		(1)		(2)		(3)		(4)		(5)	
fincom	Family income	0.000	0.934	0.000	0.666	0.000	0.677	0.000	0.712	0.000	0.905
marriage	Present marriage status	0.055	0.355	0.194	0.015	0.208	0.010	0.203	0.012	0.197	0.030
edus	Years of education, spouse					0.006	0.732	0.007	0.702	0.000	0.988
whites	White collar, spouse					-0.312	0.175	-0.317	0.170	-0.361	0.136
takecare	Take care by close relatives	0.035	0.741	0.198	0.251	0.218	0.212	0.224	0.202	0.260	0.164
medic	Have enough medical care now	0.267	0.003	0.244	0.051	0.231	0.068	0.227	0.073	-0.050	0.752
medic60	Have enough medical care at age 60			0.176	0.080	0.175	0.086	0.174	0.088	0.234	0.053
medicc	Have enough medical care at childhood			0.128	0.103	0.147	0.065	0.149	0.062	0.175	0.050
pubpay	Medical cost paid by government	-0.164	0.077	-0.133	0.293	-0.137	0.288	-0.140	0.277	-0.117	0.405
hungry	Often go to bed hungry as child	0.017	0.763	0.099	0.208	0.119	0.136	0.123	0.124	0.201	0.025
mother	Mother lives longer than 80							0.098	0.222	0.127	0.160
father	Father live longer than 80							-0.050	0.589	-0.070	0.500
sibling	Sibling live longer than 80	0.045	0.385					0.033	0.637	-0.032	0.691
/cut1	Cut-off point	-5.799		-4.893		-4.861		-4.883		-4.463	
/cut2	Cut-off point	-5.449		-4.553		-4.538		-4.559		-4.126	
/cut3	Cut-off point	-5.372		-4.474		-4.456		-4.477		-4.042	
/cut4	Cut-off point	-5.158		-4.257		-4.236		-4.257		-3.800	
/cut5	Cut-off point	-4.490		-3.568		-3.535		-3.555		-3.057	
Pseudo R2	Pseudo R2	0.081		0.110		0.114		0.115		0.129	
N	Number of Observation	3253		1886		1855		1855		1628	

**Note:** Estimation based on 2002 cross-sectional data of CLHLS.

We use (6, 5, 4, 3, 2, 1) to represent (A, B, C, D, E, F) in the Index of ADL