Short-term trends in functional limitation among older Asians: A comparison of five Asian settings

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Abstract

The objective of this paper is to examine short-term trends in the prevalence of limitation in Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL) and Nagi physical functioning tasks among persons age 60 years or older in five Asian settings: Indonesia, the Philippines, Singapore, Taiwan and the Beijing Municipality. The data come from recent panel surveys of older adults that span a period of three to four years during the mid to late 1990s. Results suggest a general trend toward an increase in functional limitation in all settings, with the most pronounced increases occurring for the Nagi functioning tasks. Compositional differences in the population accounted for little of the increase. The paper discusses the potential implications of these results and places them in the context of past and current trends in functional limitation observed in the United States.

Keywords

Functional limitation, disability, health, trends, Asia

Introduction

The purpose of this study is to examine changes in the prevalence of functional limitation among older adults in five settings in East and Southeast Asia: Indonesia, the Philippines, Singapore, Taiwan, and the Beijing Municipality. Asia in general, and the selected societies in particular, provide an excellent setting for this study. First, due to unprecedented reductions in fertility and substantial improvements in old-age mortality in recent decades, population aging throughout much of Asia is extremely rapid (Hermalin, 2000). In 1995 there were an estimated 147 million persons age 60 or over in East Asia, and 32 million in Southeast Asia. This represents a doubling of the number of older persons since 1975, and these numbers are expected to further increase nearly three-fold by 2030 (United Nations, 1999). This makes these regions among the fastest aging in the world. The percent of persons age 60 or over has increased at an annual rate of about 3% between 1975 and 1995 and is expected to continue at a slightly higher rate through 2030. This rate of growth far exceeds that experienced in the United States or Europe (Hermalin, 2000). Future growth will be most accelerated for the oldest-old (age 80 and older), for whom the prevalence of health problems is highest. In both East and Southeast Asia, the oldest old are expected to more than double between 1999 and 2050 as a percent of both the total population and the elderly population (United Nations, 1999).

These trends have policy makers in Asia concerned because of their potential implications for future disease burden and associated informal and formal care demands (Hermalin, 2000; Interministerial Committee on the Ageing Population, 1999; Ogawa and Retherford, 1997). The precise implications of population aging for future levels of health and health care utilization depend on whether the increases in life expectancy experienced in the region are accompanied by an increase or decrease in health problems in later life. Arguments

for both scenarios as well as a more intermediate view have been advanced (Fries, 1980; Gruenberg, 1977; Kramer, 1980; Manton, 1982). Even under the best of circumstances with regard to declines in disease and disability rates, however, the sheer growth in the older population that is occurring in Asia and other parts of the world will lead to increases in the absolute number of disabled persons (Manton, 1997; Mayhew, 1999). The health infrastructure in the study settings has been oriented toward problems of infectious diseases and maternal and child health and is less well-equipped to handle the health care needs of the older population (Hermalin, 2002). Gaining a better understanding of the trends and determinants of health in later life is thus critical for future planning. In addition, by investigating the universality of findings across different environments, this study can add significantly to our understanding of health processes in later life.

Background

According to projections reported recently by Mayhew (1999), the number of disabled individuals will grow substantially as societies age. Consequently, Mayhew argues that aging is poised to overtake population growth as the main factor for expanding health expenditures on a world-wide basis. He further projects that costs associated with health problems will be highest in societies where the proportion of those in older ages is greatest, and will increase most rapidly in societies undergoing rapid population aging, such as those included in the proposed study. Whether these projections are accurate for Asian societies will depend to a great extent not only on the size of the increase in the older population, but on the changes that occur in the health status of the older populations as these societies continue to develop. These can be viewed in

two ways - as changes that occur to populations measured by prevalence rates, and changes that occur in individual states of health measured by transition probabilities.

James Fries (1980) suggested that improvements in health for older populations is a natural outcome of a decrease in the incidence of disease. As a consequence, periods of morbidity for older adults are 'compressed' into the very end of life and older adults experience longer lives in better health. An opposing view, advanced by Kramer (1980) and Gruenberg (1977) holds that, along with increases in life expectancy, come more years in states of disability, as lethal sequalae of diseases are eliminated without concomitant changes in the effects of disease on quality of life. Manton (1982) has proposed an alternate scenario under which contradictory cycles of improvement and decline in health occur, leading to a state of 'dynamic equilibrium.'

The question of whether older adults are experiencing longer life with improving or worsening health has been addressed in a number of studies that examine trends and transitions in the health of older adults in the United States. Evidence from the 1970s and early 1980s indicated that the gains in life expectancy that were realized during this period were accompanied by an increasing prevalence of disability (Colvez and Blanchet, 1981), suggesting a trade-off between longer life and worsening health (Verbrugge, 1984). Waidmann, Bound and Schoenbaum (1995) have questioned the validity of disability reports amidst a changing health environment, suggesting that the increase in disability rates were a function of better diagnostic techniques and earlier detection of chronic disease. There now appears to be consistent evidence that since the 1980s there has been substantial improvement in older adult health, particularly with respect to disability. For instance, evidence from several recent studies suggests that rates of functional disability among older Americans declined during the 1980's and 1990's

(Crimmins, Saito and Reynolds, 1997; Freedman and Martin, 1998; Freedman, Martin and Schoeni, 2002; Manton, Corder and Stallard, 1993; Ofstedal, Madans and Feldman, 1994). The declines are most evident for IADLs and basic physical tasks of the Nagi variety (e.g., climbing stairs, walking ¼ mile, lifting), and no consistent results have been found with regard to trends in ADL functioning (Freedman, Martin and Schoeni, 2002).

Large panel surveys in the United States, such as the National Long-Term Care Survey, the Longitudinal Study of Aging, and more recently the Health and Retirement Study have provided invaluable data for examining health trends and transitions. Studies using these longitudinal data sources can provide the basis for the development of hypotheses about health elsewhere, but we cannot assume the relationships found in the United States are universal without comparisons across different political and cultural regimes, and areas characterized by different levels of socioeconomic development. For example, we may expect patterns in Asia to differ from those of the United States due to differing levels of baseline health (which has implications for the potential magnitude and rate of change). In addition, the aging of populations in Asia has been accompanied by more rapid changes in socioeconomic status on both an individual and a societal level than has occurred elsewhere. It is possible that health trends will vary across Asian countries themselves for these same reasons. This paper makes use of newly available longitudinal data in several Asian settings to examine whether the recent improvements in disability that have been observed in the United States are also taking place in a less developed part of the world.

Subjects and methods

Data sources

The data to be used in this paper come from representative panel surveys of older persons in Taiwan, Indonesia, the Philippines, Singapore, and the Beijing Municipality in China. The names of the surveys and key design features are provided in Appendix Table 1 and brief descriptions of the survey are provided below.

The Beijing data are from the Beijing Multidimensional Longitudinal Study of Aging conducted by the Capital University of Medical Science in Beijing. A total of 3,257 adults aged 55 and older were interviewed in the baseline wave in 1992, yielding a response rate of 85%. This sample consisted of individuals living in one of three administrative areas within the Beijing municipality. The first, Xuan Wu, is a district located in metropolitan Beijing. The other two areas, Da Xing and Huai Ruo, are rural agricultural areas located up to 100 kilometers from the city. These three areas were chosen based on their ability to represent the total municipal region with respect to socioeconomic and demographic characteristics, and the two rural areas were also chosen due to their rural environment. Follow-up interviews were conducted in 1994 and 1997.

The Indonesian Family Life Survey (IFLS) is a large-scale, nationally representative panel survey of about 7,200 households in Indonesia. The household sample was drawn from 13 provinces spanning multiple islands in the Indonesian archipelago; together these provinces account for approximately 83 percent of the Indonesian population. The survey was conducted by the RAND Corporation, in collaboration with *Lembaga Demografi* at the University of Indonesia. A primary focus of the survey, and the one that is of most relevance to this study, is on the health, economic and social functioning of the older population. As a result, the survey design included interviews with just under 5,000 randomly selected individuals age 50 or over (plus their spouses) from each household that contained requisite members. The baseline

response rate was 91%, and followup interviews with the full sample were conducted in 1997 and 2000.

The Philippine Elderly Survey (PES) is a nationally representative survey of middle-aged and older adults that was launched in 1996. The sample is comprised of 2,285 men and women 50 years of age or older, of whom 1,131 were age 60 years or older at the start of the survey. The major objective of the survey was to assess how rapid demographic change has affected older Filipinos, particularly with respect to physical and psychological health, economic well being, and familial relations and support. The response rate for the survey was 85 percent. A follow-up interview with respondents in two sizable regions in the Philippines (the greater Manila area and Leyete, a large rural province in the north, combined target sample size of 932) was conducted in 2000. A total of 167 respondents were determined to have died prior to followup, and 644 were successfully interviewed.

The National Survey of Senior Citizens in Singapore was conducted in 1995. The survey is representative of men and women age 55 years or over in Singapore. A total of 4,750 persons were interviewed. The response rate at baseline was 60%. In 1999 a follow-up survey, which repeated and expanded key health, health care utilization, socioeconomic, and informal support measures, was conducted as part of the project, "Transitions in Health, Wealth, and Welfare of Elderly Singaporeans: 1995-1999." Interviews were completed with 1,977 individuals and 557 respondents were determined to be deceased based on informant reports during the data collection period.

The Taiwan data come from the Survey of Health and Living Status of the Middle Aged and Elderly in Taiwan, a national survey of men and women 50 years of age and older in 1996, conducted by the Bureau of Health Promotion in Taiwan (formerly the Taiwan Provincial

Institute of Family Planning). This survey builds on a panel survey that began in 1989, following a cohort of persons age 60 years and over through six waves of data collection, including four in-depth personal interviews conducted in 1989, 1993, 1996, and 1999, and two abbreviated telephone interviews in 1991 and 1995. In 1996, the panel sample (comprised of persons who were then age 67 or older) was supplemented with a new representative sample of persons 50 to 66 years of age. Both panels were sampled from the national household register, which includes institutions as special households. The baseline response rate was 92% for the original sample of individuals age 60 or over in 1989, and 81% for the younger cohort of individuals age 50 to 66 who were added in 1996.

For purposes of the present paper, we make use of data on respondents who were age 60 years or over at a given wave of the survey. In addition, because we have only two waves available for two of the surveys, we limit the analysis in this paper to two waves for each setting. The waves were chosen so as to cover roughly the same interval length and the same period of time across surveys: 1993 and 1997 for Indonesia, 1994 and 1997 for Beijing, 1995 and 1999 for Singapore, 1996 and 1999 for Taiwan, and 1996 and 2000-2001 for the Philippines.

Variables

Dependent variables: Our measures of functional limitation are dichotomous variables indicating whether or not the respondent reported having difficulty performing at least one Activity of Daily Living (ADL), at least one Instrumental Activity of Daily Living (IADL), and at least one Nagi physical functioning task (0=no, 1=yes), respectively. The number and types of activities queried differed across the surveys and are listed in Appendix Table 2. The precise question wording also varied somewhat across the surveys (as shown in Appendix Table 3). For

these reasons we do not focus on cross-setting differences in prevalence in this paper, but rather on trends in prevalence *within* settings over time and on how the trends compare across settings.

Question wording was consistent across waves within settings, with two exceptions. The first exception occurred in the Taiwan survey, for which the 1996 questionnaire included a skip and stem question structure for the ADL measures. Specifically, in 1996, respondents skipped the individual ADL questions if they had no Nagi difficulties or if they reported "no" to a global/stem question concerning ADL difficulties (see Appendix Table 3). In contrast, every respondent was asked the individual ADL questions in 1999. The second exception occurred in Singapore, for which the administration of the ADL and IADL questions differed across waves. The questions used in the 1995 survey deviated from the conventional approach. For ADLs, no explicit question wording was provided for interviewers and they were instructed to record the respondent's status with respect to mobility, feeding, toileting, and personal grooming and hygiene. Respondents were asked about their IADL status in the 1995 wave, but the question wording differed from most other surveys (see Appendix Table 3). In 1999, the question wording for both ADLs and IADLs followed a more conventional approach, whereby respondents were asked whether they have difficulty with the activities because of a mental or physical health problem and, if so, how much difficulty they have. In addition, in 1999, a skip pattern was introduced such that respondents who did not report any chronic conditions (out of a list of ten conditions) were assumed to have no difficulty with functioning and were skipped out of the ADL and IADL questions. Hence, results pertaining to changes in the prevalence of ADL limitation in Taiwan and, particularly in Singapore, must be interpreted with some caution.

Independent variables: The independent variable of key interest is a dummy variable representing the survey wave (coded 0=baseline, 1=followup). In addition, to assess the extent

to which any observed change in the prevalence of functional limitation is attributable to changes in the composition of the older population, we include controls for age (coded as continuous variable ranging from 60 to 99), sex (0=male, 1=female), marital status (0=not currently married, 1=currently married), and education (primary, secondary or higher versus no formal education).

Analysis methods

To determine whether or not there were significant changes in the prevalence of limitations over time within a setting, we pool cross-sectional samples for the baseline and followup waves. We then fit two logistic regression models that estimate the log-odds that individuals report each type of limitation. The first model includes only a dummy variable for survey wave, using the baseline as the comparison category. The second model adds the compositional variables described above in order to assess the extent to which they account for any observed changes in functional limitation. These regressions take the form of:

Model 1: $ln\ (P/1\text{-}P) = \alpha_0 + \alpha_1\ T2$

Model 2: $ln\ (P/1\text{-}P) = \alpha_0 + \alpha_1\ T2 + \alpha_2 x_2 \ldots\ \alpha_k x_k,$

where α_1 represents the log odds for the difference in prevalence rates between time periods and $\alpha_2 \ldots \alpha_k$ represent the effects of compositional variables.

All analyses are weighted to account for differential sampling probabilities and non-random attrition due to non-response at followup. In addition, since repeated observations are being used in this analysis to estimate population rates at two different time periods, we need to be sensitive to the likelihood of correlated error terms. We use STATA 7.0 to conduct the regression analyses, which is capable of handling such data with its robust command by employing the Huber/White/sandwich estimator of variance (Lin and Wei, 1989).

Results

Table 1 presents distributions on key sample characteristics for persons age 60 years or over in the specified year for each of the five study settings. The average age of the samples is slightly lower in Indonesia and Beijing than in the other three settings. Females predominate in the Philippines and Singapore, whereas males predominate in Taiwan. (The male predominance in Taiwan is due to the large migration of male soldiers from Mainland China to Taiwan following the Chinese civil war, which altered the sex distribution for this age cohort.) In most settings, the majority of the sample is married. The level of education is quite low in all settings except the Philippines. One-half or more of older adults in Singapore, Indonesia and Beijing and two-fifths of those in Taiwan have no formal education. The large majority of older Filipinos received a primary level education, and one-fifth to one-quarter completed secondary or higher education.

Table 1 about here

Table 2 presents the percentage of persons age 60 or over in each setting in the designated year who reported having difficulty performing one or more ADL, IADL, and Nagi activity. Recall that the items used to measure functional limitation differed across surveys (see Appendix Table 2), so we are not able to compare prevalence levels across settings. Our interest here is to compare the prevalence of functional limitation over time within each setting.

Table 2 about here

With the exception of Singapore, each study setting experienced a significant increase in the prevalence of functional limitation in at least one of the three domains. The most marked increases occurred with respect to Nagi limitation. In all four of the settings that included Nagi

measures, significant increases in the percent reporting Nagi limitation were observed. The increases ranged from 17 percent in Taiwan, to 48 percent in Beijing. In addition, Indonesia and Taiwan experienced significant increases in the prevalence of ADL limitation, and Beijing and the Philippines experienced significant increases in the prevalence of IADL limitation. The Philippines also showed an increase in ADL limitation, however due to small sample size, the difference was not statistically significant. Singapore is the only country that did not exhibit a significant change in either of the functional domains measured—ADLs or IADLs.

The final three tables present results from multivariate logistic regression models predicting ADL, IADL, and Nagi limitation, respectively, for each setting. Results are presented as odds-ratios. As noted previously, data from both survey waves within a setting were pooled, and a dummy variable representing the survey wave (0=baseline, 1=followup) was included in the model. In addition, the samples were weighted to be representative of the target populations, and standard errors were adjusted to account for repeated observations on the same individuals. The top panel of the tables presents results from bivariate models that include only survey wave as a predictor; the bottom panel presents results from multivariate models that adjust for compositional effects of key sample characteristics.

Focusing first on ADL limitation (Table 3), the unadjusted odds-ratios in the top panel simply reproduce the bivariate results in Table 2 and show that the prevalence of ADL limitation for persons age 60 years or older increased significantly in Indonesia and Taiwan, increased slightly (but not significantly so) in the Philippines, and did not change in Singapore or Beijing. Controlling for key compositional factors leads to slight declines in the odds-ratios. Although the declines are not large, they are sufficient enough to reduce the cross-wave differences in Indonesia and Taiwan to insignificance. With regard to the effects of covariates on ADL

limitation, age shows a strong positive association with ADL limitation in all settings. The effects of other variables are less consistent, with females showing higher ADL limitation than men in Singapore, married persons showing higher levels of ADL limitation than unmarried persons in both Beijing and Singapore, and those with secondary or higher education in Taiwan showing lower levels than those with no education.

Table 3 about here

Parallel results for IADL limitation are shown in Table 4. Both Beijing and the Philippines experienced significant increases in IADL limitation, whereas no change was observed in Taiwan or Singapore (top panel). In this case, the odds-ratios for survey year did not change when compositional characteristics were added to the models (bottom panel). Hence, the observed increases in prevalence in Beijing and the Philippines cannot be attributed to changes in the composition of the population between the two survey waves, at least in terms of characteristics included in the model. Again, age shows a strong positive association with IADL limitation in all settings, and females are more likely than males to report IADL limitation in Beijing, Singapore and Taiwan. Education is also an important predictor of IADL impairment for both Beijing and Taiwan, such that those with any education (primary or secondary up) are less likely than those with no education to be limited in IADLs.

Table 4 about here

Lastly we turn to results for Nagi limitation (Table 5). The unadjusted results show substantial increases in the prevalence of Nagi limitation in all four settings for which data are available. As was the case for IADL limitation, the odds-ratios for survey year were not affected by the inclusion of compositional variables in the model. Here again, age shows a strong positive association with Nagi limitation in all settings. Sex is also an important predictor of

Nagi limitation in all settings, with women being substantially more likely then men to be limited. And, consistent with results for IADL limitation, education is an important predictor of Nagi limitation for Beijing and Taiwan, with more educated individuals reporting lower levels of limitation.

Table 5 about here

Discussion

Taken together, the findings suggest that the Asian societies represented in this study do not appear to be experiencing the improvements in physical functioning that have been observed during recent decades in the United States. On the contrary, every setting except Singapore experienced significant increases in functional limitation in at least one domain, and none experienced significant decreases in any domain. The most consistent and dramatic changes were observed for Nagi limitation, for which increases occurred in Beijing, Indonesia, the Philippines, and Taiwan. Two of the three settings that included IADL measures experienced increases in IADL limitation (Beijing and the Philippines), and two of the five settings experienced increases in ADL limitation (Indonesia and Taiwan). Changes in the composition of the older population did not account for increases in the prevalence of either IADL or Nagi limitation.

How do we reconcile the seemingly contradictory findings between Asia and the United States? Or are the findings actually contradictory? As noted earlier, findings from the United States in the 1970s and early 1980s suggest that disability among older persons actually increased for a period of time, before it started to decline in the 1980s and 1990s. It is plausible that Asia (or at least the settings examined here) is going through a similar stage. Social and

economic development and advances in the health infrastructure occurred much later in these settings than in the United States. Thus, in comparison to older Americans, older Asians may have experienced substantially more difficult living and working environments and poorer health earlier in their lives, including greater exposure to infectious diseases. These experiences are likely to have health consequences later in life. In addition, the recent improvements in survival at older ages that all of these settings have experienced, may have disproportionately benefited those in poorer health and with functional limitations. This appears to have been the case during the 1990s in Taiwan (Zimmer, Martin and Chang, 2002; Zimmer, Martin and Lin, forthcoming). Future cohorts of elderly in Asia will be very different in terms of their early life experiences, education, and economic status, and we may begin to see declines in disability among older adults over the next decade or two.

The study has some important limitations. A major limitation is the short time period over which we are trying to discern trends, and the use of only two waves of data. It will be important to replicate this study as new waves of data become available, to assess whether the increases in prevalence that we observed over a very short period of time persist over a longer period. A separate study that focused only on Taiwan, using three waves of data (1993, 1996, 1999) and more limited set of measures found evidence of longer-term trends (Zimmer, Martin and Chang, 2002). One of the planned extensions of this work is to conduct longer-term investigations in other settings where data are available. In the meantime, we must be very cautious about interpreting these findings as true population *trends*.

A second limitation relates to the use of panel data for studying population trends. Ideally we would use data from repeated cross-sectional surveys that draw fresh samples of the population at each time point. However, such surveys are rare, particularly those containing

sufficient measures of health and disability. Panel data can and are often used to study trends, but this can be problematic for two reasons. The first has to do with non-random non-response in followup waves. Over time, a panel sample is likely to become less and less representative of the target population. We address this in the current study by developing sample weights that account for non-random attrition due to non-response in the followup wave. The second potential problem is that participation in a panel study may influence responses in subsequent waves. This can be particularly problematic with regard to test-related material, such as cognitive performance tests, for which studies have documented a learning effect in repeated administrations (Jacqmin-Gadda, Fabrigoule, Commenges and Dartigues, 1997; Under, van Belle and Heyman, 1999; Zelinski and Burnight, 1997), but is generally considered to be less problematic for most other types of survey questions, such as reports of health problems and symptoms.

Future analyses will include several extensions of this work. First we plan to extend the analyses for Indonesia and Taiwan to incorporate data from the most recent survey waves (2000 for Indonesia, 2003 for Taiwan). In addition, we will examine individual activities within each domain of functional limitation to determine whether increases in limitation are observed for all indicators, or whether certain indicators within each group are responsible for the overall trends. Finally, we intend to examine trends in other health indicators and mortality patterns to better understand the dynamics that underlie the observed increases in functional limitation in these settings.

Trends in health and disability will have profound implications for the quality of life in old age, the demand for and overall cost of health care, and policies relating to delayed

retirement. Thus, is will be important to monitor trends in functional limitation and other health indicators in Asia and other regions as the data to do so become increasingly available.

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[Insert Appendix Tables 1-3 about here]

Table 1. Sample characteristics for each country by survey wave

Characteristic	Beijing		Indonesia		Philippines		Singapore		Taiwan	
	1994	1997	1993	1997	1996	2000	1995	1999	1996	1999
Age (mean)	68.2	68.8	67.3	68.0	69.7	69.6	69.2	69.6	69.5	69.8
Sex										
Male	49.9	48.9	51.2	50.1	37.2	35.2	46.4	47.8	54.8	53.1
Female	50.1	51.1	48.8	49.9	62.8	64.8	53.6	52.2	45.2	46.9
Marital status										
Married	71.4	72.6	67.3	71.7	49.6	49.9	50.8	57.1	65.9	71.4
Not married	28.6	27.4	32.7	28.3	50.4	50.1	49.2	42.9	34.1	28.6
Education										
No formal schooling	52.1	47.2	53.7	50.4	16.0	11.8	66.9	60.6	41.0	39.5
Primary	27.2	30.4	39.9	41.1	61.2	59.4	23.4	26.5	37.7	39.4
Secondary or higher	20.8	22.5	6.3	8.4	22.7	28.8	9.7	12.9	21.3	21.1
Total										
Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Unweighted N	2458	2043	1905	2016	536	452	4001	1944	3584	3591

Table 2. Prevalence of ADL, IADL and Nagi limitation by survey wave

Characteristic	Beijing		Indonesia		Philippines		Singapore		Taiwan	
	1994	1997	1993	1997	1996	2000	1995	1999	1996	1999
ADL limitation	4.9	4.7	4.2	6.5*	10.9	14.7	3.8	3.9	7.6	9.2*
IADL limitation	13.4	17.7*	n.a.	n.a.	20.9	27.2*	18.3	17.2	24.3	25.1
Nagi limitation	9.4	13.9*	45.9	58.6*	45.5	61.0*	n.a.	n.a.	43.4	50.9*

* Difference in prevalence estimates across waves is statistically significant at $p < .05$

Note: Functioning items that were not ascertained or for which cross-wave differences were too substantial to include in the analysis are indicated by n.a.

Table 3. Odds-ratios for the effects of survey wave and key compositional variables on ADL limitation

Characteristic	Beijing	Indonesia	Philippines	Singapore	Taiwan
Unadjusted Model					
Survey wave					
Baseline	1.00	1.00	1.00	1.00	1.00
Followup	0.94	1.58*	1.38	1.03	1.24*
Model Chi-square (df=1)	0.23	5.79	2.63	0.03	5.31
Adjusted Model					
Survey wave					
Baseline	1.00	1.00	1.00	1.00	1.00
Followup	0.90	1.46	1.38	0.93	1.20
Age	1.11***	1.10***	1.07***	1.12**	1.10***
Sex					
Male	1.00	1.00	1.00	1.00	1.00
Female	1.06	1.36	0.97	1.73**	1.21
Currently married					
Yes	1.42*	0.93	0.88	1.47*	0.92
No	1.00	1.00	1.00	1.00	1.00
Education					
No formal schooling	1.00	1.00	1.00	1.00	1.00
Primary	0.77	0.75	1.42	0.96	0.85
Secondary or higher	0.61	--	1.30	1.42	0.49**
Model Chi-square (df=6)	112.11	93.63	33.76	172.08	324.74

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

Table 4. Odds-ratios for the effects of survey wave and key compositional variables on IADL limitation

Characteristic	Beijing	Philippines	Singapore	Taiwan
Unadjusted Model				
Survey wave				
Baseline	1.00	1.00	1.00	1.00
Followup	1.39***	1.40*	0.93	1.04
Model Chi-square (df=1)	17.44	4.87	0.90	0.47
Adjusted Model				
Survey wave				
Baseline	1.00	1.00	1.00	1.00
Followup	1.41***	1.43*	0.87	1.01
Age	1.10***	1.08***	1.11***	1.13***
Sex				
Male	1.00	1.00	1.00	1.00
Female	1.37**	1.04	1.22*	2.28***
Currently married				
Yes	0.91	0.97	1.02	1.01
No	1.00	1.00	1.00	1.00
Education				
No formal schooling	1.00	1.00	1.00	1.00
Primary	0.67**	1.13	1.16	0.48***
Secondary or higher	0.48***	1.10	1.30	0.26***
Model Chi-square (df=6)	282.63	57.64	500.36	1300.37

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

Table 5. Odds-ratios for the effects of survey wave and key compositional variables on Nagi limitation

Characteristic	Beijing	Indonesia	Philippines	Taiwan
<u>Unadjusted Model</u>				
Survey wave				
Baseline	1.00	1.00	1.00	1.00
Followup	1.56***	1.66***	1.86***	1.35***
Model Chi-square (df=1)	25.07	39.84	22.04	34.85
<u>Adjusted Model</u>				
Survey wave				
Baseline	1.00	1.00	1.00	1.00
Followup	1.59***	1.66***	1.93***	1.37***
Age	1.10***	1.09***	1.07**	1.10***
Sex				
Male	1.00	1.00	1.00	1.00
Female	1.41**	3.64***	1.49**	2.60***
Currently married				
Yes	0.92	0.93	0.88	1.01
No	1.00	1.00	1.00	1.00
Education				
No formal schooling	1.00	1.00	1.00	1.00
Primary	0.63*	1.03	1.00	0.69***
Secondary or higher	0.44***	1.02	1.00	0.47***
Model Chi-square (df=6)	251.78	213.69	88.12	1140.11

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

Appendix Table 1. Design features of Asian longitudinal surveys

Survey name	No. of waves	Survey years	Age range	Baseline sample size	Baseline response rate
Beijing Multidimen-sional Longitudinal Study on Aging	4	1992, 1994, 1997	55+	3,614	85%
Indonesian Family Life Survey (IFLS)	3	1993, 1997, 2000	50+	4,958	91%
Philippine Elderly Survey (PES)	2	1996, 2000-2001	50+	932	85%
National Survey of Senior Citizens in Singapore (NSSC)	2	1995, 1999	55+	4,750	60%
Taiwan: Survey of Health and Living Status of the Elderly (TES)	6	1989, 1991, 1993, 1995, 1996, 1999	60+	4,049	92%
Survey of Health and Living Status of the Middle-Aged (TMS)	2	1996, 1999	50-66	2,462	81%

Appendix Table 2. ADL, IADL and Nagi activities included in each survey

Activity	Beijing	Indonesia	Philippines	Singapore	Taiwan
ADL:					
Bathing	x		x		x
Dressing	x	x	x	x	x
Eating	x		x	x	x
Getting in/out of bed	x				x
Walking around house	x		x	x	x
Toileting		x	x	x	x
Grooming	x				
IADL:					
Shopping	x		x	x	x
Managing money	x		x		x
Using transportation	x		x	x	x
Doing light housework			x		x
Doing heavy housework					x
Using telephone					x
Preparing own meals	x		x	x	
Taking medications					
Nagi:					
Stand for 15 minutes					x
Crouch, squat, kneel, bow		x	x		x
Raise hands over head					x
Grasp with fingers			x		x
Lift heavy object		x	x		x
Climb stairs	x		x	x	x
Walk 200-300 meters	x		x		x
Walk 5 kilometers		x			
Draw water from well		x			
Stand up from floor		x			
Stand up from chair		x			

Appendix Table 3. Question wording for ADL, IADL and Nagi survey measures

Survey	Wave	ADL	IADL	Nagi
Beijing	1994	"Can you do the following activities without help?"	"Can you do the following activities without help?"	"Can you do the following activities without help?"
	1997	Same as 1994.	Same as 1994.	Same as 1994.
Indonesia	1993	"If you have to (activity), could you do it?" *Note: For ADLs, the questions pertain to ability to do the activity 'without help'.*	Not asked.	"If you have to (activity), could you do it?"
	1997	Same as 1993.	Not asked.	Same as 1993.
Philippines	1996	*Stem question 1:* "Because of a physical or mental health problem, do you have any difficulty in handling your personal care needs by yourself? For example, eating, dressing, bathing, or getting around the home?" *Stem question 2:* "Do you use any instruments or does anyone help you do any of these things?" *If yes to either of above, ask for each activity separately:* "Do you have difficulty (activity)?"	*Stem question:* "Because of a physical or mental health problem, do you have ANY difficulty in handling your routine needs-- like everyday household chores, preparing meals, shopping, managing your money, or using transportation to get around?" *If yes:* "Because of a physical or mental health problem, do you have any difficulty (activity)?" If yes: "How much difficulty do you experience (activity)?"	"Do you have any difficulty (activity)?" *If yes:* "How much difficulty do you have (activity)?"
	2000	Same as 1996.	Same as 1996.	Same as 1996.
Singapore	1995	*Instruction to interviewer:* "Record through observation and check with respondent or family members." *Response categories for each activity range from:* '1=independent' to '5=severely impaired and requires total assistance'.	"Are you <u>able</u> to perform the following tasks on your own?"	Not asked.
	1999	*Asked only if R reported having ever had one or more of a set of 10 common chronic conditions.*	*Asked only if R reported having ever had one or more of a set of 10 common chronic conditions.*	*Asked only if R reported having ever had one or more of a set of 10 common chronic conditions.*

		"Because of a mental or physical health problem, do you have difficulty with (activity)?" *If yes,* how much difficulty do you experience with (activity)?"	"Because of a mental or physical health problem, do you have difficulty with (activity)?" *If yes:* "How much difficulty do you experience with (activity)?"	"Do you have any difficulty with (activity)?" *If yes:* "How much difficulty do you experience with (activity)?"
Taiwan	1996	*Note: ADL questions are asked only if R reports having difficulty with one or more Nagi task.* *Stem question:* "As for aspects of daily life like eating, getting dressed, bathing, getting around indoors, getting out of bed, or going to the bathroom, do you have problems that are health-related or physical? Or do you need special aids or other people to help you?" *If yes to above, ask for each activity separately:* "Next, I will mention some common daily activities. Tell me, if you do them independently, is there any difficulty?" *If yes:* "What level of difficulty do you have?" [**Do not count difficulty due to temporary illness or injury.**]	"If you yourself do the activities below, given your health or physical condition, do you have difficulty?" *If yes:* "Do you have some difficulty, great difficulty, or are you completely unable to do them?" *If R has never done a certain activity, then ask:* "If you had to do it, could you?"	"If no one helps you and you have no aids to help you, will you have trouble doing the activities below **by yourself**?" *If yes:* "Will you have some difficulty, great difficulty, or will you be unable to do them at all?" *If R has never done a certain activity, then ask:* "If you had to do it, could you?"
	1999	No skip or stem question was used in 1999. Rather, all Rs were asked: "Next, I will mention some common daily activities. Tell me, if you do them independently, is there any difficulty?" *If yes:* "What level of difficulty do you have?" [**Do not count difficulty due to temporary illness or injury.**]	Same as 1996.	Same as 1996.