DISABILITY AND ACTIVE LIFE EXPECTANCY AMONG OLDER CAMBODIANS

Zachary Zimmer

Older adults in Cambodia are survivors of harsh living conditions, including poverty and periods of extreme violence. Although these experiences may affect health outcomes, little data has existed to monitor Cambodia's older population. The current paper uses data from the 2004 Study of the Elderly in Cambodia (SEC) and focuses on disability status. The data is the first of its kind for Cambodia—a comprehensive survey employing a representative sample of adults 60 and older living across the country. Disability prevalence by age and sex, Active Life Expectancy (ALE) and common correlates of disability, using Activity of Daily Living (ADL) items, are examined. In addition, disability prevalence rates are compared to those for older adults living in other countries in South-east Asia. The results indicate that older Cambodians are more disabled than their counterparts living elsewhere. Possible reasons include long-term influence of social disruption and poverty. Women live longer than men, but spend a greater proportion of their remaining life in states of disability and severe disability. Correlates of disability show that younger age, being male, having higher income satisfaction, being married and living in urban areas associate with lower probabilities of reporting disability. A contribution of the analysis is the examination of a basic measure of health among a population of which little is known.

KEYWORDS: active life expectancy; ageing; Cambodia; disability; functional status; South-east Asia

Background

Older adults in Cambodia have survived decades of extreme political and social volatility, including civil war, genocide and mass migration (Meng-Try 1981; Huguet 1991; Kiernan 1996, 2002; Heuveline 1998). The period between 1975 and 1979, when the Pol Pot led Khmer Rouge held power throughout the country, was a brutal one (Ung 2000; Chan 2004). During this period, excess mortality due to violence, famine and disease was substantial (Meng-Try 1981; Heuveline 1998; Kiernan 2003; Neupert & Prum 2003). Although more peaceful conditions have prevailed over the last decade, living conditions are still difficult. The country is struggling economically, poverty is widespread, health care resources are underdeveloped and under-funded, roads and other infrastructure are in poor condition, literacy rates are low and HIV/AIDS prevalence rates are high (Ott 1997; Annear 1998; Huguet *et al.* 2000; Beresford *et al.* 2004; Kola 2004).

It is not difficult to imagine that past conflict and violence, coupled with harsh living conditions, could have deleterious effects on the health of Cambodia's older population. Examinations in other parts of the world have linked war and violence to stress, anxiety, depression and other mental health problems, which may subsequently contribute to the

Asian Population Studies, Vol. 2, No. 2, July 2006
ISSN 1744-1730 print/1744-1749 online/06/020133-16
 DOI: 10.1080/17441730600923109

development of chronic health and functional disorders (Farhood *et al.* 1993; Butera *et al.* 1999; Pedersen 2002). More broadly, the type of violence and conflict that has been experienced in Cambodia impinges on the ability to develop health services, thus reducing access to quality care (Ityavyar & Ogba 1989; Agudelo 1992; Lanjouw *et al.* 1999). The poverty conditions in which many older adults find themselves also inhibit access to care due to insufficient income to pay for these services. Moreover, enduring deprivation due to living in poverty for many years may have longer term influences on the prospects of healthy ageing.

Unfortunately, data on health outcomes among older adults living in such extreme conditions are not readily available. For Cambodia, a lack of applicable data is a result of a long period of isolation from the rest of the world and the elimination of academic institutions in the 1970s by the Khmer Rouge (Huguet 1991; Chandler 2000). Universities are now being re-established and government and non-governmental agencies have recently collected some social and demographic data, including a 1998 census, a Demographic and Health Survey, and several socio-economic surveys conducted by the National Institute of Statistics (National Institute of Statistics 1997; Huguet *et al.* 2000; National Institute of Statistics, Directorate General for Health [Cambodia], and ORC Macro 2000). The current study employs the 2004 Survey of the Elderly in Cambodia (SEC). This survey is the first of its kind—a comprehensive survey employing a representative sample of adults 60 and older living across Cambodia. The project that generated the SEC is a joint effort between the University of Michigan, the Population Council, and the Royal University of Phnom Penh, and research using the data is supported by the National Institute on Aging and UNFPA Cambodia. Among the goals of the project is to provide much-needed information on the health conditions of Cambodia's elderly population. Given the dearth of previous research on the subject, the analysis provided here is meant to present some initial descriptive, comparative, and explanatory findings on a basic measure of health and well-being.

The current study has several aims. First, it examines survey responses to a series of Activities of Daily Living (ADL) items. ADLs are tasks necessary for self-maintenance and daily survival and an inability to conduct an ADL can be classified as a disability. Second, it compares Cambodian responses to ADL items with those found in surveys conducted in other South-east Asian countries. Third, ADLs are employed to estimate Active Life Expectancy (ALE). Fourth, correlates of ADL disability are examined via multivariate equations using a small number of standard demographic predictors.

As for the fourth aim, previous research across a number of populations has suggested that younger age, being male, being married and having a high socio-economic standing (for example, having high levels of education and income) are associated with a lower likelihood of reporting a disability (Manton 1989; House *et al.* 1990; Kaplan 1992; Pol & Thomas 1992; Rogers *et al.* 1992; Strawbridge *et al.* 1992; Preston & Taubman 1994; Crimmins *et al.* 1996; Melzer *et al.* 2001; Zimmer *et al.* 2002). In the developed world, rural residence has been shown to be associated with better health outcomes, although the situation in developing countries is less clear (Gillanders *et al.* 1996; Verheij 1996; Harpham *et al.* 2003). Given the lack of infrastructure in rural areas, one might expect disability status to be more favourable for urban Cambodians. These factors (age, sex, marital status, socio-economic status and urban/rural residence) represent some of the most important demographic correlates of disability, and the present analysis will

examine these to ascertain whether they relate within the Cambodian elderly population in expected ways.

Disability and Active Life Expectancy

A popular conceptualization of the disablement process defines a functional limitation as an inability to perform basic physical movements, like walking or getting up from a sitting position. Functional limitations influence the capacity to carry out daily tasks that are usual and necessary, like getting out of bed or going shopping (World Health Organization 1990; Verbrugge & Jette 1994; Deeg *et al.* 2003). In turn, an individual who has difficulty conducting necessary and usual tasks is considered to possess a disability.

Because a daily task is linked to specific surroundings, and may also have a cultural context, a disability can be conceptualized as a gap between ones physical capacity and demands of an environment (Verbrugge & Jette 1994). For instance, a necessary and usual task like getting out of bed requires a certain functional capacity. Having a functional limitation, like the inability to get up from a sitting position, can make the task of getting out of bed difficult, and, therefore, lead to a disability. But, the type of bed in which one sleeps, a function of environment, may influence performance and, therefore, give rise to a disability status. An individual in a poor developing country who sleeps on a mat on a hard floor may have the disability due to the difficulty of the task, while an individual in a developed country who sleeps on a more conventional bed may not, despite similarities in functional capacity. Subsequently, the individual sleeping on a mat on the floor may have a greater need for assistance. A task like shopping for food may involve an even larger array of environmental circumstances, such as the location of a market and the condition of the infrastructure like transportation and road conditions. Since disability status comments on aptitude in performing necessary tasks within ones surroundings, it is a principal indicator of well-being and the need for physical assistance, and accordingly is an excellent starting point for evaluating the health of an older population of which little is known.

The current analysis employs ADLs, a standard set of daily tasks that are obtained by way of self-reports on surveys (Katz *et al.* 1963). These are tasks that are necessary for self-maintenance, and the inability to perform one of these is defined as a disability. ADLs have been used in numerous surveys across many different types of populations, and have been translated into many different languages. The SEC includes four common ADLs—'getting up from lying down', 'eating', 'bathing' and 'dressing'—all of which are used in the current study.

Active Life Expectancy (ALE) in the current study refers to the number of years an individual can expect to live without a disability (Katz *et al.* 1983). It combines information on task performance with mortality and is unaffected by the age structure of a population. Thus, it is an ideal tool for comparing health of population groups, such as males versus females. ALE is becoming widely used in international research and, therefore, the estimates obtained from one population can be readily compared with others (Saito *et al.* 1999, 2003; Mathers 2002). In addition to examining expected life without disability, ALE can also assess expected life in a variety of functional states, such as without any functional limitations, with moderate limitations, or with severe limitations.

Methods

The 2004 Survey of the Elderly in Cambodia (SEC)

Although some social and demographic surveys of Cambodians have been conducted since the mid-1990s, older adults have not been the focus of these, with the exception of a 1999 survey conducted by HelpAge International (Kato 2000). The 2004 Survey of the Elderly in Cambodia (SEC) involved a sample of 1273 adults aged 60 and older living throughout Cambodia who were interviewed between April and October of 2004. The survey was conducted in the homes of these older adults. Interviewers were students and staff from the Royal University of Phnom Penh. The survey took about one hour and yielded extensive data on a number of topics. In a small number of cases where the older adult themselves were incapable of responding to the questionnaire items, a proxy, who was a family member, was used to complete the questionnaire.

The sampling was a multiple-stage systematic probability conducted in two steps—the first in Phnom Penh and the second in other provinces. Although Cambodia consists of 24 provinces, the six provinces with the highest populations, including over 50 per cent of the total Cambodian population, were selected: Battambang, Kampong Cham, Kandal, Phnom Penh, Prey Veng and Takeo. Within Phnom Penh province, administrative Villages were chosen using a listing provided by the National Institute of Statistics (2000). Within each, there was a random selection of two Enumeration Areas (EAs). Interviewers were sent to the EAs to identify households containing an older adult. Several weeks later, interviewers returned to randomly selected households to obtain an interview. Within the five other provinces, sampling involved a systematic selection of Districts, then Communes within Districts, then Villages within Communes. Once Villages were selected, the sampling procedure continued in the same fashion as Phnom Penh.

The sample was over-represented in Phnom Penh, so a weighting procedure was used to adjust. The final weighted sample is representative of the six provinces. Since only one person per household was interviewed, those living in households with a single older adult had a higher probability of being selected in comparison to households with two or more. Therefore, an additional weight adjusted for the number of older adults living within households. Analysis was performed to determine whether the weighted sample matched other representative surveys, such as the 1998 census, the 2004 Intercensal survey, and the 2000 Demographic and Health Survey, and the current sample was found to be similar. More detailed information about the data is provided in Knodel *et al.* (2005).

Measures

The respondents were asked whether they had any difficulty performing the four ADLs without assistance from anyone: 'eating', 'bathing', 'dressing' and 'getting up from a lying down position'. If a difficulty was reported, individuals were asked whether they had a little difficulty, a lot of difficulty or so much difficulty that they could not conduct the task at all. I defined the reporting of a difficulty of any severity as a disability. In the analysis that follows, I report the percentage that had disabilities with respect to at least one of the four items, and with specific items. I also refer to the percentage reporting severe disabilities as having a lot of difficulty or being unable to conduct a task.

A Cronbach's alpha reliability test on the four ADLs yields the value 0.769. A principal components factor analysis shows the four load highly onto a single factor with a 2.495

eigenvalue explaining 62.4 per cent of the variance. A correlation matrix shows coefficients between items ranging from 0.45 to 0.80. Hence, the four are well associated, although they are not completely correlated.

For multivariate equations, I examined several correlates. Age is continuous but is categorized for descriptive analyses. Sex is coded as female versus male. Marital status is coded as married versus not married. The not married category includes 'widowed', 'never married' and 'divorced or separated'. However, because of nearly universal marriage (only one per cent of the current sample has never been married) and very infrequent divorce, nearly all of those not married were widowed and further delineation of the variable is not sensible. Place of residence is rural or urban based on the classification of the Village of residence by the Ministry of Planning (National Institute of Statistics 2000). Two indicators of socio-economic status are literacy and income satisfaction. Literacy is derived from a question on ability to read, with the categories 'illiterate', 'somewhat literate' (those that can read but not well) and 'literate'. Reliable measures of income are difficult to obtain, so a replacement was a survey item that asked whether respondents were satisfied with their current income. The measure included 'being unsatisfied', 'being somewhat satisfied', 'being satisfied' and 'having missing data'. The latter category was included because of a fairly high amount of missing data for this item (three per cent), which maps closely to proxy respondents. Table 1 provides a description of the sample by showing distributions for these covariates by sex, with *p*-values provided to show whether the distributions differ by sex. Women were more likely than men to be not married, to live in rural areas and to be illiterate. There is no significant sex difference in age or income satisfaction.

Analysis

I begin by showing the percentage reporting specific ADL difficulties and at least one, or any difficulties. I also compare the reporting of ADL difficulties in Cambodia with

TABLE 1
Description of sample.

	Total population	Males	Females	*P*-value[a]
N	1273	512	761	
Age (mean)	68.8	68.5	68.9	0.981
Not married (%)	48.7	18.4	69.1	0.000
Rural (%)	9.4	7.4	10.8	0.045
Literacy (%)				
Illiterate	59.2	27.7	80.4	0.000
Semi-literate	22.1	33.0	14.7	
Literate	18.7	39.3	4.9	
Income satisfaction (%)				
Not satisfied	22.1	21.2	22.7	0.586
Somewhat satisfied	52.1	52.6	51.8	
Satisfied	22.8	23.8	22.1	
Missing	3.0	2.3	3.4	

[a]Tests difference between males and females.

results from other surveys conducted in the region. The calculation of ALE requires division of the sample into disability states. Using terminology that is common in ALE analyses, I defined an 'active' state as being able to perform all four ADLs, or having no disability. This may also be referred to as a 'disability-free' state. Although the term 'active' in this context is considered biased by some, given that those with disability may still lead active lives in other ways, I use the term here for conventional purposes. As for those limited in ability, they are subdivided into having 'less severe' or 'severe disability'. Those with 'less severe disability' reported a little difficulty with tasks, and those with 'severe disability' reported a lot of difficulty or they were unable to conduct a task.

Calculations of ALE can be based upon prevalence-based life tables when only cross-sectional data are available or multi-state life tables when panel data are available. The current calculation is limited to the former, commonly referred to as the Sullivan method (Sullivan 1971). It decomposes life expectancy into life remaining in various states, determined by applying prevalence rates for disability to an Lx column of a life table (Jagger 1999; Saito *et al.* 1999; Laditka & Hayward 2003). To be specific, the Lx column of a life table provides person-years lived within an age interval. For instance, the Lx column for ages 60–64 would specify the sum of the years that a particular population has spent between ages 60 and 64. So, if the population size were 100, and there were no deaths to people aged 60–64, then the person-years lived within the interval would be 500. However, given some mortality between ages 60 and 64, with the specific number of deaths being determined by mortality rates within the age interval, the person-years would be something less than 500. A disability-free Lx column can be determined by multiplying person-years lived within the interval by the proportion of the population that does not have a disability, and a disability Lx column can similarly be determined by multiplying by the proportion with a disability. The sum of these latter two columns will equal the total person-years lived. The result is additional life table columns that assign person-years lived in states of disability, which summed together equal total life expectancy.

For the current study, prevalence rates by age and sex are determined from the SEC, while the life table mortality rates and resultant Lx columns come from an abridged life table provided by the National Institute of Statistics (2004). The relationship between age and having a disability is positive and linear, such that increasing age relates to a higher probability. Females reported disabilities more frequently than did males. Preliminary analyses showed no significant age by sex interaction. Therefore, the most useful estimation of prevalence comes from the smoothing of rates by age and sex using a maximum likelihood procedure. The variances of prevalence rates are then used to determine standard errors and confidence intervals (Jagger 1999).

Finally, I employed logistic regression to examine demographic correlates of disability. Here, I present the odds of reporting individual ADL difficulties, any difficulties and any severe difficulties by age, sex, marital status, education, satisfaction with income and rural/urban residence.

Results

Prevalence of ADL Disability

Table 2 shows the per cent reporting difficulties with ADLs and the percentages for similar items obtained from surveys of older adults conducted in four other South-east

TABLE 2
Percentage with specific ADL disabilities in Cambodia and other countries in South-east Asia.[a]

	Cambodia	Burma[b]	Indonesia[b]	Philippines[c]	Thailand[d]
Getting up from lying down	18.8	8.2[e]***	3.7 [e]***	na	na
Eating	8.7	5.8***	2.8***	4.4***	3.4***
Bathing	8.4	6.7**	2.7***	6.6**[f]	6.0[f]***
Dressing	6.2	5.1	1.9***	5.6	2.9***

***$p<0.01$, **$p<0.05$, when comparing other countries to Cambodia.
na = not available.
[a]Results from Burma, Indonesia, Philippines and Thailand are standardized by the age/sex distribution for Cambodia. [b]From the World Health Organization's 1989 Health and Social Aspects of Ageing in South-east Asia (Andrews n.d.). [c]From the 1996 Philippine Elderly Survey (Natividad & Cruz 1997). [d]From the 1995 Social Welfare of the Elderly in Thailand (Chayovan & Knodel 1997). [e]Question asked about getting up from bed. [f]Bathing and toileting are combined.

Asian countries—Burma, Indonesia, the Philippines and Thailand. To facilitate comparison, results for the other countries were standardized for the age and sex distribution in Cambodia using direct standardization (Newell 1988). Item wording across surveys was generally comparable, but any differences are noted at the bottom of the table. Two of the other surveys (Thailand's and the Philippines') included people aged 50 and older, but only those 60 and older have been included in the table. *P*-values obtained from difference in proportion tests are provided to show whether prevalence rates from the other four countries are statistically different from those found in the SEC.

For Cambodia, the highest prevalence was for 'getting up from lying down', with nearly 19 per cent of older adults reporting this disability. Fewer had difficulties eating (about nine per cent), bathing (about eight per cent) or dressing (about six per cent). In Burma and Indonesia, the only other surveys to ask about getting up from lying down (although the question in these two countries was about getting up from bed), this ADL item had the highest prevalence. Similarly, dressing is the least frequently reported disability in three of the four other surveys.

Disability prevalence for each of the ADLs is higher in Cambodia than in any of the other four countries. In some cases, the differences are moderate. For instance, there is no statistically significant difference in the percentage reporting difficulties dressing between Cambodia and either Burma or the Philippines. In other instances, Cambodian elders are much more likely to report limitations. For instance, less than a third as many older adults in Indonesia and less than half in Thailand reported difficulties dressing.

I conducted some additional analyses to examine the structure of ADL disabilities. Of those who had reported one disability only, the one most likely reported was getting up from lying down, but this tendency was not universal. About 16 per cent with one difficulty reported it to be eating, eight per cent bathing and one per cent dressing. Those who had three disabilities were most likely able to eat while having difficulties conducting other tasks. Again, this was not universal as between 10 per cent and 20 per cent of those able to do just one task without difficulty reported it to be either getting up from lying down, bathing, or dressing.

Table 3 examines prevalence for men and women and across age groups. Because there is very little age by sex interaction, results are not shown for the combination of age

TABLE 3
Percentage reporting ADL disabilities by age and sex.

	Disability of any severity					
	N	Any	Getting up	Eating	Bathing	Dressing
Total population	1273	23.0	18.8	8.7	8.4	6.2
Men	512	19.1	15.3	7.2	7.2	5.9
Women	761	25.8	21.2	9.8	9.1	6.4
Age						
60–64	418	11.7	9.3	4.6	2.9	1.5
65–69	337	21.7	17.4	6.6	3.9	3.3
70–74	294	30.9	25.9	14.7	10.6	8.7
75–79	149	29.5	26.1	9.4	12.6	10.1
80+	104	44.2	32.7	16.4	32.0	23.3
	Severe disability					
	N	Any	Getting up	Eating	Bathing	Dressing
Total population	1273	9.3	7.3	3.6	3.1	2.4
Men	512	7.4	5.5	2.9	2.5	2.0
Women	761	10.6	8.5	4.1	3.6	2.6
Age						
60–64	418	3.4	2.6	1.7	0.7	1.0
65–69	337	7.4	5.6	2.1	0.6	0.3
70–74	294	14.0	10.5	7.5	5.3	3.4
75–79	149	13.4	10.7	2.7	5.3	3.4
80+	104	22.3	19.2	8.7	12.6	10.7

and sex. The top part of the table shows the percentage having a difficulty of any severity, while the bottom part shows the percentage having a severe difficulty. Results are shown for the percentage having any difficulty (that is, at least one of the four) and the percentage having specific difficulties. Looking first at the top part of the table, women have a higher prevalence across tasks. For instance, about 19 per cent of men and about 26 per cent of women reported any ADL disability. As for severe disability, women again had higher prevalence; about seven per cent of men reported any severe disability compared to about 11 per cent of women.

The percentage reporting ADL difficulties increased fairly linearly with age. The exception was the 75- to 79-year-olds, who were less likely to report a disability and a severe disability than would be expected. For instance, looking at the top part of the table, the percentage reporting any difficulty of any severity increases from about 12 per cent among those 60–64 all the way to 44 per cent among those 80 and older, with increases of about ten percentage points per age group, except for virtually no increase when moving to the 75- to 79-year group. Similarly, looking at the bottom part of the table, the percentage with any severe difficulty increases from about three per cent to about 22 per cent from the youngest to the oldest, with the 75–79 group being again an anomaly. Variation to the linear trend may be a function of sampling error, though it does induce questions about possible links between historical circumstance and health outcomes. It is possible, for instance, that certain

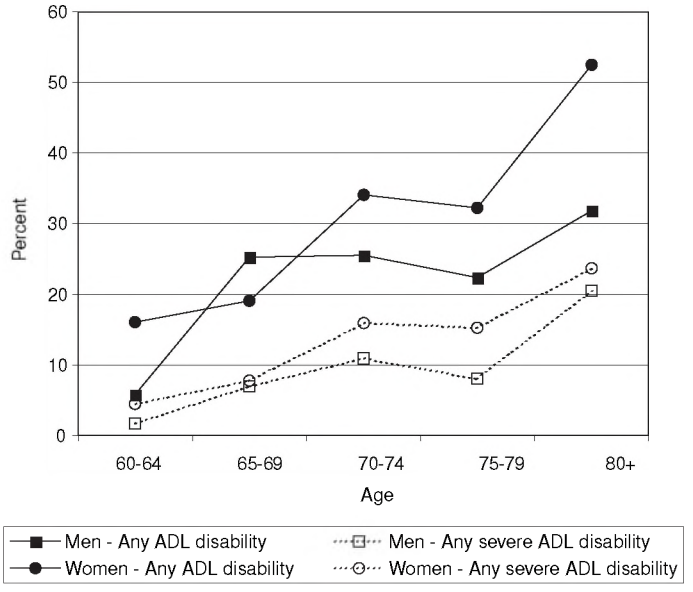

FIGURE 1
Percentage reporting any ADL disability and any severe disability by age and sex.

age cohorts were differentially influenced by earlier life conditions related to the violent and epidemiological history that characterizes Cambodia. It is, however, difficult to speculate on the precise reasons for the effect without additional information.

The relationship between age, sex and disability is further highlighted in Figure 1, which plots the percentage reporting any ADL difficulty and any severe difficulty by the combination of age and sex. The figure graphically shows a general linear increase with age. Men at each age group were generally less likely to report ADL difficulties than women. As noted above, there is little interaction between age and sex, with the exception of a crossover for any disability at age 65–69. The lowest prevalence occurred among 60- to 64-year-old men (six per cent reported any and two per cent reported severe) and the highest among the 80 and older women (53 per cent reported any and 24 per cent reported severe). It is curious that the levelling of prevalence rates at the 75- to 79-year-old age group is similar for both men and women and for both any and severe disability.

Active Life Expectancy

Table 4 presents ALE results with 95 per cent confidence intervals. The number of expected years of life, the number of years expected in the active state (i.e. disability-free), and the number of years expected without severe disability are shown. Since only an abridged life table was available for the ALE estimations, the results are presented in five-year age groups. They should be interpreted as follows: a man who turns 60 can expect to live 15.0 more years, 11.9 of which are expected to be spent without disability, and 13.8 of which are expected to be spent without severe disability. A man who turns age 65 can expect to live 12.0 more years, and so forth. Simple subtraction provides the number of years expected in various states of disability. For instance, a man who turns 60 can expect

TABLE 4
Active life expectancy estimates by age and sex, with 95 per cent confidence intervals in parentheses.

	Age	Total life expectancy	Expected life without disability	Expected life without severe disability
Men	60	15.0	11.9 (12.5–11.3)	13.8 (14.2–13.4)
	65	12.0	9.0 (9.6–8.4)	10.8 (11.2–10.3)
	70	9.3	6.5 (7.2–5.9)	8.2 (8.6–7.7)
	75	7.1	4.5 (5.3–3.8)	6.0 (6.5–5.4)
	80	5.3	3.0 (3.9–2.2)	4.3 (5.0–3.6)
Women	60	17.0	12.2 (12.7–11.6)	15.0 (15.4–14.6)
	65	13.6	9.1 (9.6–8.6)	11.7 (12.1–11.2)
	70	10.6	6.5 (7.1–5.9)	8.8 (9.2–8.3)
	75	8.1	4.5 (5.1–3.8)	6.4 (6.9–5.8)
	80	6.1	2.9 (3.7–2.2)	4.5 (5.1–3.8)

to live 3.1 years with disability (i.e. 15.0–11.9), 1.2 years with severe disability (i.e. 15.0–13.8) and 1.9 years with less severe disability (13.8–11.9).

For both men and women, years of active life decline with age. For instance, women aged 60 can expect 12.2 of their remaining 17.0 years of life to be spent without disability and 15.0 without severe disability. By subtraction, this means that they can expect 4.8 years with disability and 2.0 years with severe disability. By age 80, they can expect only 2.9 of their remaining 6.1 years to be lived without disability and 4.5 years without severe disability.

Women, at each age, live longer than men do, but there is less difference in number of disability-free years. For instance, women aged 60 live about two years more than their male counterparts. But, the female advantage in years without a disability is merely about a third of a year, and the advantage in years without a severe disability is a little over one year. The net result is that women live on for more years but also more years disabled. At age 60, a man can expect 3.1 years with a disability, while the corresponding number for women is 4.9. At age 80, a man can expect 2.3 years with a disability and 1.0 year with a severe disability. The corresponding numbers for women at that age are 3.2 and 1.6.

Figure 2 transposes results into percentage of remaining life expected in various states of disability. For both men and women, increasing age brings increasing proportion of life in states of any and severe disability. For instance, at age 60, women can expect to live about 70 per cent of their remaining years disability-free, but by age 80, less than half of their remaining years are disability-free. The percentage of time with severe disability increases steadily for women from about 15 per cent at age 60 to about 25 per cent by age 80. Comparing the results for women and men at each age, women can expect a greater percentage of their remaining lives to be spent with any, with less severe and with severe disability. For instance, men at age 60 can expect about 80 per cent of their lives to be spent in the active state, without any ADL disability, compared to about 70 per cent for women.

Predictors of ADL Disability

Finally, I turn to multivariate equations that examine common demographic predictors of disability. Table 5 presents the results in the form of odds ratios. On

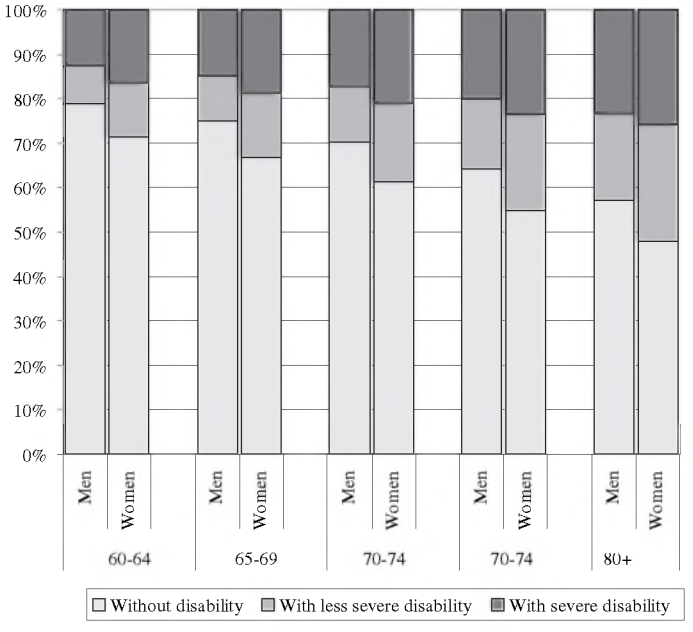

FIGURE 2
Percentage of remaining life spent in various states of disability by age and sex.

balance, the directions of associations are similar in Cambodia to those found in other settings. The effects of age and income were fairly consistent across disability measures, with higher age and less satisfaction with income relating to a greater probability of disability. Those with missing information on income, who were probably those unable to answer the question due to severe mental or other health problems, were most likely to

TABLE 5
Logistic regression results predicting any, severe and task specific disabilities.

	Any	Any severe	Getting up	Eating	Bathing	Dressing
Age	1.07***	1.08***	1.07***	1.05***	1.11***	1.10***
Female (vs. male)	1.54*	1.75	1.68*	1.17	1.04	0.67
Not married (vs. married)	1.20	1.05	1.07	1.66***	1.63*	2.52***
Rural residence (vs. urban)	1.57**	1.19	1.64*	1.16	2.00***	1.71
Literacy (vs. literate)						
Semi-literate	1.59***	0.83	1.63***	1.28	0.88	1.01
Illiterate	0.99	0.70	0.99	0.92	1.01	1.20
Income satisfaction (vs. satisfied)						
Somewhat satisfied	1.32	2.20**	1.25	2.33**	1.91**	1.64
Not satisfied	2.44***	2.77***	2.07***	1.52	2.57***	1.75
Missing information	3.8***	8.36***	3.21***	6.11***	6.69***	5.36***
Model χ^2	342.2***	376.9***	243.9***	95.4***	185.9***	287.2***

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
Note: Uses robust standard errors to adjust clustering by district.

report disabilities. Other results are less likely to be statistically significant, yet generally confirm the hypotheses in terms of direction. Women, those not married and those in rural areas, were more likely than others to report a disability, other things being equal.

Several additional specific observations can be made. First, marital status had the strongest influence on dressing, and also influenced eating and bathing, but had no significant influence on getting up from bed. One reason for this may be that eating, dressing and bathing difficulties were experienced by a much smaller proportion of the population and, therefore, reflect more serious underlying conditions, which themselves may be more related to marital status. Second, income is a particularly strong predictor of disability. The odds ratios for income are all fairly large, particularly for those not satisfied. Insignificance is likely more a function of the small proportions with specific ADL difficulties. Third, it is the significant predictors for difficulties getting up that appear to drive the predictors for any disability. The most likely reason for this is simply the proportion of the population with difficulties getting up, which is at least double the proportion with any other specific ADL difficulty. Fourth, rural residence exerts its strongest influence on bathing limitation. Indeed, bathing facilities are much more modern and easier to negotiate among those living in urban Phnom Penh than in the other areas. Finally, the results for literacy are the least confirming. Those who were semi-literate were more likely to report any disability and difficulties getting up, but results comparing the illiterate to the literate are insignificant across the models. It is difficult to speculate why literacy has such a minimal association with ADL difficulties, although possible reasons include selection effects, where illiterates are less likely to live to old age.

Conclusion

Cambodia has emerged from a long period of conflict and violence, during which time the country was isolated from the rest of the world. Only recently has data become available that allows for examination of the health conditions of its citizens. The current analysis employed several ADL items to assess disability status, ALE and predictors of disability. In many ways, the results conform to the hypotheses. Women and older individuals are more likely to report disabilities than are men and younger individuals. At age 60–64, only about two per cent of men reported a severe disability compared to about six per cent of women. By age 80, about 20 per cent of men reported severe disability compared to about 24 per cent of women. By age 80, about one in three men reported a disability of any severity compared to about one in two women. Those not married, living in rural areas and with lower levels of socio-economic status, the last measured as literacy and satisfaction with income, were generally more likely than others to report disabilities.

Analysis of ALE showed that women live longer than men, with the extra years of life being spent in both states of less severe and severe disability. Moreover, as older Cambodians age, they can expect to spend a greater proportion of their remaining years with ADL disability and a greater proportion of disabled years suffering from severe disabilities. As an example, a 60-year-old woman can expect to live 17.0 years—12.2 without any disability, 2.8 with less severe and 2.0 with severe disability. An 80-year-old woman can expect 6.1 more years of life with only 2.9 of those being disability-free, 1.6 with less severe and 1.6 with severe disability. This means that the proportion of life spent with a disability as measured by ADLs is 28 per cent for the 60-year-old and 52 per cent for

the 80-year-old, while the proportion of disabled life spent with severe disability is 42 per cent for the 60-year-old and 50 per cent for the 80-year-old.

I presented some data that compared ADL disability of older Cambodians with older adults in other South-east Asian countries. Direct comparisons are always difficult given differences in culture, language, interpretation of survey items, survey administration and differences in question wording. This being said, the results show substantially higher prevalence in Cambodia versus Indonesia and Thailand, and moderately higher versus Burma and the Philippines. Several previous calculations of ALE have been conducted in other South-east Asian countries (Saito *et al.* 2003). These comparisons are even more hazardous since some of the items used to define the 'active' state differed from the current study. But, as superficial as it may be, it is worth noting that estimates of ALE provided by Lamb (1999), which used ability to eat, dress, groom, walk, get out of bed and bathe as items to measure an active state, reveal that Cambodian elders live a substantially greater percentage of their remaining years in a disabled state than do elders in Indonesia, North Korea and Thailand and a moderately greater percentage than those in Burma and Sri Lanka.

Is it reasonable that older Cambodians suffer from higher rates of disability and have lower ALE than their counterparts in other South-east Asian countries? Although precise comparisons would require a much more extensive set of activity tasks, and might include more general functional limitation items and physical performance tests, if Cambodian elders are more disabled, there are several possible reasons. First, few others have experienced the degree and type of social disruption that have been experienced by older Cambodians. Previous research, cited earlier, suggested a number of ways in which this can lead to negative health outcomes. Second, with respect to many indicators, Cambodia is more underdeveloped than other countries in the region. Cambodia has a lower GNP and literacy rate than all other South-east Asian countries with the exception of Laos (Population Reference Bureau 2004). To the degree that socio-economic development is related to health, for instance, through the delivery of services, Cambodia could be disadvantaged in contrast to its counterparts. Third, disability, as measured through ADL, interact physical ability with the social and environmental setting (Vergrugge & Jette 1994). Real environmental barriers that Cambodian elders contend with, such as those that relate to impoverished living conditions and a lack of household amenities, may make it more difficult for them to conduct usual and necessary daily activities in comparison to elders living elsewhere. In short, conflict and violence coupled with harsh living conditions might offer part of an explanation of why older Cambodians experience such high rates of disability.

ACKNOWLEDGEMENT

An earlier version of this paper was presented at the annual meeting of the International Network on Health Expectancy and the Disability Process (REVES) in May 2005. This research was supported by grants from the National Institute on Aging (sub p/g F009700, sub p/g F010799, R01 AG20063-01) and from UNFPA Cambodia.

REFERENCES

AGUDELO, S. F. (1992) 'Violence and health: preliminary elements for thought and action', *International Journal of Health Services*, vol. 22, no. 2, pp. 365–376.

ANDREWS, G. R. (1990) *World Health Organization Regional Office for Southeast Asia Collaborative Study on Social and Health Aspects of Aging in Burma, Indonesia, North Korea, Sri Lanka and Thailand 1990* [computer file], World Health Organization, Regional Office for Southeast Asia, New Delhi [producer], Inter-university Consortium for Political and Social Research, Ann Arbor, MI [distributor].

ANNEAR, P. (1998) 'Health and development in Cambodia', *Asian Studies Review*, vol. 22, no. 2, pp. 193–221.

BERESFORD, M., NGUON, S., ROY, R., SISOVANNA, S. & NAMAZLE, C. (2004) *The Macroeconomics of Poverty Reduction in Cambodia*, Report from the United Nations Development Programme, Asia-Pacific Regional Programme on the Macroeconomics of Poverty Reduction, Kathmandu, Nepal.

BUTERA, J. B., BULTINCK, F. J. & MERCIER, P. (1999) 'The Rwandan family facing survival: the psychiatric repercussions of the war', *International Congress Series*, vol. 1179, pp. 193–198.

CHAN, S. (2004) *Survivors: Cambodian Refugees in the United States*, University of Illinois Press, Chicago.

CHANDLER, D. (2000) *A History of Cambodia*, Westview Press, Boulder, CO.

CHAYOVAN, N. & KNODEL, J. (1997) *A Report on the Survey of the Welfare of the Elderly in Thailand*, Institute of Population Studies, Chulalongkorn University, Bangkok.

CRIMMINS, E. M., HAYWARD, M. D. & SAITO, Y. (1996) 'Differentials in active life expectancy in the older population of the United States', *Journal of Gerontology: Social Sciences*, vol. 51B, no. 3, pp. 111–120.

DEEG, D. J. H., VERBRUGGE, L. M. & JAGGER, C. (2003) 'Disability measurement', in *Determining Health Expectancies*, eds J. M. Robine, C. Jagger, C. D. Mathers, E. M. Crimmins & R. M. Suzman, John Wiley & Sons, Hoboken, NJ, pp. 203–220.

FARHOOD, L., ZURAYK, H., CHAYA, M., SAADEH, F., MESHEFEDJIAN, G. & SIDANI, T. (1993) 'The impact of war on the physical and mental health of the family: the Lebanese experience', *Social Science and Medicine*, vol. 36, no. 12, pp. 1555–1567.

GILLANDERS, W. R., BUSS, T. F. & HOFSTETTER, C. R. (1996) 'Urban/rural elderly health status differences: the dichotomy reexamined', *Journal of Aging and Social Policy*, vol. 8, no. 4, pp. 7–24.

HARPHAM, T., REED, H., MONTGOMERY, M., SATTERHWAITE, D., MOSER, C. & COHEN, B. (2003) 'Mortality and morbidity: is city life good for your health?', in *Cities Transformed: Demographic Change and Its Implications in the Developing World*, eds M. R. Montgomery, R. Stren, B. Cohen & H. E. Reed, National Academies Press, Washington, pp. 259–299.

HEUVELINE, P. (1998) 'Between one and three million: towards the demographic reconstruction of a decade of Cambodian history: 1970–79', *Population Studies*, vol. 52, pp. 49–65.

HOUSE, J. S., KESSLER, R. C., HERZOG, A. R., KINNEY, A. M., MERO, R. P. & BRESLOW, M. F. (1990) 'Age, socioeconomic status and health', *The Milbank Quarterly*, vol. 68, no. 3, pp. 383–411.

HUGUET, J. W. (1991) 'The demographic situation in Cambodia', *Asia-Pacific Population Journal*, vol. 6, no. 4, pp. 79–91.

HUGUET, J. W., CHAMRATITHIRONG, A., RAO, N. R. & THAN, S. S. (2000) 'Results of the 1998 population census in Cambodia', *Asia-Pacific Population Journal*, vol. 15, no. 3, pp. 3–22.

ITYAVYAR, D. A. & OGBA, L. O. (1989) 'Violence, conflict and health in Africa', *Social Science and Medicine*, vol. 28, no. 7, pp. 649–657.

JAGGER, C. (1999) 'Health expectancy calculations by the Sullivan Method: a practical guide', *Research Paper Series, no. 68*, Nihon University Population Research Institute, Tokyo, Japan.

KAPLAN, G. A. (1992) 'Health and aging in the Alameda County study', in *Aging, Health Behavior and Health Outcomes*, eds K. W. Schaie, D. Blazer & J. S. House, Lawrence Erlbaum Associates, Hillsdale, NJ, pp. 69–88.

KATO, E. U. (2000) 'Ageing in Cambodia: tradition, change and challenges', in *Ageing in the Asia-Pacific Region*, ed. D. R. Phillips, Routledge, New York, pp. 360–374.

KATZ, S., BRANCH, L. G., BRANSON, M. H., PAPSIDERO, J. H., BECK, J. C. & GREER, D. S. (1983) 'Active life expectancy', *New England Journal of Medicine*, vol. 309, pp. 1218–1224.

KATZ, S., FORD, A. B., MOSKOWITZ, R. W., JACKSON, B. A. & JAFFEE, M. W. (1963) 'Studies of illness in the aged: the index of ADL, a standardized measure of biological and psychosocial function', *Journal of the American Medical Association*, vol. 185, pp. 914–919.

KIERNAN, B. (1996) *The Pol Pot Regime: Race, Power and Genocide in Cambodia Under the Khmer Rouge, 1975–1979*, Silkworm, Chiang Mai.

KIERNAN, B. (2002) 'Introduction: conflict in Cambodia, 1945–2002', *Critical Asian Studies*, vol. 34, no. 4, pp. 483–495.

KIERNAN, B. (2003) 'The demography of genocide in Southeast Asia: the death tolls in Cambodia, 1975–79, and East Timor, 1975–80', *Critical Asian Studies*, vol. 35, no. 4, pp. 585–597.

KNODEL, J. E., KIM, S. K., ZIMMER, Z. S. & PUCH, S. (2005) 'Older persons in Cambodia: a profile from the 2004 Survey of Elderly', *PSC Research Report 05-576*, Population Studies Center, University of Michigan, USA.

KOLA, K. (2004) 'Fighting poverty in Cambodia', *The Contemporary Review*, vol. 284, no. 1658, pp. 164–166.

LADITKA, S. B. & HAYWARD, M. D. (2003) 'The evolution of demographic methods to calculate health expectancies', in *Determining Health Expectancies*, eds J. Robine, C. Jagger, C. D. Mathers, E. M. Crimmins & R. M. Suzman, John Wiley & Sons, Hoboken, NJ, pp. 221–234.

LAMB, V. L. (1999) 'Active life expectancy of the elderly in selected Asian countries', *Research Paper Series, no. 69*, Nihon University Population Research Institute, Tokyo, Japan.

LANJOUW, S., MACRAE, J. & ZWI, A. B. (1999) 'Rehabilitating health services in Cambodia: the challenge of coordination in chronic political emergencies', *Health Policy and Planning*, vol. 14, no. 3, pp. 229–242.

MANTON, K. G. (1989) 'Epidemiological, demographic and social correlates of disability among the elderly', *Milbank Memorial Fund Quarterly*, vol. 67, no. suppl. 2, pt. 1, pp. 13–58.

MATHERS, C. D. (2002) 'Health expectancies: an overview and critical appraisal', in *Summary Measures of Population Health: Concepts, Ethics, Measurement and Applications*, eds C. J. L. Murray, J. A. Salomon, C. D. Mathers & A. D. Lopez, World Health Organization, Geneva, pp. 177–204.

MELZER, D., IZMIRLIAN, G., LEVEILLE, S. G. & GURALNIK, J. M. (2001) 'Educational differences in the prevalence of mobility disability in old age: the dynamics of incidence, mortality, and recovery', *Journal of Gerontology Social Sciences*, vol. 56B, no. 5, pp. S294–S301.

MENG-TRY, E. A. (1981) 'Kampuchea: a country adrift', *Population and Development Review*, vol. 7, no. 2, pp. 209–228.

NATIONAL INSTITUTE OF STATISTICS (1997) *Cambodia Socio-Economic Survey 1997: Technical Report on Survey Design and Implementation*, National Institute of Statistics, Phnom Penh.

NATIONAL INSTITUTE OF STATISTICS, DIRECTORATE GENERAL FOR HEALTH [CAMBODIA] AND ORC MACRO (2000) *Cambodia Demographic and Health Survey 2000*, National Institute of Statistics, Directorate General for Health, Phnom Penh, Cambodia and Calverton, MD.

NATIONAL INSTITUTE OF STATISTICS, MINISTRY OF PLANNING, CENTER FOR POPULATION STUDIES AND ROYAL UNIVERSITY OF PHNOM PENH (2004) *First Revision Population Projections for Cambodia, 1998–2020*, UNFPA, Phnom Penh.

NATIVIDAD, J. N. & CRUZ, G. T. (1997) 'Patterns in living arrangements and familial support for the elderly in the Philippines', *Asia-Pacific Population Journal*, vol. 12, pp. 17–34.

NEUPERT, R. F. & PRUM, V. (2003) *Cambodia: Reconstructing the Demographic Stab of the Past and Forecasting the Demographic Scar of the Future*, Paper presented at the IUSSP Seminar on the Demography of Conflict and Violence, Oslo, Norway, November 8–11.

NEWELL, C. (1988) *Methods and Models in Demography*, Guilford Press, New York.

OTT, M. C. (1997) 'Cambodia: between hope and despair', *Current History*, vol. 96, no. 614, pp. 431–436.

PEDERSEN, D. (2002) 'Political violence, ethnic conflict, and contemporary wars: broad implications for health and social well-being', *Social Science and Medicine*, vol. 55, no. 2, pp. 175–190.

POL, L. G. & THOMAS, R. K. (1992) *The Demography of Health and Health Care*, Plenum Press, New York.

POPULATION REFERENCE BUREAU (2004) *2004 World Population Data Sheet*, PRB: Washington, DC.

PRESTON, S. H. & TAUBMAN, P. (1994) 'Socioeconomic differences in adult mortality and health status', in *Demography of Aging*, eds L. G. Martin & S. H. Preston, National Academic Press, Washington.

ROGERS, R. G., ROGERS, A. & BELANGER, A. (1992) 'Disability-free life among the elderly in the United States: sociodemographic correlates of functional health', *Journal of Aging and Health*, vol. 4, no. 1, pp. 19–42.

SAITO, Y., CRIMMINS, E. M. & HAYWARD, M. D. (1999) 'Health expectancy: an overview', *NUPRI Research Paper Series, no. 67*, Nihon University Population Research Institute, Tokyo, Japan.

SAITO, Y., QIAO, X. & JITAPUNKUL, S. (2003) 'Health expectancy in Asian countries', in *Determining Health Expectancies*, eds J. Robine, C. Jagger, C. D. Mathers, E. M. Crimmins & R. M. Suzman, John Wiley & Sons, Hoboken, NJ, pp. 289–318.

STRAWBRIDGE, W. J., KAPLAN, G. A., CAMACHO, T. & COHEN, R. D. (1992) 'The dynamics of disability and functional change in an elderly cohort: results from the Alameda County study', *Journal of the American Geriatrics Society*, vol. 40, no. 8, pp. 799–806.

SULLIVAN, D. F. (1971) 'A single index of mortality and morbidity', *American Journal of Public Health*, vol. 86, no. 4, pp. 347–354.

UNG, L. (2000) *First They Killed My Father*, HarperCollins, New York.

VERBRUGGE, L. M. & JETTE, A. M. (1994) 'The disablement process', *Social Science and Medicine*, vol. 38, no. 1, pp. 1–14.

VERHEIJ, R. A. (1996) 'Explaining urban-rural variations in health: a review of interactions between individual and environment', *Social Science and Medicine*, vol. 42, no. 6, pp. 923–935.

WORLD HEALTH ORGANIZATION (1990) *The Composite International Diagnostic Interview (Version 1.0)*, WHO, Geneva, Switzerland.

ZIMMER, Z., NATIVIDAD, J. N., OFSTEDAL, M. B. & LIN, H. (2002) 'Physical and mental health of the elderly', in *The Well-Being of the Elderly in Asia: A Four-Country Comparative Study*, ed. A. I. Hermalin, University of Michigan Press, Ann Arbor, MI, pp. 362–416.

Zachary Zimmer, University of Utah, Institute of Public and International Affairs, 260 S. Central Campus Drive, Room 214, Salt Lake City, UT 84112, USA. Tel: +1 801 585-0718; E-mail: zachary.zimmer@ipia.utah.edu