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Asia Pac J Public Health published online 26 May 2011
DOI: 10.1177/1010539511409923

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What is This?
Changes in Active Life Expectancy Among Older Thais: Results From the 1997 and 2004 National Health Examination Surveys

Uthaithip Jiawiwatkul, PhD¹, Wichai Aekplakorn, MD, PhD¹, Patama Vapattanawong, PhD¹, Pramote Prasartkul, PhD¹, and Yawarat Porapakkham, MD, MPH²

Abstract
This study aims to determine the disability prevalence and changes in active life expectancy of the Thai older people between 1997 and 2004. Data on disability of older people aged ≥60 years were obtained from the National Health Examination Surveys. Disability refers to one or more restrictions on the activities of daily living. The Sullivan method was used to calculate active life expectancy. A total of 4048 older people in 1997 and 19372 older people in 2004 were included in the analysis. Active life expectancy at age 60 of men was 16.5 years in 1997 and 17.6 years in 2004, whereas that of women was 17.9 and 19.9 years, respectively. Women spent a greater proportion of the remaining life with disability. The proportion of active life for both genders also increased during the 7-year period suggesting an evidence of the compression of morbidity in Thai older people.

Keywords
active life expectancy, disability, older Thais

Introduction
The age structure of the Thai population has been rapidly changing, similar to other middle-income countries, as a result of the substantial long-term declines in fertility and mortality. Both the absolute size and proportion of adults aged 60 years and older are increasing dramatically. The proportion of Thai population aged 60 years and older increased from 5% (1.7 million) of the total population in 1970 to 9.5% (5.9 million) in 2000 and projected to reach 21% (14.6 million) by the year 2025.¹ The life expectancy (LE) at birth for males and females increased from 58.0

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and 63.8 years in 1970 to 69.9 and 74.9 years in 2000 and has been projected to be 74.8 and 80.3 years in 2025, respectively. An increasing number of old age population with long LE leads to a question of whether the older people live longer with healthy life. Active life expectancy (ALE) is a useful indicator to answer the question. It summarizes how morbidity and mortality combine to determine the expected years of active and inactive life for the average persons in the population. ALE refers to expected number of years lived without disability based on the model of performance for activities of daily living (ADL). The sum of the expected number of years spent in disabled and active states equal to total LE. ALE can be considered in absolute terms, that is, the number of remaining years lived without disability, or in relative terms, that is, the proportion of ALE to the total LE.

The increase in LE and in the proportion of the older people could result in at least 3 scenarios related to ALE. First, the optimistic view considering that the onset of chronic diseases can be postponed by primary and secondary prevention of illnesses through health services and personal healthy lifestyle; thus, morbidity and disability will then be compressed into a shorter period of time at the end of life. This scenario results in the increase in proportion of years spent with healthy life. Second, the pessimistic view is that the increase in longevity does not reflect the improvement in morbidity and disability. The increase in LE is more likely because of the reductions in fatality rates from chronic diseases rather than to the declines in the incidence of these diseases. Consistent studies in the West and Asia showed increases in the proportion of years spent in poor health among older people with longer lives. The third scenario considers the reconciliation between the optimistic and pessimistic views. The increase in LE is partly explained by a slowing down in the rate of progression of chronic disease. Thus, the decline in mortality leads to the increase in the prevalence of chronic disease but less severe.

In Thailand, there was very limited information on the changes in pattern of ALE of older people. Thus, this study aimed to examine disability prevalence and changes in ALE of the Thai older people between 1997 and 2004. Understanding the pattern of ALE would be helpful in guiding health care planning to reduce the burden from illnesses and disabilities.

Methods

This study used 2 types of data: disability and mortality data. The prevalence of disability in ADLs was obtained from the second and third National Health Examination Surveys (NHES II and NHES III), conducted in 1997 and 2004, respectively. The NHES II and NHES III are cross-sectional surveys of multistage probability sampling of the noninstitutionalized Thai population. A 3-stage stratified probability sampling method was used to yield a nationally and regionally representative sample in both surveys and the sampling methods have been described elsewhere. Briefly, the first stage of sampling was a random selection of provinces (8 in 1997 and 36 in 2004). The second stage, for each province, electoral units in urban areas or villages in rural areas were randomly selected by proportional to size (PPS) and the final stage involved random selections of a predetermined number of individuals (aged ≥1 year in 1997 and aged ≥15 years in 2004) in each of the electoral units and villages. Finally, a sample of 16 176 persons aged ≥1 year in 1997 and a sample of 39 290 persons aged ≥15 years in 2004 were obtained. The present study focused on the older people aged 60 years and older, including 4048 persons in 1997 and 19 372 persons in 2004. The response rates of elderly sample were 80.8% in 1997 and 92% in 2004. Quality of information was ensured in the data collection in both surveys by interviewers’ training, and fieldwork supervision and checking for relevancy of data.

Both surveys have a similar set of questions to measure 6 activities of basic ADL. The information was obtained by face to face interview. In both surveys, the majority of respondents
 (>92%) were able to be interviewed on their own whereas the rest were accompanied by a close relative or others who stayed in the same house to facilitate the interview.

ADL disability is considered essential to ensure the independent living or active life. In this study, a person is defined as “having ADL disability” or “is disabled” if he or she reported being unable to do one or more of ADLs by himself or herself without aids. These activities are eating, dressing, bathing, toileting, moving within the house, and moving between bed and chair. The age-specific prevalence of ADL disability was calculated for the year 1997 and 2004 of men and women. The overall age-adjusted prevalence of ADL disability of both years was standardized based on the Thai population of year 2004.

Mortality data were obtained from the Survey of Population Change (SPC), which is a survey conducted by the National Statistical Office (NSO) at an interval of every 10 years. Mortality data from the 2005-2006 SPC were adjusted for the completeness of deaths and were then used to construct the abridged life tables for the Thai population in 2004. Because of the incompleteness of mortality data in 1997, a constructed life table for the year 2004 was also used for the 1997 calculation of ALE.

Active life expectancy refers to the average number of years an individual is expected to live without restriction in a number of ADLs as mentioned above.

Life table technique and the Sullivan method were employed to estimate ALE based on prevalence of disability. Briefly, the first step was the calculation of the person-years of life spent in active state or without disability for each age interval by multiplying the \( nL_x \) function from life table with the age-specific disability prevalence. Then, these person-years in active were summed from age \( x \) and older to produce the total person-years in active state. The final step was the calculation of ALE by dividing the age-specific total person-years by the age-specific \( l_x \) function from the life table.

**Ethical Approval**

This study was approved by the ethical committee of Ramathibodi Hospital, Mahidol University, Committee on Human Rights related to researches involving human subjects, based on the Declaration of Helsinki. The informed consent forms were obtained from all respondents in both surveys.

**Results**

Table 1 shows characteristic of the respondents distributed by age group and educational levels in 1997 and 2004. The proportions of individuals aged ≥80 years was significantly higher in women than in men \((P < .05)\) and higher in 2004 than in 1997 for both genders \((all Ps < .05)\). The proportions of older persons having educational levels of secondary school or higher were significantly higher in men than in women \((all Ps < .05)\) for both years and also significantly higher in the year 2004 than in 1997 for both genders \((all Ps < .05)\).

**Prevalence of ADL Disability**

Overall, the age-standardized prevalence of disability among older men decreased from 9.8% in 1997 to 3.6% in 2004, whereas that of older women decreased from 13.0% in 1997 to 5.2% in 2004 (Table 2). The older women had significantly higher prevalence of ADL disabilities in almost every age group compared with older men. Prevalence of ADL disabilities among older persons with primary school or lower education was significantly higher than those with secondary school or higher education. These patterns were similar for both years.
Table 1. Distribution (Percentage) of Older Thais by Gender, Age Group, and Education Level in 1997 and 2004

<table>
<thead>
<tr>
<th>Sociodemographic Background</th>
<th>1997</th>
<th></th>
<th>2004</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men (n = 1731)</td>
<td>Women (n = 2317)</td>
<td>Total (n = 4048)</td>
<td>Men (n = 9419)</td>
<td>Women (n = 9953)</td>
</tr>
<tr>
<td>Age group (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-64</td>
<td>35.5</td>
<td>33.2</td>
<td>34.3</td>
<td>30.5</td>
<td>27.9</td>
</tr>
<tr>
<td>65-69</td>
<td>26.8</td>
<td>26.1</td>
<td>26.4</td>
<td>25.5</td>
<td>24.5</td>
</tr>
<tr>
<td>70-74</td>
<td>18.7</td>
<td>18.6</td>
<td>18.7</td>
<td>18.5</td>
<td>18.8</td>
</tr>
<tr>
<td>75-79</td>
<td>10.4</td>
<td>10.9</td>
<td>10.7</td>
<td>11.3</td>
<td>12.3</td>
</tr>
<tr>
<td>≥80</td>
<td>8.5b</td>
<td>11.2b</td>
<td>9.9b</td>
<td>14.3b</td>
<td>16.6b</td>
</tr>
<tr>
<td>Education attainment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school and lower</td>
<td>92.3</td>
<td>96.8</td>
<td>94.7</td>
<td>89.3</td>
<td>96.5</td>
</tr>
<tr>
<td>Secondary school and higher</td>
<td>7.7b</td>
<td>3.2a</td>
<td>5.3</td>
<td>10.7b</td>
<td>3.5a</td>
</tr>
</tbody>
</table>

*aSignificant difference between men and women of the same year at P < .05.
*bSignificant difference between 1997 and 2004 of the same gender at P < .05.

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Table 2. Age- and Gender-Specific Prevalence and 95% CI of ADL Disabilitya of Older Thais in 1997 and 2004

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>1997</th>
<th></th>
<th>2004</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prevalence (%)</td>
<td>95% CI</td>
<td>Prevalence (%)</td>
<td>95% CI</td>
<td>Prevalence (%)</td>
</tr>
<tr>
<td>60-64</td>
<td>7.1</td>
<td>4.8, 9.4</td>
<td>5.8c</td>
<td>3.9, 7.6</td>
<td>2.0c</td>
</tr>
<tr>
<td>65-69</td>
<td>10.7c</td>
<td>7.7, 13.6</td>
<td>11.5c</td>
<td>8.9, 14.0</td>
<td>2.1c</td>
</tr>
<tr>
<td>70-74</td>
<td>10.8c</td>
<td>7.3, 14.2</td>
<td>15.3c</td>
<td>11.6, 19.1</td>
<td>4.1bc</td>
</tr>
<tr>
<td>75-79</td>
<td>5.9b</td>
<td>2.5, 9.2</td>
<td>17.6bc</td>
<td>12.6, 22.5</td>
<td>4.4b</td>
</tr>
<tr>
<td>≥80</td>
<td>20.7bcd</td>
<td>13.9, 27.4</td>
<td>32.7bc</td>
<td>26.2, 39.2</td>
<td>13.0d</td>
</tr>
</tbody>
</table>

Abbreviations: ADL, activities of daily living; CI, confidence interval.
*aDefinition of ADL disability in 1997 and 2004: unable to do one or more of activities of daily living, including eating, dressing, bathing, toileting, moving within the house, and moving between bed and chair.
*bSignificant difference between men and women of the same year at P < .01.
*cSignificant difference between 1994 and 2007 of the same gender at P < .01.
*dSignificant difference between 1994 and 2007 of the same gender at P < .05.
*eAge standardized to the 2004 Thai population.
Table 3 presents the total LE, ALE, and the proportion of ALE to the total LE (ALE/LE). The ALE at age 60 for men in 1997 and 2004 were 16.5 and 17.6 years, respectively. For women, ALE was 17.9 years in 1997 and 19.9 years in 2004. The life table results for both years showed that older women at all ages had longer LE than older men. ALE of women was also longer than that of men.

The proportions of the remaining years spent without disability, estimated from ALE/LE, were higher among men compared with women in all age groups. Men at age 60 who are expected to live in active state throughout their remaining lifetime were about 89.1% in 1997 and 95.3% in 2004. ALE/LE among women at age 60 was 83.3% in 1997 and 92.6% in 2004 (Table 3). The ALE/LE in both genders also decreased with increasing age. Both ALE and the ALE/LE for both genders and all ages increased between 1997 and 2004.

**Active Life Expectancy**

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**Discussion**

The findings from this study suggested marked decreases in disability rates and improvement in ALE in older Thais during this 7-year period. An evidence of gender differential in disability and ALE/LE was observed that the prevalence of disability in women was higher than that of men and the ALE/LE was lower in women compared with men.

The definition of ADL in this study was used in most other studies. The finding of improvement in the disability prevalence between 1997 and 2004 was consistent with other populations. The reduction in old-age disability rates in Japan was found during 1993-2002. Similar result among American older people was found in that disability prevalence decreased by 1.45% between 1997 and 2004. Comparison of the level of disability in this study and other studies...
must be taken with caution because of the different definitions and the level of disability severity among studies. In addition, ALE is sensitive to the different calculation methods. However, the trends or changes in disabilities with other countries that use relatively similar definitions could be compared.

The reduction in disability found in this study could be attributed to the improvement in medical care, and the increases in number of health promotion and prevention programs, which have been jointly implemented by the Ministry of Public health and Thai Health Promotion Foundation of Thailand in the past decade.

The findings of gender difference in disability and ALE/LE are consistent with other studies in many countries.22,23 The longer LE with disability among women may because of the relatively better survival among women after the development of disability.24 Previous study of the same population reported that the prevalence of chronic diseases such as hypertension and diabetes mellitus was higher in older women than in older men.25 These chronic diseases could result in disability conditions. Further study is needed to look into this issue. However, identification of older persons with disability along with health promotion and health service programs should be more targeted toward the older women.

The proportion of the remaining years spent without disability also decreased during this period, which supports the compression of disability in Thailand. The consistent result indicated the increase in active life expectancy among older Americans from 1992 to 2003.26 The reduction in lifetime with the unhealthy state was also found among Denmark older people between 1987 and 2005.27 A study in Netherlands revealed that the number of years with moderate and severe disabilities has reduced, resulting in an increase in the number of years with minor disabilities, which supported the scenario of dynamic equilibrium.15 However, our study did not estimate the degree of disability severity, thus the dynamic equilibrium could not be tested.

In addition, this study found differences in ADL disabilities with different levels of education, as those with lower education had more prevalence of disabilities. However, educational differences in ALE could not be categorized in this study because of the lack of information on educational status in the mortality data. Studies of population in Western developed nations indicated that the wealthy and highly educated persons spent a smaller proportion of disabled life compared with poor and less educated persons.24,28 Other studies from Asian countries indicated the consistent results that the proportion of life spent in active state was higher among older adults with higher socioeconomic status compared with their lower status counterparts.29,30 Therefore, further study of the differences in ALE between subgroups of population such as socioeconomic groups and minority groups are warranted. It is also important in the development of intervention program to reduce the health inequity in Thailand.

There were limitations in the present study. It is possible that the prevalence of disability from these consecutive surveys might be underestimated. Older persons with severe disability or bedridden conditions might not be included in the survey. Disability is reversible, thus people who enter into disabled state could exit from this state. The information on this reversible transition cannot be obtained from the cross-sectional survey. A longitudinal study of disability would provide such information, which has more benefits to monitor the program implementation. Owing to the incompleteness of age-specific mortality data among old age population in the 1997, the 2004 life table was used to estimate the ALE instead. This might overestimate the active life years for 1997 but underestimate the percentage changes of active life years.

Conclusions

ADL disability identifies basic independence in daily personal care and is often used as the benchmark for the burden of disease in elderly population. The findings indicated that older
women had higher prevalence of ADL disability than older men, and their prevalence increased with age. Although women lived longer than men, their proportion of the remaining years lived without disability, which was measured by the proportion of active life expectancy to the total life expectancy, was lower than that of men. The increase in proportion of the remaining years spent without disability during the 7-year period supports the compression of morbidity hypothesis. However, given the aging population, it is likely that the absolute number of older people living with disability is still substantial. Thus, adequate preparation for caring of the elderly who are in active state needs to be addressed at the family, community, and country levels. In addition, health promotion programs started in the young to prevent chronic diseases should be strengthened in order to minimize unnecessary morbidity and disability at older age.

Acknowledgments

We would like to thank the National Health Examination Survey Office, Health System Research Institute, and Bureau of Health and Strategy, Ministry of Public Health for their support in this study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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