# Trends of Disability under Different Measurement Schemes in the Chinese Elderly Population, 2002 to 2008

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## INTRODUCTION

As the life expectancy of human being is prolonged in our time, to monitor and understand the trends of disability in the later life is valuable for society with growing population in old age. Researchers have been long aware of the co-existence of two major twisted processes affecting the disability prevalence in the elderly population: one the hand, the social/medical/behaviors changes such as positive lifestyle changes, medical advancement, and appropriate health-promoting polices will compress the morbidity of the elderly in later life (Fries 1980; 2003); on the other hand, the same sets of changes will save more of those frail elderly who are supposed to decease (Gruenberg 1977; Olshansky, Carnes, & Cassel 1990). Depending on the weights of the two effects, disability trends among old people could vary in different societies which are a different stage (Robine & Michel 2004; Christensen et al. 2009;), or in a single society at different times (Martin, Schoeni, & Andreski 2010).

In monitoring the temporal changes of disability prevalence, index of Activity of Daily Life (ADL) and instrument ADL (IADL) are routinely used as the disability measurement. However certain problems in the measurements are long noticed in this field. When disability trends are observed in different directions, "at the heart of this debate are critical issues of measurement." (Freedman and Martin 1998, p1457). Even question designs for the ADL and IADL measures could lead to substantial variations in the trend estimation (Freedman et al. 2004). When the mechanisms of the disability trends are the research focus, the issue of

measurement become a more significant issue, as the routinely-used measurements i.e. ADL and IADL are comprehensive and their heterogeneous components need to be clarified. Since the disability model was developed over years (Nagi 1965; WHO 1980; Verbrugge and Jette 1994; WHO 2001), one of the core insights is that disability is "the expression of a functional limitation in a social context" (Verbrugge and Jette 1994, 3). Disability, therefore, is not only a biomedical outcome but also based on multiple non-physiological mechanisms such as behavioral, psychological, social, and environmental pathways. For example, a self-reported difficulty in shopping by an old person, as one of the item in IADL, may be just due to the poor community infrastructure rather than anything related to physical health. As a result, the observed disability trends based on such measures actually reflect the changes of a mixture of disability components, both intrinsic and external.

To decompose the ADL/IADL trends has therefore been a main topic of researchers in better understanding what drives the changes of disability among people of old age. In a recent study, Schoeni, Freedman, & Martin (2008) summarized the factors which account for ADL/IADL disability trends, including accommodations, physical/sensory/cognitive functioning , diseases and conditions, medical care, health behaviors, economic and sociodemographic factors, environmental exposure and early/midlife factors. Among these factors, psychological factors are particularly important as it helps to reveal to what extent the disability trends are made of changes in functional health. However, in the current disability trend studies, most of functional limitations are measured in a self-reported way.

In the clinic geriatrics, the self-reported method of measuring disability has been criticized mostly due to its nature of subjectivity (Melzer et al 2004; Terwee et al. 2006); and the utility of the objectively-observed performance-based measurements (such as gait speed) has been

highly acknowledged (Guralnik et al. 1989, 2000). Consequentially, the combined use of self-reported and performance-based assessments are often recommended for better characterizing severity of disability and functional limitations in practice (Elam et al. 1991; Reuben et al. 2004). More recently, the self-reported and performance-based measures for disability have been applied together in the population-based studies, which revealed that self-reported ADL and IADL are significantly affected by non-physiological factors, objective indictors have added value to better differentiate the severity of disability, and combined use of both types of measurements could reveal non-physiological and/or modifiable factors and thus better inform the intervention designs and policymaking (Purser et al. 2010; Feng et al. 2012).

The performance-based measures, if used in the disability trend studies, could also help clarify the structure of disability trends of ADL/IADL by disentangling the intrinsic and external dimensions of disability changes. As the objective measures are hardly affected by the non-physiological factors, its trends could mostly capture changes in the impairment-based rather than context-based function health. To compare the performance-based and the ADL/IADL-based trends could thus provide valuable information to understand what drives the disability trends, either physiological or non-physiological factors. In particularly, when the temporal changes for physiological and contextual dimensions of disability are not consistent in the same direction, the combined use of both self-reported and performance-based measures could effectively reveal how disability trends are structured.

Such inconsistence of the disability trends has been noticed by recent literatures. Christensen and colleagues (2013), for example, compared two Danish birth cohorts of nonagenarians, in 1905 and 1915, and found out that the ADL disability was significant improved in the later cohort, whereas the physical performance tests (grip strength, chair stand, and gait speed)

showed no difference among the two cohorts. Zeng and colleagues (2014) adopted the same research design to analyze the Chinese nonagenarians, finding that the self-reported ADL disability was significantly improved in later cohorts, but the direction of changes for objective physical performance tests (stand-up from a chair, pick-up a book from the floor, and turning around 360 degrees) were just the opposite. In both studies, the researchers proposed that inconsistencies between these trends are likely due to the changes of non-physiological factors in the elderly life. In particular, the case of China suggests a possible pattern of disability trends in developing societies where the socioeconomic changes are rapid. That is, the significant improvement of non-physiological dimensions of disability such as age-friendly environment, more assistance facility and better social support may drive the ADL/IADL disability trends downward even though function limitations of the elderly increase at the same time.

This study compares disability trends for the Chines elderly population over 65 based on a series of measurement schemes, both self-reported and performance-based, which capture different dimensions of disability, in order to better reveal the structure of the disability trends among the Chinese elderly. More specifically, we proposed to examine the following four types of disability measurement schemes, each of which has certain affiliation to the disablement model (Table 1):

1) The self-reported dependency in doing ADL activities: these questions ask whether the elderly respondent needs anyone to assist for the specific ADL items, with the item on continence being excluded. Such measures reflect a broad ranges of elements in the disablement model, physiological, psychological, environmental, and social.
2) The self-reported difficulty in doing IADL activities independently: this scheme asks whether the respondent feels any difficulties in doing the specific IADL items

independently. As the questions are checking the situation where no personal assistance is present, the effect of social support is ruled out.

3) The self-evaluated function performance: in this measurement scheme, the elderly is asked if they can accomplish certain function tasks such as continuously crouching for 3 times, lifting 5 kilograms, and walking for 1 kilometer without a stop. Because these questions require the respondent to imagine a virtual setting so that all environmental/facility and social support factors could be effectively controlled.
4) The observed function performance: This scheme is a series of performance-based tests, in which the interviewer objectively examines the physical function of the respondent (to stand up from chair without using hands, pick up a book from floor and turn around 360 degrees). As a result, the non-physiological factors could be ruled out to the maximum extent, including those psychological ones.

We examine these disability trends by gender and rural/urban residence, as there exist significant health disparities along these two dimensions among Chinese elderly (Zeng et al. 2003; Feng et al. 2013). And we further examine how the observed ADL/IADL disability trends could be explained by physiological, psychological, medical, sociodemographic, and life-history factors.

## METHODS

### Data

The data are from the Chinese Longitudinal Healthy Longevity Survey (CLHLS). The CLHLS is a national-wade survey of the Chinese elderly population, conducted in randomly-selected halves of the counties/cities in 22 out of the 31 provinces in China. The baseline survey started in the year of 1998, when all centenarians at the chosen counties/cities were

interviewed with informed consents. For each centenarian, one nearby octogenarian and one nearby nonagenarian with pre-designated age and sex were randomly sampled to ensure comparable numbers of male and female octogenarians and nonagenarians at each age from 80 to 99. The follow-up waves was conducted in 2000, 2002, 2005, 2008 and 2011 with re-interviewing all survivors and replenishing the diseased and lost to follow-up. Only after the 2002 wave, the survey began to sample elderly people aged from 65 to 79. The sample sizes in different waves are 9,093 in 1998, 11,199 in 2000, 16,064 in 2002, 15,538 in 2005, 16,540 in 2008, and 7,375 in 2011.The survey design has been described elsewhere and the data was reported good in quality and representative of the elderly population in Mainland China (Zeng et al. 2008).

In this study, we chose to use the 2002, 2005 and 2008 waves of the CLHLS, which contained 45,567 observations of Chinese older adults aged 65 and over with 15,069 in 2002, 14,939 in 2005 and 15,559 in 2008. The pooled data fit well the standard for disability trend analyses, which requires data from the exactly same survey with three or more time points over six or more years (Freedman, Martin, & Schoeni 2002). More importantly, these three waves of the CLHLS were conducted under the same survey agency so that comparisons across waves should be more robust. And the wave of 2011 was not included because it only tracked previous without replacement due to budget limitations and it was conducted under a different survey agency. Missing values were not imputed in that the nonresponse rates of the CLHLS data were low both at the unit level and item level. All institutionalized cases were dropped from the dataset. Institutionalized elders in China are generally in worse physical health due to the governmental regulations (Gu et al. 2007). If the ratio of institutionalization increased in the examined time period, dropping institutionalized elderly may bring bias in

the estimation of disability trend. However, the total number of institutionalized elders maintained stable and low (about less than 2%) in this period (Wu, Mao, and Zhong 2009).

**Measurement of Disability and Function**

For the ADL disability, the survey asked whether respondent need any assistance from others in bathing, dressing, indoor transferring, toileting, and feeding. For each specific activity, the need of any assistance was coded as 1 otherwise 0; and individuals reporting dependency at one or more of these activities was determined to have ADL dependency. The IADL index asks whether the elderly has difficulty in doing the following activities independently such as using public transportation, doing laundry, shopping, cooking meal and visiting neighborhood. Any reported difficulty was coded as 1 otherwise 0 for each IADL item; and any difficulty in one or more of these items was considered to have difficulty in IADL. Self-evaluated function performance was measured through three questions, which asked respondents if they have difficulty in continuously crouching for 3 times, lifting 5 kilograms, and walking for 1 kilometer without a stop. Any reported difficulty was coded as 1 otherwise 0 for each item; and any difficulty in one or more of the three items was considered to have difficulty in self-evaluated function. Last, three performance-based tests were conducted to measure the observed function performance. In these tests, respondents were asked to stand up from chair without using hands, pick up a book from floor, and turn around 360 degrees. Any failures in performing the task was coded as 1 otherwise 0 for each test; and any failure in one or more of the three tests was considered to be limited on observed functions.

**Covariates**

Based on the literature about the correlates of the ADL/IADL disability trend, particularly in the Chinese older adults, (Schoeni, Freedman, & Martin 2008; Feng et al. 2013; Martin et al.

2014), we included a broad range of covariates. The basic demographics had age, gender, ethnicity (Han/non-Han), and residence (rural/urban). We also examined other health conditions. Cognitive function was measured by a Chinese version of MMSE, with a threshold of 24 as the criteria for cognitive impairment. For depressive symptoms, we used three questions, asking whether the respondent feel useless (yes/no), anxious (yes/no) and lonely (yes/no); any positive response from each question indicates the existence of depressive symptoms. We included a variable for comorbidity , which indicated if the respondent had any of the major diseases such as heart disease/stroke, cardiovascular disease, diabetes and arthritis. At last, the self-reported health was included (bad/very bad as 1; otherwise 0).

We then included various social and environmental covariates at different life stages of the elders to further examine exploratory factors for the ADL/IADL disability trends. The early life covariates had birth place (rural/urban), experience of frequent hunger in childhood (yes/no), adequacy of medical care in childhood (yes/no), and availability of tap water in childhood (yes/no). The middle life covariates included schooling for at least one year (yes/no), frequent physical labor in the past (yes/no), mainly working in agriculture before age 60 (yes/no), adequacy of medical care at age 60 (yes/no), and availability of tap water at age 60 (yes/no). The late life covariates had marital status at present (spouse/no spouse), coresidence with family at present (yes/no), adequacy of financial resources at present (yes/no), adequacy of medical care at present (yes/no), and availability of tap water at present (yes/no).

**Analytical Strategy**

Due to the unique design of the CLHLS, prevalence statistics were reported with a weighting method adjusting for age, gender, and rural/urban residence. To model the temporal change of the disability from 2002 and 2005, we used a random-effect model with the categorical year as the independent variable. The model controlled for the female, age, rural/urban residence, and proxy report. As panel data, the CLHLS contained repeated observations for same participants across different waves; and the random-effect logit model allows for correction of the incurred intrapersonal correlations by using a random intercept for each participant in the model.

We developed a set of nested regression model to explore how the ADL/IADL disability trends could be explained. Taking the previous model as baseline, we further added the observed function performance and the self-evaluation function performance as Model II. We then added the other health conditions such as cognitive impairment, depressive symptoms, comorbidity and self-reported health as Model III. Last, social and environmental factors at different life stages were added as Model IV. All analyses were performed using Stata/SE 12.0.

**RESULTS**

Table 2 summarized different prevalence rates under the four disability measurements in the Chinese older adults. Across the three waves, the rate of ADL dependency was the lowest from 4.7% to 7.5% in this period; in contrast, approximately one fifth of the Chinese elderly were observed to have one or more limitations in the performance tests. Measurements of the self-evaluated functions and the IADL difficulty had shown the highest rates, 23.3%-26.4% and 27.5%-29.5%, respectively. Based on the crude estimations, the prevalence of disability declined for the measurements of ADL, IADL and self-evaluated function, but not for the

observed function. Descriptive statistics of covariates are also noteworthy. As can be seen in Table 2, the old people in our sample were generally born in rural areas (about 85%) with poor experience of their childhood such as hunger (about 67%), inadequacy of medical care (about 60%) and shortage of tap water (about 97%). Approximately half of these elders were not educated and three fifth took agriculture as their major occupation prior to the age of 60. However, in late life, most of them reported adequacy in medical care and financial resources, and more than half of them had access to tap water in daily life.

The adjusted disability odds ratios in 2005 and 2008 in reference to the year of 2002 ere summarized in Table 3. When demographics and proxy reporting were under control, dependency in ADL in 2005 and 2008 showed a substantial decline in comparison with the baseline year of 2002: an elderly was 21% less likely to be disabled in 2005, 51% less likely in 2008. Examination of the five specific ADL items further revealed that dependency in bathing maintained a declining trend from 2002 to 2008, while dependency in the other four items merely declined in 2008, but not in 2005. Such a pattern generally held across gender and rural/urban residence, especially for female and rural elders. The positive trends were also observed under the measurement of IADL; however it was not as substantial and consistent as the changes of the ADL dependency. The trends of specific IADL items had some mixed results. For example, the risk of having difficulty in doing laundry independently increased by 8% in 2005, but decreased by 15% in 2008; and with regard to the difficulty in shopping independently, there was no significant changes in 2005, but the odds ratios was reduced by 12% in 2008. The trends of IADL difficulties by gender and rural/urban residence were also mixed. Females and rural residents had significant improvement in almost all IADL items in 2008; in contrast, males and urban residents only experienced an improvement of IADL disability in 2008.

As can be also been from Table 2, the odds ratios of self-evaluated function performance showed no significant changes from 2002 to 2008; however it is interesting to note that the gender-specific trends had opposite directions: The difficulty in self-evaluated function was reduced by 10% in 2005 and 19% in 2008 among women, meanwhile increased by 13% in 2005 and 12% in 2008 among men. Results of the specific items revealed that, from 2002 to 2008, the difficulty in self-evaluated function of males increased significantly in continuously crouching for 3 times and walking for 1 kilometer; and for women, the self-evaluated function were improved in lifting 5 kilometers and walking for 1 kilometer.

Contrary to the positive or neutral disability trends under the self-reported measurement schemes, the objective measurements with three performance tests showed that the Chinese elderly had worse functional health from 2002 to 2008 (Table 2). The odds ratios of observed limitations in these tests increased 7% in 2002 and 12% in 2008. The significant increase of functional limitations was mainly reflected in two tests, i.e. turning around for 360 degree and picking up a book from floor. And such a negative trend was consistent across gender and rural/urban residence.

Table 4 examined how the ADL/IADL trends could be explained by covariates. For ADL trends, when the function measurements and other health conditions were added to the baseline table (Model II and Model III), the odds ratios declined from 0.79 to 0.59 in 2005, and from 0.49 to 0.39 in 2008. A similar pattern also applied to the IADL trends. When social and environmental factors at different life stages were further added (Model III), the odds ratio of ADL disability further declined from 0.59 to 0.56 in 2005, while the odds ratio of IADL disability slightly increased from 0.73 to 0.77 in 2005. The associations of these

covariates with ADL/IADL disability are also noteworthy. People of older age, female gender, Han ethnicity, and urban residence have higher risk of ADL/IADL disability. Poor physical and cognitive function, depressive symptom, comorbidity, and negative global health rating were all associated with ADL/IADL disability. Education experience, agriculture job before age 60, and currently being married were associated with less ADL/IADL disability, whereas coresidence with family member, adequate financial resources, adequate medical care, and current availability of tap water were associated with more ADL/IADL disability.

## CONCLUSION & DISCUSSION

Disability is a highly context-based health outcome of the later life. To understand the sources and mechanisms of disability is important for medical interventions, eldercare program and public policy. ADL and IADL indexes currently used to examine the disability trend of the elderly population are comprehensive measures which do not differentiate the external barriers of activities and physiological functions in the disablement model. This study calls for more attentions to such a measurement problem, especially when researchers aim to understand how disability trends are driven. More specifically, we attempt to problematize the use of ADL and IADL in the disability trend studies through examining four measurement schemes in a disability trend study which have different affiliations with the disablement model. In particular, a measurement scheme is introduced based on performance-based function tests, which is rarely applied in the current disability trend studies. Different from the self-reported measures such as ADL and IADL which could be affected by psychological, environmental, and social factors, the objective-observed function performance directly reflects the impairment-based functional limitation and thus could provide valuable information to promote the substantive analyses of the disability trends and related policymaking discussions.

Through analyzing the disability trends in the Chinese elderly population from 2002 to 2008, we detect contrasting temporal changes between the self-reported and performance-based measurement schemes, as supports the unique value of the performance-based measurement in the disability trend studies. The observation that the trends based on performance-based function tests were opposite in comparison with improvement trends of ADL and IADL suggests that it is likely that the improvement of ADL and IADL could be largely due to the substantial improvement of living conditions, living environment and social support of the Chinese elderly in this period, as these external factors such as the assistive technology and built-in environments could greatly the reduce dependency and difficulty of elderly with function limitation in preforming daily activities (e.g. Clark and George 2005; Freeman et al. 2005).

The difference we found between the self-reported disability and performance-based function may have some broader implications for other health measurements. The difference of the self-reported health and interviewer-rated health been noticed in the recent literature and the health rating by a non-professional interviewer was reported to provide an extra value for the routinely-used self-reported health (Brissette et al. 2003; Smith and Goldman 2011). Using the same dataset, we additionally examined the trends of the self-reported health and interviewer-rated health in the Chinese elderly population (results available upon request). We found some similar patterns to our disability analyses that the Chinese older adults had no significant change in self-reporting their global health from 2002 to 2008, whereas the interviewer-rated health indicated a negative trend.

It has been well acknowledged that the socioeconomic development and medical advancement could promote population health in old age on the one hand, but on the other hand drive the disability prevalence upward by saving more frail elders (Manton 1982; Myers et al. 2003; Robin & Michael 2004). The observed declines in the physical function among Chinese elders in this study reflect that the effects of saving more frail elders may overweigh the forces of health promotion in this period of time. However, the observed improvement of ADL/IADL disability further suggests that the external factors could possibly reverse the trends of function decline trends. That is, even if more people of old age may have functional limitations, their disability may still be reduced by more social support, and better environment and facility. Such a pattern could help us better understand the intertwining models of the social development and the population health in the old age.

By examining the disability trends by specific items within each measurement scheme, our analyses provide more clues to understand the current disability trends in the Chinese elderly population. For example, the improvement of bathing facilities in home designs and the growth of home appliance usage such as washing machines seem to play a major role in the positive changes of ADL/IADL disability. And the functional limitations of the Chinese older adults in turning around and picking up book from floor, which increased significantly in the investigation period call for special cautions of the policymakers. It is also interesting to note that the ADL/IADL improvements are more significant among the disadvantaged sub populations such as the women and rural residents.

Our efforts to decompose the disability trends of ADL and IADL by separately examine four types of measurement schemes may provide new perspectives to understand what drives disability trends. When the ADL/IADL disability trends is used as a proxy to understand the

functional health of the older adults, these measurements could bring certain bias without differentiating the contextual barriers and inherent impairment of disability. In particular, to put special cautions on the use of ADL/IADL measurements is granted for studies of disability trends in developing societies such as China where the rapid socioeconomic changes may make the disability trend more sensitive to the contextual rather than intrinsic factors.

One of the major limitations in this study is that the performance-based measurements used in this analyses may not be fully capture the functional components of the ADL and IADL indexes. Therefore, it is possible that the certain functional dimensions related to ADL/IADL activities may have different trends, which were not addressed in our analyses. More studies are definitely warranted to further explore this issue for better performance-based measurement scheme.

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**Table 1: Four Types of Disability Measurements**

| | Intrinsic dimension | | External dimension | |
|---|---|---|---|---|
| | Physiological factors | Psychological factors | Environment /Facility | Social Support |
| Self-reported dependency in ADL | × | × | × | × |
| Self-reported difficulty in IADL, independently | × | × | × | |
| Self-reported difficulty in function | × | × | | |
| Performance-based limitation in Function | × | | | |

**Table 2: Descriptive Results (weighted results)**

| **Year** | | **2002** | **2005** | **2008** |
|---|---|---|---|---|
| **Sample Size** | | 15,069 | 14,939 | 15,559 |
| **% Any Dependency in Activities of Daily Living (ADL)** | | **7.5** | **5.9** | **4.7** |
| | % Bathing | 6.7 | 5.5 | 4.2 |
| | % Dressing | 2.3 | 2.4 | 2.4 |
| | % Toileting | 2.3 | 2.4 | 2.3 |
| | % Indoor Transferring | 1.8 | 1.9 | 2.0 |
| | % Feeding | 1.4 | 1.3 | 1.6 |
| | % Proxy report | 5.4 | 5.2 | 5.9 |
| **% Any Difficulty in Instrumental ADL (IADL)** | | **26.4** | **25.9** | **23.3** |
| | % Using Public Transportation independently | 22.1 | 22.1 | 20.6 |
| | % Doing Laundry independently | 11.5 | 11.4 | 10.2 |
| | % Shopping independently | 10.4 | 9.9 | 9.7 |
| | % Cooking Meal independently | 9.7 | 9.7 | 9.8 |
| | % Neighbor Visiting independently | 4.9 | 5.3 | 5.3 |
| | % Proxy Report | 5.0 | 5.0 | 6.4 |
| **% Any Difficulty in Self-evaluated Function** | | **29.3** | **29.2** | **27.5** |
| | % Continuously Crouching for 3 Times | 22.5 | 23.5 | 22.0 |
| | % Lifting 5 Kilograms | 18.3 | 17.9 | 17.1 |
| | % Walking for 1 Kilometer without stop | 17.2 | 17.4 | 17.8 |
| | % Proxy Report | 4.9 | 4.8 | 6.2 |
| **% Any Limitation in Observed Function** | | **17.9** | **19.8** | **18.4** |
| | % Standing up from Chair without Using Hands | 11.5 | 12.1 | 11.2 |
| | % Picking Book from Floor | 9.0 | 11.7 | 10.0 |
| | % Turning around for 360 Degrees | 7.8 | 7.9 | 8.9 |
| **Demographics** | Mean of Age (SD) | 72.4 (6.0) | 72.5 (6.0) | 73.1 (6.3) |
| | % Female | 53.1 | 52.2 | 52.2 |
| | % Han ethnicity | 94.2 | 94.5 | 94.1 |
| | % Rural Residence | 65.4 | 57.5 | 57.2 |
| **Health Conditions** | % Cognitive Impairment by MMSE | 15.3 | 14.7 | 18.4 |
| | % Depressive Symptom | 65.8 | 64.3 | 64.4 |
| | % Comorbidity | 34.4 | 35.5 | 38.3 |
| | % Self-rated Health as Bad or Very Bad | 14.9 | 15.5 | 16.0 |
| **Historical and Social Factors** | | | | |
| *Early life* | % Born in Rural Area | 86.2 | 83.5 | 85.2 |
| | % Hunger in Childhood | 66.2 | 67.8 | 69.8 |
| | % Adequacy of Medical Care in Childhood | 40.8 | 41.8 | 40.1 |
| | % Availability of Tap Water in Childhood | 3.1 | 4.2 | 3.4 |
| *Middle Life* | % Schooling for at least One Year | 48.8 | 54.0 | 56.9 |
| | % Often Doing Physical Labor in the Past | 82.7 | 81.1 | 82.9 |
| | % Mainly Working in Agriculture before Age 60 | 61.9 | 58.7 | 63.1 |
| | % Adequacy of Medical Care at Age 60 | 89.4 | 91.0 | 90.8 |
| | % Availability of Tap Water at Age 60 | 33.3 | 41.7 | 39.2 |
| *Late Life* | % Married at Presence | 58.5 | 59.6 | 61.1 |
| | % Coresidence with Family at Presence | 87.1 | 87.2 | 85.5 |
| | % Adequacy of Financial Resources at Presence | 80.5 | 76.1 | 78.6 |
| | % Adequacy of Medical Care at Presence | 91.4 | 90.7 | 93.6 |
| | % Availability of Tap Water at Presence | 55.9 | 63.1 | 63.8 |

**Table 3: Odds Ratios of Disability and Global Health in 2005 and 2008 (2002 as reference group) by Gender and Rural/Urban Residence**

| | Total | | Gender | | | | Residence | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Female | | Male | | Rural | | Urban | |
| | 2005 | 2008 | 2005 | 2008 | 2005 | 2008 | 2005 | 2008 | 2005 | 2008 |
| **Any Dependency in ADL** | **0.79*** ** | **0.49*** ** | **0.79*** ** | **0.47*** ** | **0.80** ** | **0.52*** ** | **0.74*** ** | **0.46*** ** | **0.84** ** | **0.51*** ** |
| Bathing | 0.86*** | 0.52*** | 0.86** | 0.51*** | 0.86* | 0.54*** | 0.80*** | 0.49*** | 0.91 | 0.54*** |
| Dressing | 1.08 | 0.79*** | 1.06 | 0.76*** | 1.13 | 0.87 | 1.02 | 0.73*** | 1.14 | 0.85 |
| Toileting | 1.03 | 0.73*** | 1.00 | 0.70*** | 1.12 | 0.80* | 0.98 | 0.67*** | 1.08 | 0.80** |
| Indoor Transferring | 1.09 | 0.84** | 1.03 | 0.81** | 1.21 | 0.93 | 1.03 | 0.79*** | 1.13 | 0.90 |
| Feeding | 1.04 | 0.84** | 1.04 | 0.77*** | 1.05 | 1.01 | 0.95 | 0.72*** | 1.17 | 1.02 |
| **Any Difficulty in IADL** | **1.00** | **0.80*** ** | **0.93** | **0.75*** ** | **1.07** | **0.86** ** | **0.91** | **0.77*** ** | **1.14** | **0.84** ** |
| Using Public Transportation independently | 1.05 | 0.96 | 1.00 | 0.86** | 1.12* | 1.10 | 1.00 | 0.93 | 1.14* | 1.01 |
| Doing Laundry independently | 1.08* | 0.85*** | 1.08 | 0.84*** | 1.09 | 0.85** | 1.00 | 0.78*** | 1.22*** | 0.91 |
| Shopping independently | 1.03 | 0.88** | 0.96 | 0.75*** | 1.15* | 1.11 | 0.97 | 0.84*** | 1.12 | 0.91 |
| Cooking Meal independently | 1.10* | 0.95 | 1.08 | 0.90* | 1.13* | 1.02 | 1.04 | 0.89* | 1.18** | 1.00 |
| Neighbor Visiting independently | 1.18*** | 0.96 | 1.15** | 0.88* | 1.26** | 1.12 | 1.12* | 0.92 | 1.26*** | 0.97 |
| **Any Difficulty in Self-evaluated Function** | **1.00** | **0.96** | **0.90*** | **0.81*** ** | **1.13*** | **1.12*** | **0.95** | **0.95** | **1.07** | **0.95** |
| Continuously Crouching for 3 Times | 1.10** | 1.04 | 1.06 | 0.96 | 1.15** | 1.16** | 1.07 | 0.98 | 1.15** | 1.12* |
| Lifting 5 Kilograms | 1.00 | 0.94 | 0.99 | 0.91* | 1.00 | 0.99 | 0.96 | 0.90** | 1.04 | 1.00 |
| Walking for 1 Kilometer without stop | 1.02 | 1.01 | 0.98 | 0.90* | 1.10 | 1.16** | 0.98 | 1.01 | 1.08 | 0.98 |
| **Any Limitation in Observed Function** | **1.07*** | **1.12*** ** | **1.07** | **1.10*** | **1.07** | **1.15** ** | **1.01** | **1.11** ** | **1.16** ** | **1.13*** |
| Standing up from Chair without Using Hands | 1.02 | 1.03 | 1.01 | 1.01 | 1.05 | 1.06 | 0.98 | 1.06 | 1.09 | 0.97 |
| Picking Book from Floor | 1.14*** | 1.15*** | 1.13** | 1.17*** | 1.16** | 1.11* | 1.09* | 1.15** | 1.20*** | 1.11 |
| Turning around for 360 Degrees | 1.04 | 1.46*** | 1.05 | 1.43*** | 1.05 | 1.51*** | 0.96 | 1.43*** | 1.17** | 1.50*** |

Note: Results are adjusted by age, gender, ethnicity, rural/urban residence and the proxy reporting. **p<0.05 **p<0.01 ***p<0.001*

**Table 4: Odds Ratios of ADL and IADL in 2002, 2005 and 2008**

| | ADL | | | | IADL | | | |
|---|---|---|---|---|---|---|---|---|
| | Model I | Model II | Model III | Model IV | Model I | Model II | Model III | Model IV |
| **2005 (2002 is reference group)** | **0.79*** ** | **0.73*** ** | **0.59*** ** | **0.56*** ** | **1.00** | **0.97** | **0.96** | **0.98** |
| **2008 (2002 is reference group)** | **0.49*** ** | **0.44*** ** | **0.39*** ** | **0.39*** ** | **0.80*** ** | **0.74*** ** | **0.73*** ** | **0.77*** ** |
| **Demographics** | | | | | | | | |
| Age | 1.12*** | 1.05*** | 1.06*** | 1.06*** | 1.18*** | 1.11*** | 1.10*** | 1.10*** |
| Female | 1.40*** | 1.03 | 0.95 | 0.92 | 2.22*** | 1.36*** | 1.25*** | 1.11* |
| Han ethnicity | 1.98*** | 1.84*** | 1.75*** | 1.48** | 1.20** | 1.07 | 1.03 | 1.01 |
| Rural Residence | 0.51*** | 0.49*** | 0.47*** | 0.79*** | 1.21*** | 1.28*** | 1.21*** | 1.14** |
| Proxy report | 7.30*** | 4.51*** | 3.86*** | 3.41*** | 4.25*** | 2.44*** | 1.70*** | 1.61*** |
| **Any Limitation in Observed Function** | | 5.30*** | 4.13*** | 4.18*** | | 3.04*** | 2.40*** | 2.41*** |
| **Any Difficulty in Self-evaluated Function** | | 8.82*** | 6.29*** | 6.34*** | | 18.48*** | 14.06*** | 13.79*** |
| **Other Health Conditions** Cognitive Impairment by MMSE | | | 1.59*** | 1.80*** | | | 2.11*** | 2.12*** |
| Depressive Symptom | | | 1.16** | 1.26*** | | | 1.43*** | 1.45*** |
| Comorbidity | | | 1.53*** | 1.43*** | | | 1.16** | 1.14** |
| SR-Health as Bad or Very Bad | | | 1.82*** | 2.13*** | | | 1.54*** | 1.65*** |
| **Social-environmental Factors** | | | | | | | | |
| *Early life* Born in Rural Area | | | | 1.13 | | | | 0.99 |
| Hunger in Childhood | | | | 0.82**** | | | | 0.96 |
| Adequacy of Medical Care in Childhood | | | | 0.93 | | | | 0.93 |
| Availability of Tap Water in Childhood | | | | 1.28 | | | | 0.79 |
| *Middle Life* Schooling for at least One Year | | | | 0.97 | | | | 0.80*** |
| Often Doing Physical Labor in the Past | | | | 0.94 | | | | 0.96 |
| Mainly Working in Agriculture before Age 60 | | | | 0.63*** | | | | 1.01 |
| Adequacy of Medical Care at Age 60 | | | | 0.99 | | | | 1.03 |
| Availability of Tap Water at Age 60 | | | | 1.56*** | | | | 0.85** |
| *Late Life* Married at Presence | | | | 0.77*** | | | | 0.78*** |
| Coresidence with Family at Presence | | | | 3.12*** | | | | 1.80*** |
| Adequacy of Financial Resources at Presence | | | | 1.18* | | | | 1.12* |
| Adequacy of Medical Care at Presence | | | | 1.12 | | | | 0.82* |
| Availability of Tap Water at Presence | | | | 1.42*** | | | | 1.14** |