DETERMINING PUBLIC HEALTH PRIORITIES FOR AN AGEING POPULATION : THE VALUE OF A DISABILITY SURVEY

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Abstract. In order to determine which diseases and health problems were most strongly associated with long-term disability among the Thai elderly and to determine their public health priority, a national cross-sectional multistage random sampling survey was conducted in 1997. Four thousand and forty-eight Thai older persons aged 60 years and over were recruited and interviewed by trained interviewers. Overall, 769 (19%) people reported having a long-term disability. Participants with long-term disability (LD) reported having between one and 21 long-term diseases or health problems. Eighteen of these problems were independently associated with LD in logistic regression analysis. Nearly half of the cases with LD (46.4%) suffered from two or more health problems. The odds of LD increased with the number of problems suffered. The problems contributing most to the population burden of disease as assessed by population attributable risk fractions were hemiparesis, arthritis, accidents (unintentional injuries), blindness and other eye diseases, kyphosis, weakness of limbs, deafness, and hypertension. This ranking of public health priority differs from conventional approaches using mortality statistics and disability adjusted life years (DALYs). In conclusion, national disability surveys provide a valuable means of assessing the population burden of disability and determining the underlying causes of disability. These methods provide a direct assessment of disability prevalence and disease priorities for rapidly ageing transitional countries where death certification may be incomplete or inaccurate.

INTRODUCTION

Traditionally, public health priorities have been assessed by mortality statistics. In rapidly ageing populations, particularly those in developing countries, mortality statistics tend to be inaccurate or incomplete and do not reflect those conditions that do not cause death but contribute chiefly to morbidity and disability. Long-term disability - the inability to perform of daily living - is a major public health issue because of its impact on the economic productivity of families and the wider costs to health and social services. Furthermore, the social disadvantage that may be experienced by disabled people themselves results in inequality of social and economic opportunities, and injustice.

In old age, disabilities are the result of the cumulative effects of diseases and health problems affecting them throughout the life course (Guralnik *et al*, 1989; Campbell *et al*, 1994). It is common to find that disability is associated with two or more diseases or health problems (Verbrugge 1992; Guralnik *et al*, 1993; Ettinger *et al*, 1994). However, in public health priority setting, it is common to focus on specific diseases rather than the cumulative or combined effects of several diseases in causing disability (Murray and Lopez, 1996). Current priority setting is oversimplified as it fails to deal with interactions between health problems, and among ageing populations, does not assess multiple pathology, particularly those problems that are not fatal. Estimates of the global burden of disease in developing countries have been made by making use of often inadequate routinely collected mortality

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data, supplemented by consensus derived estimates of the disability associated with chronic diseases (Murray and Lopez, 1996).

We believe that this approach can be improved upon by using disability surveys, which can be carried out in most countries and might provide a more accurate picture of the true burdens of disease experienced by ageing populations. To illustrate such an approach, a national survey of long-term disability among Thai elderly people was performed and estimates made of the causes of disability and their health importance.

MATERIALS AND METHODS

Sampling

A multi-stage random selection cross-sectional survey (National Health Examination Survey II) was performed in 1997 by the Ministry of Public Health of Thailand. The sampling frame used was derived from the decennial census of 1995-1996, which defined four main geographic regions of Thailand from which eight provinces within each region were randomly selected. From these provinces, between 61 and 71 villages/communities were randomly selected, and finally within each village/community 15 people aged 60+ years were randomly selected to take part in the survey. Bangkok was sampled as if it were a region and a similar stratified simple random sampling system was used. A target of 1,000 participants in each region was set and interviews were held in participants' homes with repeat visits made as necessary by Ministry of Public Health personnel.

Defining long-term disability

Data on disability were collected using a structured questionnaire administered by trained interviewers. A series of questions was used to identify the elderly with long-term activity limitation (long-term disability) and long-term disease/health problems. The questions were:

1. 'Have you had any long-term condition or health problems for 6 months or longer?'

2. 'What are these long-term condition or health problems?'

3. 'Have any of these long-term condition or health problems been caused by accident?'

4. "Do these long-term condition or health problems prevent or limit you in the kind or amount of activity you can do?' and

5. 'If, yes, how long has your activity been limited?'

Participants who answered positively to question 4, and in addition had suffered for at least 6 months, were classified as having long-term disability. The prevalence of long-term condition/ health problems among those with and without long-term disability was compared and tested for statistical significance by means of the chi-square test. Those associations with a statistical significance meeting a p-value of 0.05 or less were entered into a logistic regression analysis using long-term disability as the dependent variable and each of the other diseases or health problems as independent variables. Additional possible confounding variables (*ie* age, sex, literacy) were also assessed in the model. The odds ratio and 95% confidence interval were used to assess the independent contributions of each of the diseases and health problems.

Population attributable risk fractions were then calculated based on the strength of association (*ie* odds ratio) of the diseases or health problems with long-term disability and the prevalence of the diseases or health problems in the population studied using the formula (Armitage and Berry, 1987):

$$\text{Population attributable risk fraction} = \frac{Px(OR-1)}{Px(OR-1)+1}$$

Population attributable risk fractions enable both the strength of association and the commonness of disease to be taken into account and consequently useful for determining priorities from a public health perspective. The SPSS-PC program was used for statistical analysis.

RESULTS

From a total population of 5,010 people approached, 4,048 took part, giving a response rate of 80.8%. Of the 962 non-participants, reasons for not taking part were 'could not be contacted without specified reasons (764, 79.4%)', 'did not want to participate (63, 6.6%)', 'death (62, 6.4%)', 'migration to live in other areas (42, 4.4%)', and 'hospitalization (31, 3.2%)'. Thus, the corrected

response rate for those available to be interviewed in their own homes was 83.0%.

Of the 4,048 participants, 57% were women and the mean age (SD) was 69.7 (7.3) years. Overall, 769 (19%) reported long-term disability, of whom 61% were women. The mean age (SD) of subjects with and without long-term disability was 72.3 (8.3) and 69.1 (6.9) years respectively. The number of long-term condition/health problems reported by those people with long-term disability varied from one to 21. Nearly half (46.4%) of them reported suffering from two or more long-term diseases or health problems. The prevalence of long-term disability increased with age and was higher in women within each age group (Fig 1).

Age and multiply adjusted (*ie* age, sex, literacy and each of the other diseases or problems) odds ratios for long-term disability given the presence of specific diseases and health problems are shown in Table 1. The strongest associations were
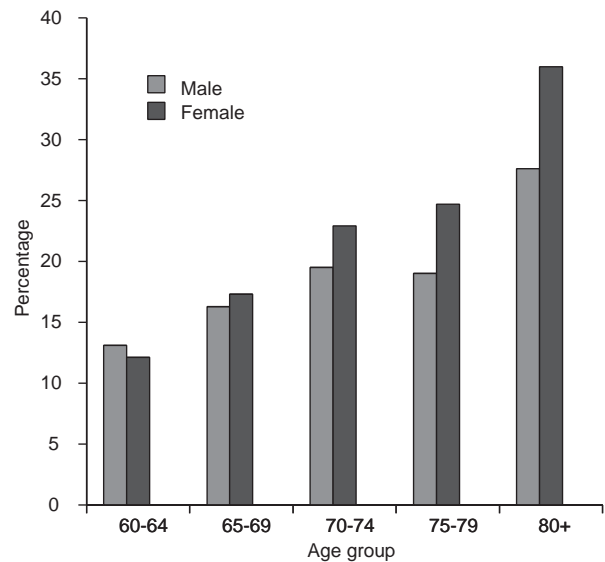

Fig 1–Prevalence of long-term disability by age and sex.

Table 1
Long-term diseases or health problems associated with long-term disability among a Thai elderly population.

	Number (%) of affected subjects	Age-adjusted odds ratios	Multiply adjusted odds ratios[a]	95% confidence intervals
Special senses				
Blindness (unilateral and bilateral)	75 (1.85)	9.21	6.98	3.97 - 12.27
Eye diseases	487 (12.03)	2.21	1.85	1.48 - 2.36
Deafness/severe hearing loss	126 (3.11)	4.39	4.24	2.81 - 6.40
Locomotor problems				
Kyphosis/kyphoscoliosis	45 (1.11)	9.24	10.74	5.20 - 22.20
Contracture of limbs	34 (0.84)	15.30	8.04	3.15 - 20.54
Arthritis/arthralgia	958 (23.67)	1.61	1.72	1.41 - 2.09
Loss of hands-feet-fingers and/or toes	14 (0.35)	5.50	3.49	1.13 - 10.80
Neurological problems				
Dementia	90 (2.22)	3.32	2.06	1.24 - 3.44
Convulsions	17 (0.42)	4.22	3.35	1.12 - 10.06
Weakness of limbs	171 (4.22)	5.17	3.50	2.41 - 5.08
Cardiovascular problems				
Hemiparesis	86 (2.12)	13.97	10.21	5.79 - 17.97
Ischemic heart diseases	96 (2.37)	2.33	2.50	1.54 - 4.04
Other heart diseases	164 (4.05)	2.09	1.68	1.12 - 2.50
Hypertension	600 (14.82)	1.97	1.58	1.25 - 2.01
Other				
Diabetes mellitus	334 (8.25)	1.94	1.66	1.23 - 2.25
Renal diseases	56 (1.38)	2.49	2.65	1.39 - 5.04
Accidents (unintentional injuries)	209 (5.16)	7.11	4.13	2.93 - 5.83

[a]adjusted for each of other diseases/health problems and confounders including age, sex and literacy (*ie* the full model).

found for kyphosis or kyphoscoliosis (OR 10.7, 95% CI 5.2 - 22.2), hemiparesis (OR 10.2, 95% CI 5.8 - 18.0), contracture of limbs (OR 8.0, 95% CI 3.2 - 20.5), and blindness (OR 7.0, 95% CI 4.0 -12.3). All those with loss of a limb reported long-term disability and consequently the odds ratio was not estimated, but only five people were affected.

The relationship between long-term disability and number of independently associated diseases and health problems is shown in Table 2. The odds of long-term disability increased in a step-wise relationship with the number of diseases/health problems.

Table 3 shows the population attributable risk fractions (PARF) of diseases and health problems and their ranks. PARF is the proportion of long-term disability that can be 'explained' by a specific disease or health problem. As can be seen in Table 3, very rare problems such as contrac-

Table 2

Relationship between the number of diseases/health problems identified from the logistic regression and long-term disability, age-adjusted odds ratios and 95% confidence intervals.

Number of diseases/health problems	Total number of subjects	Number (%) of subjects with LD	Age-adjusted odds ratios	95% confidence intervals
0	1,802	108 (6.0)	1	-
1	1,360	304 (22.4)	4.47	3.53 - 5.65
2	588	183 (31.1)	6.99	5.37 - 9.10
3	197	107 (54.3)	17.58	12.43 - 24.86
4+	101	67 (66.3)	30.79	19.37 - 48.96

Table 3

Population attributable risk fractions of common diseases/health problems independently associated with long-term disability and priority ranks based on their population attributable risk fractions.

	Population attributable risk fractions (%)	Priority ranks
Special senses		
Blindness (unilateral and bilateral)	10.0	4
Eye diseases	9.3	7
Deafness/severe hearing loss	9.2	8
Locomotor problems		
Kyphosis/kyphoscoliosis	9.8	5
Contracture of limbs	5.6	10
Arthritis/arthralgia	14.6	2
Loss of hands-feet-fingers and/or toes	0.9	17
Neurological problems		
Dementia	2.3	14
Weakness of limbs	9.5	6
Convulsion	1.0	16
Cardiovascular problems		
Hemiparesis	16.3	1
Ischemic heart disease	3.4	12
Other heart diseases	2.7	13
Hypertension	7.9	9
Other		
Diabetes mellitus	5.2	11
Renal diseases	2.2	15
Accidents (unintentional injuries)	13.9	3

ture of limbs, while being strongly associated with disability (multiply-adjusted OR 8.0) has only a small PARF of 5.6% as it is very uncommon, affecting only 34 (<1%) of the population. By contrast, arthritis is only relatively weakly associated with disability (multiply-adjusted OR 1.7) but is very common (23.7% affected) and consequently has a large PARF of 14.6%.

The priority rankings of diseases/health problems among Thai elderly identified in this study were compared with other methods of priority setting (Table 4). The disability adjusted life years (DALYs) method of the Global Burden of Disease project (Murray and Lopez, 1996) using the classification 'Other Asia and Islands' for people aged 60+ years, ranked ischemic heart disease as the most important problem, followed by cerebrovascular disease, tuberculosis and lower respiratory tract infections, and cataracts. A national Thai initiative (Smutharaks *et al*, 1997) using DALYs derived from prevalence data on morbidity and mortality data for people aged 65 + years, placed cardiovascular diseases as first priority, followed by malignant neoplasms, diseases of the digestive system, respiratory diseases and diabetes mellitus. Priority setting based on national Thai mortality data for 1996 (Data of national mortality registration in 1996) gave a different set of priorities, reflecting the inadequate and inaccurate recording of cause of death in older people. If those problems reflecting non-diagnostic causes of death are discounted, mortality data gave the following priorities: heart failure, malignant neoplasms, diabetes mellitus, cerebrovascular diseases, and accidents.

DISCUSSION

In a large scale, national randomly sampled population a high response rate (83%) was achieved and a representative sample of people aged 60+ years studied. Linking the methods to the tried and tested national census survey was successful and ensured that new efforts to derive sampling frames and ensure official co-operation were not required to establish a national disability survey. Despite sampling older people, the response rate did not differ from the First National Health Examination Survey conducted in 1991 (Health System Research Institute, 1996).

One in eight of the sample aged 60-64 years reported long-term disability and this increased to one in three among those aged 80+ years. These levels of disability are lower than those reported in a comparable national disability survey in the UK where almost 70% of those aged 80+ reported long-term disability (Martin *et al*, 1988). In disability surveys performed in Southeast Asia, rates vary widely (Andrews *et al*, 1986) and a recent review for the Association of Southeast Asian Nations reported disability rates among those aged 75+ years ranging from a low of only 5% (Philippines) to a level of 60% (Myanmar) (Ebrahim, 1997).

Self-reports of disability and morbidity are widely used and are accepted as tools for epidemiological and public health surveys (Robine *et al*, 1992; Strawbridge *et al*, 1996; Thailand Health Research Institute, 1996; Fried and Guralnik, 1997). However, self-reports may be inadequate for assessing burdens of disease because of selective under-reporting of some types of disability (*eg* mental illness due to stigma or denial; dementia due to inability to comply with survey procedures) and over-reporting (*eg* in anticipation of benefits or help). In addition, the type of disability, its threshold and the duration used to define a person as 'disabled' is likely to vary between cultures and places, over time and between surveys. These methodological differences are likely to explain variation in prevalence of disability found between surveys.

The strength of association of underlying diseases and health problems associated with long-standing disability is unlikely to be affected by problems of definition. Use of logistic regression methods helps in identifying those factors that are independently associated with increased likelihood of long-term disability - as several of the disease-disability associations are likely to be confounded by age and the effects of other diseases. The need to make adjustment for such confounders is shown by the tendency for odds ratios to attenuate, often quite markedly, from age-adjusted to multiply-adjusted estimates (Table 3). The adjusted analyses performed demonstrate the importance of diseases that have their effects on the locomotor system (kyphosis, arthritis, weakness of limbs, hemiparesis), special senses (vision and hearing), and emphasise the importance of accidents.

Table 4
Priority ranking of diseases/health problems ofThai elderly from this study and from other sources.

Ranks	The present study	The Global Burden of Disease (6)[a]	National Workshop on Prioritization of Health Research and Development (8)[b]	National mortality data in 1996 (9)[c]
1	Hemiparesis	Ischemic heart diseases	Cardiovascular diseases (noncommunicable)	Senility (R54)
2	Arthralgia or arthritis	Cerebrovascular diseases	Malignant neoplasms	Heart failure (I50)
3	Accidents (unintentional injuries)	Tuberculosis	Diseases of digestive system (noncommunicable)	Ill-defined and unknown causes of mortality (R95-R99); symptoms, sign and abnormal clinical and laboratory findings, not elsewhere classified (R00-R53; R55-R94)
4	Blindness	Lower respiratory infections	Respiratory diseases (noncommunicable)	Malignant neoplasm without specification of site (C80)
5	Kyphosis or kyphoscoliosis	Cataracts	Diabetes mellitus	Diabetes mellitus (E10-E14)
6	Weakness of limbs	Chronic obstructive pulmonary disease	Neurological diseases (noncommunicable)	Cerebrovascular diseases (I60-I69)
7	Eye diseases	Cirrhosis of liver	Respiratory infections	Other unspecified disorders of circulatory system (I99)
8	Deafness or severe hearing loss	Dementia	Diseases of genito-urinary system (noncommunicable)	Accidents (unintentional injuries) (V01-X59)
9	Hypertension	Diabetes mellitus	Accidents (unintentional injuries)	Other septicemia (A41)
10	Contracture of arms and/or legs	Trachea, bronchus, lung cancers	Diseases of sense organs (noncommunicable)	Complications and ill-defined descriptions of heart disease (I51)
11	Diabetes mellitus	Mouth and oropharynx cancers	Tuberculosis	Pneumonia (J12-J18)
12	Ischemic heart diseases	Accidents (unintentional injuries)	Musculo-skeletal disorders (noncommunicable)	Malignant neoplasm of liver and intrahepatic bile ducts (C22)
13	Other heart diseases	Nephritis/ and nephrosis	Diarrheal diseases	Other paralytic syndrome (G83)
14	Dementia	Stomach cancer	Deformities (noncommunicable)	Ischemic heart diseases (I20-I25)
15	Renal diseases	Osteoarthritis	Self-inflicted (intentional injuries)	Hypertensive diseases (I10-I15)

[a]DALY based approach of people age 60 and over in 'Other the Asia and Islands' (includes Thailand) -1990.
[b]DALY based approach of people age 65 and over in Thailand -1993; using prevalence rate of morbidity instead of incidence rate; intensive problems with limited data on morbidity and inadequate mortality data report.
[c]Use National data on mortality in 1996 and analyse for this project; 47% of causes of death among Thai elderly age 60 and over were recorded as 'senility' (R54 in ICD10); 6.7% were reported in category 'Ill-defined and unknown causes of mortality' (R95-R99 in ICD10); symptoms, sign and abnormal clinical and laboratory findings, not elsewhere classified (R00-R53; R55-R94) accounted for 2.9% of all death.

At older ages, multiple pathology is the rule rather than the exception and this is shown in our analyses. Our findings support the notion that long-term disability is a cumulative phenomenon resulting from various pathologies and impairments. In most instances the onset of disability is slow, subtle, and progressive, much like the development of the chronic diseases that cause it. Thus, prevalent health problems may have more impact than short-duration incident disease in predicting long-term disability (Fried and Guralnik, 1997). Further work, preferably using cohort study designs, examining the impact on long-standing disability of different combinations of underlying diseases is required to identify potential interactions between diseases causing locomotor problems, impairment of special senses, and accidents. Such analyses may well identify groups at high risk of becoming disabled in the event of further disease or health problem occurrence, in whom preventive action may be taken.

At present Thailand, in common with many transitional countries, is in a period of economic depression, which creates public concern over use of limited national health-care resources. Moreover, people's expectations of health care are growing. Thus, prioritization of health actions, both health services and public health initiatives, has become increasingly important. Disability Adjusted Life Years (DALYs) have been proposed as a global or international health indicator for determining priorities and allocating resources (Murray *et al*, 1996; Wright and Walley, 1988). DALYs combined data on mortality and morbidity into a simple indicator but require adequate national data and assume that social values are comparable between populations. The concept, complexity of calculation and the links between priorities and resource allocation have all been criticised (Anonymous, 1996; Fried and Guralnik, 1997; Sayers and Fleidner, 1997).

Problems in the application of DALYs are exemplified by a Thai study, which was only able to determine priorities as broad diagnostic groups owing to limited disease incidence data. Of greater importance in ageing populations, mortality data at ages over 60 years is very inaccurate with over half of all deaths attributed to senility or other ill-defined and unknown causes (Division of Health Statistics, 1996). In Thailand, as in many other countries, death certification is carried out by non-medical personnel and is seen as a primarily legal requirement. Even if death certification could be improved, the priorities determined would not reflect the major health concerns in ageing populations.

The use of population attributable risk fractions (PAFR) has been widely used to determine public health 'importance' of diseases or health problems. In our study, we have used it as an indicator of the importance of specific diseases or health problems in causing long-term disability. It would be wrong to interpret PAFR as the proportion of long-term disability that would be avoided if a specific disease or problem were removed as other unmeasured confounders are likely to operate (reducing the strength of associations estimated) and interventions are likely to be only partially effective in reducing disease occurrence. However, the PAFR is readily and explicitly calculated from simple disability survey data and provides an alternative, and probably more relevant view, of public health priorities among older people in ageing populations.

Our study demonstrates importance of hemiparesis (due to stroke), arthritis, accidents, blindness and other eye diseases, kyphosis/kyphoscoliosis, weakness of limbs, deafness, and hypertension, and confirms findings of an earlier more detailed, but smaller, survey of an urban slum population (Jitapunkul *et al*, 1994). Perhaps surprisingly, ischemic heart disease, malignancies and infectious diseases were not identified as high priorities but our focus was on long-term disability rather than survival - and these diseases tend to either kill rapidly or are curable. By contrast, the Global Burden of Disease approach and mortality data do not highlight accidents or impairments of special senses. None of these methods deal adequately with mental health problems, which are common, cause misery and suffering, and are often easily treatable.

Many of the diseases and health problems associated with long-term disability can be prevented or modified by health actions. Priority setting requires not just information on disease burdens, however measured, but also a clear health policy. The major aim of health policy for older people is to

increase the proportion of life span spent in good health, that is to increase disability-free life expectancy. Paradoxically, effective interventions for 'killer' diseases, which tend to increase life expectancy more than disability free life expectancy will also tend to increase the time spent in disabled health states. Interventions for treatment of acute ischemic heart disease, malignant neoplasms, and respiratory infections fall into this category. By contrast, focusing on those diseases that are associated more with disability and less with survival (*eg* arthritis, visual and hearing impairment) will tend to compress disability and reduce the possible health and social care impacts of ageing populations. Consequently, we believe that in rapidly ageing developing countries, it is necessary to compare the impact (in terms of cost and compression of disability) of public health programs using DALY/mortality derived priorities with disability prevalence priorities.

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