Active life expectancy and functional health transition

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Abstract

Despite dramatic successes in improving human survival, many studies in western settings indicate that longer life expectancy does not mean healthier life (Crimmins, Hayward and Saito, 1994; Robine, Romieu and Michel, 2003). Many sick people who have been rescued from early death continue to live to older ages with an increased risk of acquiring chronic conditions over their remaining lifetime and ending up with multiple diseases, some with disability (Verbrugge, 1989). Thus, longevity gains may translate to an increased number and percentage of older people with disability and in need of long-term care and expensive medical attention.

Introduction

In the Philippines where significant aging has yet to begin, the concept of ALE is relatively new. Little is known on the level of ALE. Less clear is its differentials across socio-economic and demographic setting and the extent to which they compare with those found in aging societies. How does ALE associate with age, gender, education and place of residence? Are females' longer life chances translated into better quality of remaining life? What is the effect of educational advantage on the quality of remaining life? This study aims to address these information gaps by assessing the functional health status of older Filipinos 50 years and over. First, we examine a baseline estimate of their ALE and the extent to which this varies by gender. Then, using recently collected panel data on older Filipinos we examine the patterns and determinants of changes in functional health over four years. Finally, we show possible difference in ALE by subgroups of the population based on the results from multistate life table method.

Background

Health Expectancy (HE) is a generic term typically referring to the average number of years an individual can expect to live in a given health state (Mathers, Robine and Wikins, 1994). An attractive feature of HE is that it combines the fundamental dimensions of health (mortality, morbidity and disability) into a summary indicator to provide information on the length of life and the healthfulness of life. It shares other important properties with life expectancy (LE) such as independence from the age structure of the population and its measurement in expected years of life (Nusselder and Looman, 2004). The concept of HE resulted from a broadening in the conceptualization of health from a metric (which uses length of life as a measure of health status) to a quality of life perspective. HE is often called ALE when Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) are used as measures of health status. Specifically, ALE measures health in terms of functional ability, not disease status.

Previous research on health expectancy underscores the significance of age, sex and socioeconomic status as predictors of health expectancy (Crimmins, Hayward and Saito, 1996; Liu et al. 1995; Hayward and Heron, 1999; Robine and Romieu, 1998). Particularly, increased levels of disability with advancing age as well as clear gender differences have been reported. Females were generally found to outlive males but were more likely to live a greater part of their remaining life in disability. Such differentials have been attributed in part to key socioeconomic factors including the mediating effect of education and income (Maddox and Clark, 1992 in Peek et al. 1999). Low income and low occupational status were found to account largely for women's lower self-rated health (Ross and Bird, 1994 in Peek et al. 1999). Gender variations may be traced in part to measurement bias. For example, some studies identify the gendered nature of certain instrumental activities of daily living (IADL) tasks, a set of activities used to gauge functional ability, as a possible cause of differences in ALE between males and female (Allen, Mor, Ravis and Houts, 1993 in Peek et al. 1999). Prior study on ALE in the Philippines however, indicated no clear trend of gender advantage except at age 80 years where males showed significantly higher proportion of ALE (Lamb, 1999).

A small but growing body of literature demonstrates higher education to be associated with better functioning (Camacho et al. 1993; Crimmins and Saito, 2001; Land et al. 1994; Meng-Fan Li, 2003). In the U.S., findings indicate initial signs of a compression of morbidity or a shortening of the period between final illness and death, for those of higher educational status as evident in the concentration of the increase in healthy life expectancy among those with the highest level of education while those in the lower education are still experiencing an expansion of morbidity (Crimmins and Saito, 2001). The mechanism by which education impinges on health is manifest through its impact on lifestyle and health behaviors. Low levels of education appear to influence behaviors that are significantly associated with adverse health outcomes (Haveman and Wolfe, 1984). In particular, people with lower SES who are also more likely to have low education are more likely to have greater exposure to wider range risk factors such as smoking, alcohol drinking, lack of exercise, unhealthy diet and work hazards, factors whose effects are cumulative over a lifetime and may manifest in functional health problems at old age.

But while advancing age may be associated with a higher likelihood of disability the process of decline in health is not irreversible. Studies on health dynamics cite significant evidence of recovery from disability among older people. In Japan approximately 30 per cent of older people who were in a state of disability in 1987 regained their functional ability during the following three years (Liu et al. 1995). A similar study among American older people reported a 20 per cent recovery rate within a two year period (Rogers, Rogers and Belanger, 1990) although these levels should not be compared given the differences in measures and time frames. In Taiwan, recent findings show a declining rate of recovery from inactive state as age increases with the males more likely to exhibit higher levels of recovery (Meng-Fan Li, 2003). A host of socioeconomic and environmental factors were found to explain health recovery including age, participation in organizational activities, social support and self-rated health. In particular, younger age and better self-rated health may influence health status by reducing the risk of becoming disabled or dying and by facilitating recovery (Liu et at, 1995). Particularly, the study shows lower education, not being married and smoking may increase the risk of disability, but they do not have a negative effect on recovery.

Subjects and Methods

Data for the study came from two elderly surveys: the1996 Philippine Elderly Study (1996 PES) and the 2000 Philippine Follow-up Survey (alternatively referred herein as the Panel Study). The 1996 PES is the first survey on a nationally representative sample of older people in the Philippines and designed to investigate how rapid demographic change in the society has affected the elderly. It collected a whole range of characteristics of older people including their health. A multi-stage sampling design was made to generate a total of 2285 respondents aged 50 years and older of which 1311 were aged 60 years and older.

The 2000 Philippine Follow-up Survey was likewise the first attempt to generate panel data on the elderly in the country. The follow-up data covered two out of five original areas of the 1996 PES namely MetroManila (NCR) and the province of Leyte, which together account for 46 percent of the total respondents in the 1996 PES (Natividad and Cruz, 2002). Metro Manila was selected to represent the highly urban sample while Leyte represents a combination of both urban and rural. Basically the same survey instrument was used in both surveys with minor revisions in the follow-up questionnaire. A total of 932 respondents from the 1996 PES were tracked down for a follow-up interview from 2000 to 2002 for the panel study. Of this number, 68.9 per cent were successfully interviewed, 18.1 per cent died and 13 per cent were lost to follow-up.

For those who were reported to have died at follow up, mortality data came from interviews of surviving family members, neighbors and friends who were knowledgeable of the circumstances of the death and consisted of information on date and place of death, the cause of death and the health services received by the respondent prior to death. Among those who were reported lost to follow up, validation with the death registry of the National Statistics Office was conducted to verify whether the respondent who could not be located had actually passed away. Through this procedure we were able to improve our estimate of mortality.

Of the respondents who were reported to have moved from their original residence in 1996 all efforts were exerted to obtain information on their possible whereabouts. Based on this information the movers were followed up at their new addresses provided the new residence was within a reasonable distance from the original address or within the study areas in general. Through this procedure a number of those who in 2000 were not residing in their 1996 address were located.

Measurement

Definition of Health Status

In order to estimate Active Life Expectancy (ALE), health status is defined in terms of functioning ability based on ADLs and IADLs. Those who do not have difficulty performing four ADLs including walking around the house, eating, putting on clothes/dressing, and taking a bath/going to bathroom and five IADLs including preparing own meal, shopping for groceries or personal items, managing own money, doing light housework, and using transportation are regarded as healthy or active, otherwise unhealthy or disabled. Composite index combining ADLs and IADLs is expected to enhance the range and sensitivity of health measurement as compared to those limited to either ADL or IADL indicators only (Spector and Fleishman, 1998). In effect, respondents are classified as unhealthy if they are unable to independently provide self care or to perform the tasks necessary to live independently due to health problems.

Explanatory Variables

In order to examine changes in health status over two survey periods, three sets of explanatory variables, namely, demographic, socioeconomic and health behavior/self-assessed health are employed. The explanatory variables refer to information taken in 1996.

The demographic characteristics are age, sex and place of residence. Place of residence is categorized into urban and rural residence with the different social settings representing differences in lifestyle patterns and access to health facilities. Urban areas are normally associated with better level of health services while the rural setting is associated with lower incomes and poorer health access (Eberhardt et al. 2001).

Education is used as an indicator of socioeconomic status. The education variable was dichotomized based on the 1996 PES sample distribution which showed elementary education as the modal highest educational attainment (mean number of years in school is 4.6 years). Accordingly, education is categorized into those with elementary or less (meaning 6 years of schooling or less) and those with higher than elementary education (i.e. 7+ years of education).

There are a number of health-related explanatory variables used in the study. These are self-rated health, exercise and two health risk behaviors, smoking and drinking. Smoking and drinking are defined in terms of current health risk behavior (currently drinking or smoking vs. not currently smoking or drinking/never drank nor smoked). Those who never experienced the risk behaviors as well as those who dropped out from the habit were lumped together since data show them to have more comparable levels of functional disability. The variable exercise is also composed of two categories: those who engaged in physical exercise at least weekly and those who did so less frequently or not at all. Self-assessed health is categorized into those who perceived their health to be poor and those who assessed their health as not poor (i.e. fair, good, very good or excellent).

Data Analysis

The paper used two approaches to compute ALE: (1) the prevalence-based life table or the Sullivan method and the (2) multistate life table method (MSLT). This paper presents the ALE estimates from both methods although a direct comparison is not feasible given the differences in sampling structure.

The Sullivan method made use of the age- specific disability rates of the older population 50 years and over obtained from the 1996 PES and the age-specific mortality data by sex derived from the 1995 computed Life Table for the Philippines (Cabigon and Flieger, 1997**)**. We utilized the 1995 life table because life table for 1996, year the survey is conducted is not available. The proportion of institutionalized older people is negligible in the country thus, this is not taken into account in the computation of ALE. One limitation in the Sullivan method is that the method requires life tables by the specific subgroups of the population. The Sullivan method is often used to compute health expectancy by sex, partly because life tables by sex are available in the most of the countries in the world. In some countries, life tables are also available by ethnicity or by region. However, it is very rare to find life tables by the level of education or by urban/rural. In order to compute health expectancy by education, for instance, logitudinal survey data and the other methods of computation such as the MSLT are used.

For the MSLT method, there are four possible health transitions emanating from two initial health states (active or inactive): active to inactive; active to dead; inactive to active; inactive to dead) and the two retention statuses, (active to active; inactive to inactive). This multi-state approach for computing ALE was performed with the aid of a computer program called IMaCH (version 0.96), a maximum Likelihood Computer Program using Interpolation of Markov Chains developed by Brouard and his colleagues at INED (Brouard and Lievre, 2002) and using methodologies pioneered by Laditka and Wolf (1998).

The IMaCH assumes that age-related changes in health are governed by a Markovian process. Under the Markov assumption, an unhealthy male or female at any age has at least a probability of returning to the healthy state with the probability of recovery being independent of either the duration of the current episode of poor health or the occurrence of prior episodes of poor health (Laditka and Hayward, 2003). The basic methodology of IMaCH is multinomial logistic regression model to generate health transition probabilities. It produces outputs of total life expectancy and health expectancy with standard errors of the estimates.

IMaCH computes for both the population and status-based life table estimates. Population-based tables describe the potential life cycle events for the whole population while the status-based tables can be used to compare the prospective life cycles of those who reach specified ages in different health states (Saito, Crimmins and Hayward, 1999).

To explore the factors associated with health transitions, multinomial logistic regression (MNLR) was employed using the panel data. Two separate models of health transition were considered, each emanating from either of two initial health states: active or inactive. For both models, the reference category was those who retained their initial health states. Four states are considered at follow up: active, inactive, dead and lost to follow up. Although "lost to follow-up" is not a health outcome, it was included in the modeling and treated as a separate category to include all possible trajectories that the respondents in the initial study may take so as to avoid bias in the estimate. A multiple classification analysis (MCA) was conducted to show the marginal effects of the independent variables for each of the transitions. The multinomial logistic regression analysis was performed using the STATA program (version 8).

Results

Active Life Expectancy (Sullivan Method)

Results from the Sullivan Method shown in Table 1 indicate that a considerable proportion of older people's remaining life is lived in inactive state. Generally the number of remaining active and inactive years decline with age albeit at a more gradual rate for the latter. They reach a convergence at about age 70 for the females and 75 for the males where a crossover is noted with more years expected to be spent in an unhealthy than healthy state.

[Table 1 about here]

Consistent with findings in advanced aging societies (Crimmins, Saito and Hayward, 1996; Rogers et al. 1989; Martin and Kinsella, 1994; Robine and Romieu, 1998) results reveal clear gender differentials with the females exhibiting an advantage in the total number of remaining years lived but with greater disability compared to the males. Results show significant difference in the number of remaining life lived in disability except those in the ages 75+ years. Sixty year old females for example can expect to live 7 years or 36 per cent of remaining life in disability compared to 4.7 years or 28 per cent, respectively for the males. The gender disparity in inactive life expectancy declines with age with the men expecting a lower proportion of remaining life lived in an unhealthy state until age 75. Beyond 75 men henceforth expect to live a higher proportion of their remaining years in an unhealthy state than do women. This pattern is consistent with the age and gender patterns of mortality and functional disability in the country, which also show a sex reversal in the 80+ age bracket (NSO, 2004; 1996 PES). These findings run counter to earlier researches in the country showing similar male and female inactive life expectancy estimates (Lamb, 1999).

Health Transition Patterns and Differentials (Panel Data)

Differences by Age and Initial Health State. Table 2 presents the distribution of respondents by initial health status in 1996 and health status at follow up in 2000 for those age 50 and above in 1996. The results show that there is significant movement in and out of one's initial health state suggesting that aging does not unequivocally mean a progressive physical decline. Rather there is evidence of recovery from unhealthy or inactive status. With the substantial proportion manifesting recovery from initial unhealthy status (22.8%) modeling transitions of functional status, completely ignoring the possibility of recovery from disability can be highly misleading (Liu et al. 1995). The high rate of recovery noted in the country that has been established in this study suggests the need to take this factor into account if a more realistic estimate of functional health transition is to be achieved.

[Table 2 about here]

Initial health status poses a significant influence on future health prospects regardless of gender. Those who are initially active are more likely to retain their health status, and less likely to experience disability and mortality. They are also more likely to be lost to follow-up which is expected given that they are more mobile than those who were initially in an inactive state. More than twice of those who are initially active remained functionally able in the follow-up period than those with functional disability to start with, particularly among the males. Those who are initially unhealthy are also more than thrice more likely to experience mortality compared to those who are initially healthy. In terms of retention, or staying in the same status for both 4-year observation period, unhealthy females experience higher retention rates which coupled with their lower mortality help explain their increased chance of experiencing a higher proportion of their remaining years in an inactive state.

Determinants of Health Transition. As shown in the bottom panel of Table 3, majority of those who reported being active in 1996 did not experience a change in their health status within the 4-year observation period. Among the initially active, 58 per cent remained active, 16 per cent became inactive, 14 per cent died and 13 percent were lost to follow-up. For the initially inactive the bottom panel of Table 4 shows the proportion in each transition state. The initially inactive were more likely to die (39%) but less likely to be lost to follow-up (8%). Those who remained inactive constituted 31 per cent of cases while 23 per cent recovered from an initial inactive state.

[Table 3 about here]

Table 3 shows the marginal effect of each explanatory variable on the transition probability among the initially active. Only significant predictors are shown. Results indicate the significant effect of age, gender, place of residence, drinking behavior and self-assessed health status on the probability of dying. Education does not appear to have a significant effect.

For those active, each additional year resulted in a 7 per cent increase in a healthy person's probability of transitioning to death. Males are 60 percent more likely to die than females. Finding show the urban disadvantage with urban residents 21 per cent more likely to experience mortality and 42 per cent more likely to experience health decline compared to rural residents. Those who were not currently drinking in 1996 were more likely to die compared with those who were currently drinking. Although seemingly counterintuitive, this negative association between drinking and the risk of death is actually not unexpected. Those who did not drink in 1996 likely included a large proportion who have stopped drinking because of health reasons and being in poorer health predisposed them to death more than current drinking did. Those who were currently drinking could have been a healthier lot. Those who gave a positive self assessment of their health were less likely to die confirming previous findings showing self assessed health to be a strong predictor of mortality (Ofstedal et al. 2002).

As shown in Table 4, among those inactive in 1996, each additional year translates to a 9 per cent decline in their chance for recovery and a 7 per cent increased risk of mortality. Urban elderly are also less likely to bounce back to active state while those with positive health state assessment register a 53 per cent increased chance of recovery.

Significant gender effect on health transition is noted over the 4 year period with the males more likely to die regardless of health state. However, there is no effect of gender on changes in health over the same period. Although findings are not significant, education effect shows an interesting pattern with the better educated less likely to die compared to those with lower education. Moreover, the former exhibit a higher retention rate as evident in the higher proportion among the unhealthy who remain unhealthy within the 4 year period (data not shown).

[Table 4 about here]

Differentials in ALE (Multistate Life Table Method)

Although we know that the effect of education is not statistically significant on any health transitions and effect of residing on urban is significant on several health transitions from MNLR analyses, we estimated active life expectancies using IMaCh with education and place of residence as the only covariate other than age. Results in Tables 5 and 6 show the population-based and status-based estimates of total, active, and inactive life expectancies, including their standard errors by education and place of residence, respectively. The former is a summary indicator of the entire sample while the latter takes into account initial health state.

[Table 5 and Table 6 about here]

Estimated life expectancies are not statistically significantly different by the level of education as indicated by standard errors. Results, however, indicate that the better educated (higher than elementary) expect to live longer than the less educated (elementary and below) among those below age 70. Like females, the better educated expect more years lived in an unhealthy state and a higher proportion of unhealthy life years to total life expectancy.

In terms of place of residence, rural residents generally expect to live longer and to spend a relatively lower proportion of that time in an unhealthy state. A 60 year old rural resident for example can anticipate to live almost 15 more years on the average or 1.5 years longer than an urban resident of the same age, 26 per cent of which will be lived in an unhealthy state while the comparable percentage for the urban resident is 43 per cent. This urban-rural disparity widens with advancing age.

Discussion

In the Philippines, the concept of health expectancy and active life expectancy are relatively new. Only two previous explorations in HE have been conducted prior to this study including an inter-country comparison in HE using ADL indicators from the 1984 WHO data (Lamb, 1999) and the self-assessed health measure using the 1996 Philippine Elderly Survey (PES) (Ofstedal et.al. 2002). Both studies made use of the Sullivan method to measure ALE.

In this analysis of ALE using 1996 PES data findings on the age and gender patterns in ALE generally conform with the observed patterns in Western societies where population aging has been going on for a much longer period. Overall we found that the number and proportion of healthy years decline with age for both sexes. Females are more likely to outlive males although females can expect to live a greater part of that life in a state of functional impairment, a finding that is generally reported in the literature on aging and health in other countries.

These findings suggest that the use of functional measures of health, the ADLs and IADLs although developed in Western settings are appropriate measures of functional status in a developing country such as the Philippines. Moreover our findings lend support to the frailty model which posits an expansion of morbidity accompanying a decline in mortality. It also implies that as we anticipate future expansions in the size of the older population a corresponding increase in the projected number with disability is expected, disproportionately so for females than males. Future policies should thus be able to articulate appropriate mechanisms to respond to this eventuality, particularly the provision of health services, health insurance and social security for the anticipated increase in the number of inactive older people in need of support. This is important in the light of current conditions of the country where the health infrastructure has generally been oriented towards infectious diseases and maternal and child health making it less equipped to handle the health requirements of older people (Hermalin, 2003).

What is somewhat unexpected is the negative effect of education on ALE from the panel data. Contrary to findings in aging societies, the better educated Filipino older people and by implication those with higher SES appear to be at a disadvantage in active life expectancy. While the better educated expect longer years to live, they also expect to live longer years and a higher proportion of remaining years in an inactive state. Given the expected increase in the level of education in the country over time, this implies that we can expect further declines in population health among older people in the future, until such time that that the effect of education become the same as that observed in the developed countries.

Conclution

There are 3 ways of interpreting the education-ALE finding. Firstly, the results are totally unreliable and there is no difference in estimated active life expectancies by education because standard errors indicate the difference is not statistically significant. Secondly, the results are wrong and the effect of education should be positive. Thirdly, the results are close to the fact but standard errors are estimated too large because of the sample size and missing cases. There is ample evidence of the effect of education on health from developed countries as discussed earlier to take the second interpretation of the results. There is a possibility of third interpretation although there is a need to probe further the mechanisms that underlie such a finding. It is possible that given the differential access to health care in a high poverty setting like the Philippines, the better educated who can afford better care are able to prolong life but not prevent the onset of disability. Thus they may live longer but are more unhealthy. In contrast, the less educated who have less access to health care are likely to die sooner. Support for the differential access to health care by education has been reported in an analysis of unmet need for health care among older Filipinos with those of lower education reporting the highest rates of unmet need, the most common reason given being “no money, cost too high (Ofstedal and Natividad, 2002). In addition, paper by Hidajat, Hayward and Saito (2004) suggests such relationship between education and health in Indonesia and China. Generally too, the link between education and measures of functional health in the

Philippines is weak as reported by Zimmer,et.al (2000) in a comparative study of Thailand, Taiwan and the Philippines.

Another finding that needs further study is the rural-urban differential. Generally we found that urban residents expect to live fewer years than rural residents and to spend a higher proportion of those years in an unhealthy state. Being an urban resident appears to put an older person at a disadvantage in general. It is also a risk factor for transitioning to an unhealthy state or to death among those who start out from a healthy state. Similar findings of an urban-rural differential in Thailand and China (Jitapunkul et al. 1999 cited in Saito, 2003; Wang, 1993 cited in Saito, 2003) suggest that urbanization in developing country settings may have an adverse effect on active life expectancy. Given the rapid pace of urbanization in these countries there is need to study further how this phenomenon affects health in general and the health of older people in particular.

Our analysis of factors that affect specific health transitions show that when controlling for initial health state age, gender and urban-rural residence effects remain. Moreover, among those in active state drinking showed a significant effect on the risk of dying. This suggests the role of lifestyle change in any future intervention program designed to increase active life expectancy among older people in the Philippines. Findings of a significant effect of self assessed health on the risk of death (among the healthy) and the risk of recovery (among unhealthy) also buttress previous findings showing self assessed health to be a strong predictor of mortality (Ofstedal. 2002), and health status.

To date much of the country's policy for older people has centered on the need to provide for health care in the form of curative services. The most significant provision in the Senior Citizens' Act (Republic Act 7432) of 1992 has been the grant of a 20 per cent discount on medicines for older people, age 60 and over- regardless of socioeconomic status. This works to the benefit of older people who have the means to purchase medicines in the first place but have no beneficial effect on those who can not afford to buy medication at all. A recently passed supplementary law to the Senior Citizens Act, RA 9257, the Expanded Senior Citizens Act of 2003 grants additional benefits that essentially expand the medical cost provisions. Specifically RA 9257 exempts the elderly from diagnostic and laboratory fees from government health centers in addition to other provisions. While such policy has the potential to provide economic relief to older people who face the burden of increased medical costs at a time when their earning capacity has diminished and there are no social safety nets other than the family to shoulder the cost of health care it fails to conceive of the issue of elderly health as more than just a medical one. Our findings on active life expectancy demonstrate that prolonging life may only mean prolonging an unhealthy life. Thus there is a need to consider the quality of life issue when policies about older people are drawn. For example, our findings underscore that promoting lifestyle change in general may be a useful addition to existing government programs to improve elderly health. Rather than simply offering ways to alleviate the cost of curative care, promotion of behaviors that are preventive in nature may go a longer way in improving elderly health and increasing active life expectancy.

The study has certain limitations. First is the much lower estimated total life expectancies compared to the published life tables. This is attributed to the problems in the data set. As noted earlier, data for the panel data covered only 2 of the 5 sample regions included in the first nationally representative survey. This resulted to a limited sample size to permit a more sophisticated levels of analysis particularly examining the ALE at the national level and for certain subgroups of the population. Given this, we can not generalize the findings based on the panel data.

As in any longitudinal study, attrition of cases posed a limitation of the data. This was largely due to migration and outright refusal. This problem was inevitable despite strategies employed to minimize this including tracking down respondents who were originally reported to have moved out from their original place of residence and by tracing possible mortality cases among those lost to follow-up. The fact that the original survey design was not planned as a longitudinal survey likewise contributed to the attrition problem.

The significant potential of panel data in advancing aging research in the country, particularly in the area of health transitions, underscores the need for a well planned longitudinal survey in the developing countries, in general and in the Philippines in particular.

References

Antonucci, T (2001). Social Relations: An examination of Social Networks, social support and sense of control. In, Birren and Schaie (ed). *The Handbook of the Psychology of Aging,* (pp. 427-452). San Diego: Academic Press.

Bengston V. L. & Shaie, K.W., eds (1999). *Handbook of Theories of Aging.* New York: Springer Publishing Company, Inc.

Brouard, N. & Lievre, A. (2002). Computing Health Expectancies using ImaCh (A Maximum Likelihood Computer Program using Interpolation of Markov Chains), INED and Euroreves.

Cabigon, J.V. & Flieger, W. (1997). 1995 *Gender-specific life tables for the Philippines, its regions and provinces*. Manila, National Statistics Office. Monograph No 17.

Camacho, T. C., Strawbridge, W.J., Cohen, R. D. & Kaplan, G. A. (1993). Functional Ability in the Oldest Old: Cumulative Impact of Risk Factors from the Preceding Two Decades, *Journal of Aging and Health* 5:439-54.

Crimmins, E. (1996). Mixed Trends in Population Health Among Older Adults, *Journal of Gerontology* 51B (5): S223-S225.

Crimmins, E.M., Saito, Y. & Hayward, M. D. (1993). Sullivan and Multistate Method of Estimating Active Life Expectancy: Two Methods, Two Issues. In J.M. Robine, C.D. Mathers, M.R. Bone & I. Romieu (eds), *Calculation of Health Expectancies: Harmonization, Consensus Achieved and Future Perspectives*, (pp. 155-60). Paris: Libbey Eurotext.

Crimmins, E., Saito, Y. & Ingegneri, D. (1989). Changes in life expectancy and disabillity-free life expectancy in the United States, *Population and Development Review* 15:235-267.

Deeg, D., Verbrugge. L. & Jagger, C. (2003). "Disability Measurement" in J.M. Robine, C. Jagger, C. D. Mathers, E. M. Crimmins, and R. Suzman (Eds.). *Determining Health Expectancies* (pp. 203-220). West Sussex, England: John Wiley and Sons, Ltd.

De Guzman, E., Magracia, M.L. & Zablan, Z. C. (1995). Mortality Differentials in the Philippines. Manial, National Statistics Office. Monograph No. 6.

East-West Center (2002). *The Future Population in Asia*. Honolulu: East-West Center.

Eberhardt, M.S., Ingram, D.D. & Makuk, D.M. (2001). Urban and Rural Health Chartbook, Health, US, 2001. Hyattsville, Maryland: National Center for Health Statistics.

Haveman, R. H. & Wolfe, B. (1984). Schooling and Economic Well-being: The Role of Nonmarket Effects. *Journal of Human Resources* 19(summer): 378-407.

Hayward, M. D. & Heron, M. (1999). Racial inequality in active life among adult Americans. *Demography* 36(1), 77-91.

Hermalin, A. I. (2003). *The Well Being of the Elderly in Asia: A Four-Country Comparative Study*. Ann Arbor, Michigan: University of Michigan Press.

House, J. S., Kessler, R. C. & Herzog A. R. (1990). Age, socioeconomic status and Health, *The Milbank Quarterly* 68, 383-411.

House, J.S., Lepkowski, J.M., Kinney, A.M. , Mero, R. P., Kessler, R. C., & Herzog, A. R. (1994). The Social Stratification of aging and health, *Journal of Health and Social Behavior* 35, 213-234.

Idler, E. L. & Benyami, Y. (1997). Self-rated health and mortality: A review of twenty-seven community studies, *Journal of Health and Social Behavior* 36:21-37.

Jagger, C. (1999). “Health Expectancy Calculation by the Sullivan Method: A Practical Guide”, *NUPRI Research Paper Series* No. 68. Tokyo: Nihon University Population Research Institute.

Lamb, V. L. (1999). Active Life Expectancy of the Elderly in Selected Asian Countries, *NUPRI Research Paper Series* No. 69. Tokyo: Nihon University Population Research Institute.

National Statistics Office (2002). *Census on Population and Housing*. Manila.

National Statistics Office (1997). *1995 Census-based National and Regional Population Projections.* Vol. 1. Manila.

Natividad, Josefina N. (1999). Health Status and Health Risk Behavior of the Elderly and the Near Elderly. Paper presented at the National Conference on the Filipino Elderly, Mandaluyong City, Philippines.

Natividad J. & Cruz, G. (2002). A Feasibility Study on the Use of the Panel Design for the Study of the Elderly and the Course of Aging in the Philippines: The Visayan Sample. Report submitted to the CIDS, University of the Philippines, Diliman.

Nusselder, W. J., & Looman C. (2004). Decomposition of Differences in Health Expectancy by Cause. *Demography* 41,2 : 315-334.

Ofstedal, M.B., & Natividad, J. (2002). Patterns of health service utilization. In A.I. Hermalin (ed.), *The Well-Being of the Elderly in Asia: A Four-Country Comparative Study*. Ann Arbor, MI: University of Michigan Press.
Ofstedal, M. B., Zimmer, Z., Cruz, G., Chan, A. & Lin, Y.H. (2002). A Comparison of Self-Assessed Health Expectancy Among Older Adults in Several Asian Settings. Paper presented at the Gerontological Socialety of America Annual Scientific Meeting, Boston, Massachusetts.

Saito, Y., Qiao, X & Jitapunkul, S. (2003). Health Expectancy in Asia. In J.M. Robine, C. Jagger, C. D. Mathers, E. M. Crimmins, & R. Suzman (eds.). *Determining Health Expectancies* (pp. 289-318). West Sussex, England: John Wiley and Sons, Ltd.

Schoen, R (1975). Constructing increment-decrement life tables, *Demography 1*2, 313-324.

Schoen, R. & Woodrow, K. (1980). Labor force status life tables for the United States, 1972, *Demography* 17, 297-322**.**

Spector, W. D. & . Fleishman, J. A (1998). Combining Activities of Daily Living With Instrumental Activities of Daily Living to Measure Functional Disability. *Journal of Gerontology:* Social Sciences 53 (1):S46-S57.

Sullivan D.F. (1971). A single index of mortality and morbidity, *HSMHA Health Rep* 86:347-354.

Verbrugge, L.M. & Jette, A. (1994). The Disablement Process. *Social Science and Medicine* 38, 1-14.

Verbrugge, L. M. (1989). Recent, Present, and Future health of American Adults, *Annual Review of Public Health* 10:333-361.

Zimmer, Z., Liu, X., Hermalin, A. & Chuang, C. (1998). Educational Attainment and Transitions in Functional Status among Older Taiwanese, *Demography* 35(3): 361-375.

Zimmer, Z., Natividad, J., Lin, H.S. & Chayovan, N. (2000). A Cross-national Examination of the Determinants of Self- Assessed Health, *Journal of Health and Social Behavior* 41: 465-481.

Zimmer, Z., Natividad, J.,. Ofstedal, M. B & Lin, H. (2002). Physical and mental health and well-being. In A. I. Hermalin (ed), *The Well-being of the Elderly in Asia: A four-country Comparative Study*. Ann Arbor, Michigan: University of Michigan Press.

Table 1. Active Life Expectancy (ALE) by age and sex, 1996 (Sullivan method)

Age and Sex	Status/ Life Expectancy (in years)			% of inactive life
	Total	Active	Inactive	
Male				
50	23.7	18.9	4.9*	20.5
55	20.1	15.2	4.9*	24.2
60	16.8	12.1	4.7*	27.9
65	13.7	9.2	4.4*	32.4
70	10.9	6.4	4.5*	41.4
75	8.4	4.1	4.3	51.1
80	3.5	1.2	2.3	64.6
Female				
50	27.0	19.3	7.8	28.7
55	23.0	15.8	7.2	31.2
60	19.0	12.2	6.9	36.1
65	15.4	9.1	6.3	40.8
70	12.0	5.9	6.1	50.9
75	9.0	3.9	5.1	56.8
80	3.6	1.4	2.2	62.0

- indicates difference between genders is significant at 0.01 level.

Table 2. Health Transitions among Filipino Older People between, 50+: 1996 and 2000 by initial health state, sex and age: Panel Data

Sex and Age	**Active**	**Inactive**	**Dead**	**Moved/Lost to follow up**	**Total (N)**
Both Sexes					
Active	57.6	15.4	13.8	13.2	100 (622)
Inactive	22.8	30.3	38.6	8.3	100 (145)
Male					
Active	57.7	13.5	16.8	11.8	100 (279)
Inactive	16.0	26.0	50.0	8.0	100 (50)
Female					
Active	57.4	16.9	11.1	14.6	100 (343)
Inactive	25.8	33.3	33.3	7.5	100 (93)

Table 3. Results of Multinomial Logistic Regression: Marginal Effects of Explanatory Variables on Transition Probabilities of Functional Status among those who were healthy at initial state, Panel Data

Explanatory Variables	Transition from Healthy			
(Baseline Characteristics)	to healthy	to unhealthy	to death	to 'lost to follow-up'
Age		0.02**	0.07**	
Male (Male=1)			0.60**	
Urban (Urban=1)		0.42*	0.21*	0.53**
Education (High school=1)				
Smoking (currently smoking=1)				
Drinking (currently drinking=1)			-1.41**	-0.32*
SAH (good or better=1)			-0.90*	
Exercise (exercise at least weekly =1)				
Sample Estimate	.575	.155	.138	.132

*.01< p ≤ .05; ** p ≤ .01.

Table 4. Results of Multinomial Logistic Regression: Marginal Effects of Explanatory Variables on Transition Probabilities of Functional Status among those who were unhealthy at initial state, Panel Data

Explanatory Variables	Transition from Unhealthy			
(Baseline Characteristics)	to healthy	to unhealthy	to death	to 'lost to follow-up'
Age	- 0.09*		0.07**	
Male (Male=1)			0.55**	
Urban (Urban=1)	-0.97*			
Education (High school=1)				-7.7*
Smoking (currently smoking=1)				
Drinking (currently drinking=1)				
SAH (good or better=1)	0.53*			
Exercise (exercise at least weekly =1)				
Sample Estimate	0.227	0.306	0.387	0.080

*.01< p ≤ .05; ** p ≤ .01.

Table 5. Population-based active life expectancy by education

	Primary education				Secondary or higher			
Age	Total LE	Active LE	Inactive LE	% of inactive LE	Total LE	Active LE	Inactive LE	% of inactive LE
50	20.1 (1.1)	15.6 (1.0)	4.5 (0.6)	22.4	21.7 (1.6)	15.9 (1.5)	5.8 (1.0)	26.7
60	14.0 (0.7)	9.7 (0.7)	4.4 (0.5)	31.4	14.5 (1.3)	9.3 (1.2)	5.1 (0.9)	35.2
70	8.9 (0.6)	5.2 (0.5)	3.8 (0.4)	42.7	8.8 (1.0)	4.7 (0.9)	4.0 (0.8)	45.5

Table 6. Population-based active life expectancy by place of residence

	Rural				Urban			
Age	Total LE	Active LE	Inactive LE	% of inactive LE	Total LE	Active LE	Inactive LE	% of inactive LE
50	21.2 (1.2)	17.3 (1.1)	3.9 (0.5)	18.4	20.2 (1.3)	13.7 (1.2)	6.5 (0.9)	32.2
60	14.9 (0.9)	11.1 (0.8)	3.8 (0.5)	25.5	13.4 (1.0)	7.6 (0.8)	5.8 (0.7)	43.3
70	9.6 (0.7)	6.2 (0.7)	3.4 (0.5)	35.4	8.2 (0.7)	3.6 (0.6)	4.6 (0.6)	56.1