Independent life expectancy in New Zealand, 1996–97

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Abstract

The objective of this article is to describe independent life expectancy (ILE) in New Zealand in 1996–97, including variations in this indicator between age, gender and ethnic groups. ILE is defined as the number of years a person can expect to live without any self-reported functional limitation requiring the assistance of another person or a complex assistive device. ILE is a positive measure of health. Its complement, expectation of life with dependency (LED), is also a useful indicator. Together, ILE and LED add up to total life expectancy (LE). The contribution to ILE from disability and mortality at each age is analysed in this article. The elasticity of ILE to changes in mortality and to changes in disability is also investigated. Finally, the burden of injury is estimated by calculating the potential gain in ILE that would result were injury-related disability and mortality to be eliminated.

Introduction

The health policy debate in New Zealand, as in other countries, has traditionally emphasised measures of population health based on mortality (including standardised mortality ratios, years of life lost and life expectancy). For example, the population-based funding formula for personal health – used to allocate some 70% of total public health spending in New Zealand – employs a 'special health need factor' based on standardised mortality ratios. This has been at the expense of more broadly-based population health indicators that take into account the quality as well as the quantity of life.

To some extent this situation reflects the longstanding availability of reliable and complete death records. Yet reliance on death as the sole health outcome worthy of measurement can seriously distort public health policy and bias resource allocation in ways that may well be sub-optimal from a societal perspective.

Such a limited view of population health is no longer necessary, with the availability of reliable survey instruments to measure health-related quality of life and disability.

Quality of life, morbidity or disability data can be combined with mortality data to produce an integrated measure of population health: one which extends the range of our understanding from life expectancy to health expectancy. Such an integrated perspective, combining both 'quality of life' and 'quantity of life' dimensions of health, recognises that further life extension may have to be traded off against losses in the quality of life (Robine, Mathers & Bone 1993).

Health expectancy indicators have the potential to transform the health policy debate in the developed world from a narrow preoccupation with the extension of life to a broader concern with population health gain (Romieu & Robine 1997; World Health Organisation 1997). These measures can also serve to bring equity objectives more sharply into focus, whether between genders, generations, social classes or ethnic groups.

In New Zealand, the concept of health expectancy was first applied by Graham and Davis (1990) to the non-institutionalised adult population aged 15–64 years, using disability prevalence estimates derived from the 1980–81 Social Indicator Survey. They have since updated these estimates, based on the disability items included in the 1992–93 Household Health Survey (Davis, Graham & Pearce 1999).

Tobias and Cheung (1998) constructed the first health expectancy tables for the total New Zealand population using disability prevalence rates from the 1996 Household Disability Survey and its companion 1997 Disability Survey of Residential Facilities. These surveys provide disability prevalence rates based on well validated disability questionnaires and on sampling frames that include both institutionalised and noninstitutionalised populations of all ages (Health Funding Authority & Ministry of Health 1998; Statistics New Zealand 1998). Due to the difference in survey design, coverage and methods of calculation, this and the earlier studies by Graham and Davis are not comparable, so a health expectancy time series does not yet exist in New Zealand.

Study design

Life tables incorporating disability were constructed for Maori and non-Maori males and females by the observed prevalence method (Sullivan 1971). Complete life tables for 1995–97 were obtained from Statistics New Zealand. Cause-specific mortality data for 1996 were obtained from the New Zealand Health Information Service. Disability prevalence rates by severity and cause were estimated from the Household Disability Survey fielded by Statistics New Zealand in 1996 and its companion, Disability Survey of Residential Facilities, fielded by Statistics New Zealand in 1997. These surveys are outlined briefly below.

The household survey, which involved a clustered random sample of private households, was a post-census survey, allowing linkage to and use of information collected in the 1996 Census. The census also provided the sampling frame for the survey. The data were collected by personal interview. A series of screening questions was used to identify participants with disability, the others forming the control group. A more detailed

'content' questionnaire was then administered to respondents with disability. Disability was defined on the basis of self-report, or proxy (caregiver) report when necessary.

The survey of residential facilities was based on a stratified random sample of long-term residential institutions for the disabled and the elderly (hospitals, long-stay institutions for the intellectually, psychiatrically and physically disabled, and rest homes). This survey was designed so that the data collected could be pooled with the data from the household survey, enabling the calculation of population-based disability prevalence rates, including persons in health and disability-related institutions, as well as those resident in the community.

Both household and institutional samples were nationally representative. The achieved sample sizes were 17 548 and 1016 respectively, representing response rates of 86% and 94%.

The functional concept of disability used in these linked surveys was defined as any limitation in activity resulting from a health problem and lasting, or expected to last, for six months or more. Respondents were asked whether they experienced any difficulty performing specified everyday activities because of a long-term condition or health problem. For children under 15 years (reported via proxy) a broader definition was used which also included specific chronic conditions and education support needs. People who indicated that they experience difficulty or need help in performing any of the itemised activities were considered to have a disability. The limitation had to be for a minimum of six months (or expected to last for that time) and not be eliminated through the use of simple corrective devices like eye glasses.

To construct ILE, the threshold for disability was set at dependency – the need for assistance (from another person or a complex assistive device) with everyday routines, either intermittently or continuously.

Results

Expectation of life in different states of health

LE, ILE and LED at selected ages (at birth, 15, 45 and 65 years) are summarised in Table 1. This table also shows the ratio of ILE to LE at each of the selected ages. Over 85% of life expectancy at birth is expected to be free from disability requiring assistance: 64.6 out of 74.3 years for males and 67.9 out of 79.6 years for females.

However, the rate of decline in ILE is faster than that for LE, so the ratio of ILE to LE decreases with increasing age. From around age 40 the decline in ILE accelerates to assume a sharp downward exponential trend. This means that while the impact of disability is felt at every age from birth onwards, it greatly intensifies at the middle-to-older ages. Nevertheless, at age 65, almost two-thirds of remaining life expectancy will still be spent independently.

The gap between LE and ILE at birth in 1996 (9.7 years for males and 11.7 years for females) provides one estimate of the burden of disease and injury sustained by the population in that year.

Life expectancy (years)		Indepe life expe (yea	Independent life expectancy (years)		Ratio of independent to total life expectancy (%)		Life expectancy with dependency (years)	
Age	Males F	emales	Males F	emales	Males Fe	males	Males F	emales
0	74.3	79.6	64.6	67.9	87	85	9.7	11.7
15	60.1	65.4	51.4	54.2	86	83	8.7	11.2
45	32.1	36.4	24.9	27.3	78	75	7.2	9.2
65	15.5	19.0	9.8	11.7	63	62	5.7	7.3

Table 1: Life expectancy and independent life expectancy at selected ages, total population, by gender, 1996–97

Source: Calculated from 1995–97 Complete Life Tables (Statistics New Zealand) and 1996–97 Disability Surveys (Statistics New Zealand)

Sociodemographic variations in health expectancy

Sociodemographic differentials are analysed in two ways. First, the gaps between genders and between ethnic groups (Maori and non-Maori) with respect to LE and ILE are measured in absolute terms. Second, the ratio of ILE to LE for each gender and ethnic group is calculated and compared. Tables 2 and 3 summarise the variations at these selected ages, expressed as the absolute number of expected life years, and as the ratio between them.

For both ethnic groups, female life and health expectancies exceed those for males at every age. However, at all ages and for both ethnic groups, the gender gap in ILE is narrower than that for LE. Thus females live longer than males at all ages and also spend longer periods of time living both independently and in a dependent state. After taking disability into account, the female advantage in survivorship over males is compensated for by the longer period of time females are expected to live in a dependent state.

Analysis of the absolute gap between ethnic groups reveals an unfavourable picture of Maori health expectancy. Maori have a significantly lower LE and ILE than non-Maori at every age, and the ethnic gap in health status tends to widen further once a measure of disability is introduced (although this is not consistent across all ages and is more evident for females than for males). Overall, however, Maori live shorter lives than non-Maori, and spend longer periods of time in states of dependence than non-Maori, both in absolute terms and as a proportion of their relatively shorter lives.

	Non-Maori			Maori	
	Males	Females		Males	Females
			at birth		
Life expectancy	75.3	80.6		67.2	71.6
ILE	65.6	68.9		57.3	58.7
			at age 15		
Life expectancy	61.0	66.2		53.4	57.7
ILE	52.3	55.1		44.8	45.4
			at age 45		
Life expectancy	32.8	37.1		26.2	29.4
ILE	25.4	28.0		20.0	20.0
			at age 65		
Life expectancy	15.8	19.3		12.2	14.5
ILE	9.9	11.9		7.4	7.5

Table 2: Life expectancy and independent life expectancy (ILE) at selected ages, non-Maori and Maori population, by gender, 1996–97

Source: Calculated from 1995–97 Complete Life Tables (Statistics New Zealand) and 1996–97 Disability Surveys (Statistics New Zealand)

For example, at birth the Maori–non-Maori gap in LE for females of 9.0 years widens into a gap in ILE at birth of 10.2 years. Indeed, the ratio of Maori to non-Maori ILE at birth provides a single, whole-of-population indicator of the inequality in health status between the two ethnic groups. In 1996 this ratio stood at 85.2% for females and 87.3% for males (or approximately 86% overall).

The ratios of ILE to the corresponding LE are summarised in Table 4. The ratio analysis adds another perspective to the assessment of which gender enjoys better health status: though living shorter lives, males enjoy a greater proportion of their lives in independence than females. Males' relative advantage in this regard is maintained throughout life and, in the case of Maori, this male advantage is enhanced over the life course.

	Female–male difference (years)			Non-M differe	aori–Maori nce (years)
	Non-Maori	Maori		Males	Females
			at birth		
Life expectancy	5.3	4.4		8.1	9.0
ILE	3.3	1.4		8.3	10.2
		а	t age 15		
Life expectancy	5.2	4.3		7.6	8.5
ILE	2.8	0.6		7.5	9.7
		а	t age 45		
Life expectancy	4.3	3.2		6.6	7.7
ILE	2.6	0.0		5.4	8.0
		а	t age 65		
Life expectancy	3.5	3.5 2.3		3.6	4.8
ILE	2.0	0.1		2.5	4.4

Table 3: Gender and ethnic differentials (in number of years) in life expectancy and independent life expectancy (ILE) at selected ages, 1996–97

Source: Calculated from 1995–97 Complete Life Tables (Statistics New Zealand) and 1996–97 Disability Surveys (Statistics New Zealand)

Age	Non	-Maori	Maori		
-	Male (%)	Female (%)	Male (%)	Female (%)	
0	87.1	85.5	85.3	82.0	
15	85.7	83.2	83.9	78.7	
45	77.4	75.5	76.3	68.0	
65	62.7	61.7	60.7	51.7	

Table 4: Ratio of independent life expectancy to life expectancy by age, gender and ethnicity, New Zealand 1996–97

Source: Calculated from 1995–97 Complete Life Tables (Statistics New Zealand) and 1996–97 Disability Surveys (Statistics New Zealand)

This analysis of ratios further highlights the poor health status of Maori, in particular Maori females. At all ages the ratio of ILE to LE is less for Maori than non-Maori.

While the gap between Maori and non-Maori males remains stable across all age groups, the ethnic gap for females widens with age, reflecting a more rapid rate of decline in independence with age for Maori females than that experienced by their non-Maori counterparts.

Health expectancy and population dynamics

The difference between LE and ILE represents the expectation of life with dependent disability (LED) or, equivalently, the expected loss of independent life years. LED at birth in 1996 was 9.7 years for males (74.3 minus 64.6) and 11.7 years for females (79.6 minus 67.9). The analysis below was carried out to understand how this loss (burden) is distributed across different age groups. This has been estimated in Figure 1 by calculating how much ILE at birth would increase if the prevalence of disability requiring assistance (dependency) and the incidence of mortality in each age group were to be reduced to zero (one age group at a time).

Disability at ages 50 and above contributes most to the gap between LE and ILE at birth. For males, the age-specific contribution is most concentrated at ages 60 to 80, while for females the peak contribution occurs a decade later, at around ages 70 to 90, with over one year of independent life lost for every five years of age over this age range. Due to low survivorship, however, the relative contribution to the loss of independent life years after age 90 for males and 95 for females is no greater than in childhood and young adult ages, despite the much higher prevalence of disability at the more advanced ages.

The space between the two curves indicates the potential gain in ILE at birth achievable by eliminating deaths in a particular age group. For example, the complete elimination of infant mortality alone would add another half-year to the ILE at birth, reflecting the relatively high risk of mortality in infancy.

The impact of mortality reduction at all ages is more marked for males, nearly double the gains from eliminating disability at most ages. Again, reductions in mortality and disability at ages 50 and above would contribute overwhelmingly to future gains in ILE at birth. The largest possible gains are expected at around ages 60 to 80 for males and 70 to 90 for females.

Elasticity of health expectancy

Insight into the relative importance of future trends in disability and mortality in determining population health status may be gained by examining the elasticity of ILE. This is done by analysing the sensitivity of ILE to a small (1%) change in mortality and/ or disability. The results, summarised in Table 5, also help to gauge the sensitivity of ILE to the changing disability and mortality profile of the population and hence the suitability of this measure as a population health status indicator.

	1% change in age- specific mortality rates (%)		1% change in age- specific disability prevalence rates (%)		
Age	Males	Females	Males	Females	
At birth	0.12	0.09	0.15	0.17	
At age 15	0.14	0.10	0.17	0.21	
At age 45	0.22	0.18	0.29	0.33	
At age 65	0.40	0.30	0.59	0.62	

Table 5: Percentage change in independent life expectancy (ILE) resulting from a 1% change in mortality *or* disability at all ages, total population, by gender, New Zealand 1996–97

Source: Calculated based on 1995–97 Complete Life Tables by Statistics New Zealand and age-specific disability prevalence rates from the 1996–97 Disability Surveys

ILE can be seen to be responsive to small changes in mortality and disability rates. Small changes are to be expected in future, given New Zealand's already low mortality environment and the chronic nature of most disabling conditions.

A mortality reduction of 1% at all ages would yield less than one additional month in ILE at birth, or a 0.12% increase for males and 0.09% for females. Conversely a 1% mortality increase would reduce ILE at birth by the same proportion. In comparison, a 1% reduction in age-specific disability prevalence rates would yield a larger increase in ILE at birth of one to one-and-a-half months, or 0.15% for males and 0.17% for females, even if the levels of mortality stay unchanged. Males are more responsive to mortality reductions and females to reductions (or expansions) in the prevalence of disability. For both genders, the relative change in ILE increases steadily with age, while the absolute change decreases.

Possible future interactions between mortality and disability can also be tested by combining the results of the separate elasticity analyses. Two scenarios are illustrated in Table 6. In both scenarios mortality rates are assumed to reduce at all ages by 1%. The disability prevalence rates are assumed to reduce by 1% at all age groups in the first scenario but to increase by 1% in the second.

Reductions in both mortality and disability would of course enhance ILE, and the effect is additive. More interestingly, a 1% reduction in mortality, combined with a 1% increase in disability prevalence – a highly likely future scenario – produces a net decline in ILE at all ages for both genders. The decline is particularly marked among females. This finding has major policy implications, for example for future health service funding requirements.

Elasticity analysis quantifies the greater effectiveness in achieving further population health gains that would result from policies aimed at disability prevention and control rather than (further) mortality reduction. This is particularly the case for females who,



Source: Calculated based on 1995–97 Complete Life Tables by Statistics New Zealand and age-specific disability prevalence rates from the 1996–97 Disability Surveys

Figure 1: Age distribution of gains in independent life expectancy at birth resulting from reductions in age specific mortality rates and/or disability prevalence rates, total male and female population, 1996–97

compared to males, already enjoy a lower level of mortality but have similar or higher prevalence of disability (depending on age).

Table 6: Percentage change in independent life expectancy resulting from simultaneous 1% change in *both* mortality *and* disability at all ages, total population, by gender, New Zealand 1996–97

Age	1% reduction in both mortality and disability (%)		1% reduction in mortality and 1% increase in disability (%)		
	Males	Females	Males	Females	
0	0.27	0.26	-0.03	-0.08	
15	0.31	0.31	-0.03	-0.10	
45	0.52	0.51	-0.07	-0.16	
65	0.99	0.92	-0.19	-0.33	

Source: Calculated based on 1995–97 Complete Life Tables by Statistics New Zealand and age-specific disability prevalence rates from the 1996–97 Disability Surveys

If maximising ILE (or minimising inequalities in ILE) is the policy goal, disability (dependency) prevention strategies will be more effective than strategies aimed at further postponing death. For females, the former strategy would in fact be twice as effective as the latter. Further reductions in mortality, if accompanied by even small increases in disability prevalence, will result in *deteriorating* population health status (especially among females), at least as measured by ILE.

Causal structure of health expectancy

The potential health gain achievable by controlling disability and/or mortality due to specific cause(s) can be estimated by calculating the corresponding cause-deleted health expectancy (that is, the health expectancy re-calculated with all disability and all deaths from the cause of interest removed). The difference between 'ordinary' health expectancy and 'cause-deleted' health expectancy is a measure of the current 'burden' on population health attributable to the cause(s) of interest.

Cause-specific analysis in health expectancy is fraught with data problems since mapping from disability to specific diseases or injuries is difficult. Survey respondents may not be able to attribute their functional limitations to specific causes and other sources of data may not be available. The 1996–97 Disability Surveys were not completely successful in collecting data on self-reported cause of disability, making it difficult to map from disability to disease or injury at International Classification of Diseases chapter level (or below) from this source. This was largely because the survey questionnaires failed to distinguish primary from secondary disabilities, and main disabling conditions from minor contributory causes – defects which could be rectified in future surveys.

Results of the 1996–97 Disability Surveys only allow grouping of 'cause of disability' into four broad categories:

- disabilities due to injuries as the sole cause (accounting for 27% of all disabilities)
- disabilities due to causes other than injury (55%)
- disabilities due to both injury and non-injury-related causes (17%), and
- causes not specified (2%).

Limited causal analysis is carried out here only on the first category. The analysis is not carried out on the other three categories since their causal structures are largely unclear.

Injury-deleted health expectancy and life expectancy are estimated by removing from the age-specific disability prevalence all disabilities due to injuries as the sole cause, and also removing from age-specific mortality all injury-related deaths. For reasons of simplicity, an assumption of independence of risks between causes (injury and noninjury) is used in the calculations. This assumption tends to overestimate the impact of cause-deletion. The overestimation effect arising from the mortality component will be small because of the relatively small number of deaths due to injuries. For disability, the overestimation effect is expected to be offset by excluding from the numerator respondents reporting disability due to both injury and non-injury-related causes. Therefore, the net effect on both mortality and disability of the independence assumption is expected to be small.

The results of injury-deleted health expectancy and life expectancy estimations are summarised in Table 7. By removing injury-related disabilities, an additional 2.3 years for males and 1.7 years for females is added to ILE at birth. This boosts ILE at birth to 66.8 years and 69.5 years for males and females respectively, an increase of 3.5% and 2.4%. As expected, completely eliminating injury-related mortality would add relatively less to ILE at birth – an additional 1.5 years for males and 0.6 years for females. Eliminating injury as both a cause of death and a cause of (dependent) disability would increase ILE at birth by 3.8 years for males and 2.2 years for females (gains of 5.9% and 3.3% respectively).

Given that a high proportion of severe injuries are potentially preventable, the scope for health gain from injury prevention and management can be seen to be large. Furthermore, the higher prevalence of injury-related disabilities and incidence of injuryrelated fatalities among males presents an opportunity to reduce the gender gap in ILE.

This analysis provides a way of quantifying the potential health gain from injury prevention. Clearly comparisons with interventions aimed at other causes (for example, cardiovascular diseases or mental health) are necessary for priority-setting and should be carefully considered in future survey designs.

	Chang	Males es after rem	oving	Females Changes after removing		
	Injury- related disability	Injury- related mortality	Injury-related disability & mortality	Injury- related disability	Injury- related mortality	Injury-related disability & mortality
			Re-estir	mated values		
LE	74.3	76.1	76.1	79.6	80.4	80.4
ILE	66.8	66.0	68.4	69.5	68.5	70.1
	Increase in n			number of years		
LE	-	1.9	1.9	-	0.8	0.8
ILE	2.3	1.5	3.8	1.7	0.6	2.2
			Percent	age increase		
LE	-	2.5%	2.5%	-	1.0%	1.0%
ILE	3.5%	2.3%	5.9%	2.4%	0.8%	3.3%

Table 7: Injury-deleted life expectancy (LE) and independent life expectancy (II	LE),
males and females, New Zealand 1996–97	

Source: Calculated based on 1995–97 Complete Life Tables by Statistics New Zealand, 1996 cause of death data supplied by the New Zealand Health Information Service and age-specific disability prevalence rates from the 1996–97 Disability Surveys (Statistics New Zealand)

Discussion

Health expectancy could provide a useful tool to support policy analysis in response to the future evolution of population health status. At least four major areas of policy application can be identified.

First, the existence of ethnic differentials in health expectancy has now been conclusively demonstrated. Compared to non-Maori, Maori have a shorter life expectancy and spend a higher proportion of their relatively shorter lives in states of dependency. Health expectancy indicators, such as the ratio of Maori to non-Maori ILE at birth, provide an index that allows us to assess whether the overall health gap between these ethnic groups is widening or narrowing in response to policy initiatives. Such a global analysis must of course be supported by specific studies (for example, analysis of ethnic specific trends in individual diseases such as Sudden Infant Death Syndrome, or risk factors such as smoking) to relate the policy responses to specific programs or interventions.

Second, gender differentials in health expectancy highlight another area of concern in formulating and evaluating health policies. Despite having lower life expectancy than

females, males also spend less time than females in states of dependency. How, then, can the health of males and females be compared? Once again, health expectancy provides an appropriate tool for such policy analysis. The results reported here indicate that the health of both genders can be expected to decline if the secular trend in survival continues but is not accompanied by a compensating decline in disability.

However, the impact on women will be greater than that on men. Therefore, for women in particular, resources need to be reallocated from policies and programs aimed at mortality reduction, to strategies focused instead on the prevention and amelioration of chronic diseases associated with significant disability but low mortality (such as musculoskeletal disorders and mental health).

Third, from a longer-term perspective, current and projected disability and mortality rates have significant implications when put into the context of population ageing. The largest population growth in the next fifteen years is expected to occur at ages 50 and above, the ages at which disability starts to make a significant impact on population health status. If the pattern of disability observed in 1996–97 persists, the baby boomers currently aged in their 40s and 50s will soon dominate health care and disability support needs. The age dynamics and elasticity analyses reported here provide insight into the implications population ageing will have on needs for these services over the next several decades.

Fourth, the estimation of cause-deleted health expectancies provides a way of measuring the burden of fatal and non-fatal diseases and injuries. Estimates of burden, coupled with assessments of the cost-effectiveness of specific interventions aimed at reducing the burden, are essential tools for evidence-based policy formulation and evaluation in the health sector.

At the same time, the proposed key health expectancy indicator, independent life expectancy, has inherent limitations. An indicator that included all levels of disability rather than just a single dependency threshold would provide a more precise measure of health. The social preferences (disability weights) needed to construct such an indicator are not yet available for New Zealand, although methods to obtain such valuations have been developed (Stouthard et al. 1997).

Health expectancy indicators based on broader concepts of health-related quality of life, rather than on disability, might also be preferred. Development of such instruments is, however, in its infancy. For the medium term, independent life expectancy would seem to provide a robust and relatively easily measured and understood indicator of population health, one which represents a substantive advance over continued reliance on life expectancy alone.

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Commentary

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Independent life expectancy in New Zealand, 1996–97

Mortality rates and life expectancy at birth are commonly used as indicators for the quality of life and the quality of the health care provided in countries. For western countries these indicators have shown remarkable improvement over the last century. During the last 30 years, mortality rates have declined by 2–3% per annum, and life expectancy has increased by about eight years. Although there are some differences, all countries are experiencing a considerable improvement in mortality and life expectancy. This may explain the popularity of these indicators in government departments.

The article by Martin Tobias and Jit Cheung addresses one of the concerns with using life expectancy as an indicator. They ask whether the extra years of life are disabilityfree or are associated with an increase in the number of disability years. It is estimated that the majority of health care expenses occur in the last two years of a person's life. If life expectancy is increased by three years over the next ten years, does this mean that on average the health care expenses are merely delayed by three years? Or does it mean that the health care expenses now occur over an extended period from three to five years and the costs are therefore proportionally increased? This is an active research area and the Australian Institute of Health and Welfare and the authors of this article are involved in trying to provide answers to this important issue. I support the view that the extra life years are primarily disability-free.

This article provides data for 1996 from New Zealand on life expectancy (LE) and independent life expectancy (ILE). The results support the earlier known differences in life expectancy: females have a life expectancy at birth that is five years greater than males, and Maori life expectancy at birth is 8.5 years less. The paper then estimates the ILE, and shows that the average number of disability years is 11. Maori also have a similar number of disability years, even though their life expectancy is lower. New Zealand is unable to provide trend data, due to changing definitions of disability, but this article does provide baseline data from which to monitor trends.

Although this article presents important data, it also makes many claims as to the importance of these methods when developing health policy. While health policy should be based on data, it is important that those providing the data do not make extravagant

claims as to their potential applications. I wish to discuss these issues and try to obtain some balance in regard to the claims of the authors.

In reading this article it is important to note that the life expectancies are for a theoretical cohort of persons who experience the mortality rates for 1996. However, population cohorts experience the 1996 rates only once in their lifetime: the other rates are those prior to 1996 and post-1996. The prior rates are higher than the 1996 rates, while the post rates will be lower. In fact, for those alive now, the life expectancies given in the paper will be underestimates, since they do not take account of the trends in mortality. Thus, the life expectancy figures provided are to be used as a way of summarising the mortality rates for 1996, not for projections.

This is not the only problem with using LE or ILE for health policy. These indicators give the expectation of the years of life, but not their distribution. Readers could mistakenly assume that the number of disability years has a normal or symmetric distribution about a mean of 11 years. However, the distribution is similar to an exponential distribution: that is, one with a large skew to the right. The median for the distribution will be considerably less than 11 years (possibly three years), and the mode will be zero or one year. (The same situation occurs with length of stay in a hospital, with a mean of five days, a median of two and a mode of day-only.)

The mean can therefore create misleading views when interpreting trends or when using it for policy. For example, should we reduce the mean by reducing the proportion with a large number of disability days (achieved by reducing the rate of disability or mortality for ages less than 65 years), and hence make the distribution less skew, or should we reduce the rates for all ages? This is not a new issue, and one approach is to use a new indicator, person years of life lost (PYLL). PYLL measures the excess mortality in ages less than 65, and gives a greater weight to the deaths in the younger age groups. This indicator allows health policy to focus on the preventable deaths in those under 65 years. The same logic would suggest that person years of independent life lost (PYILL) would be a more appropriate indicator, since it considers only those years less than 65 years that are disability-free. I would expect that such an indicator would reveal more clearly the differences between the Maori and non-Maori populations.

Another issue is that understanding differences in life expectancy is not easy. Converting the differences into observed and expected deaths or years of life provides policy analysts a better tool with which to quantify the different issues. This approach was used by Coory and Gibberd (1998) and Zander, Gomes and Gibberd (1998) to quantify the impact of small-area variation in mortality rates on the number of preventable deaths. The results provide clearer guidelines as to what are the important policy issues.

The introduction to the article notes that resource allocation in health care is based on a population approach, where the health need index of the population is estimated from variables such as mortality rates. The claim is that a more refined mortality index will improve the estimate of health need. It is important to correct this claim, which is based on the assumption that a higher mortality rate causes a higher health need index. In fact, there is no causation assumed, but the association between mortality rates and health need allows mortality to be used as a surrogate variable for measures such as socioeconomic status, education, income and lifestyle to estimate the health need (Gilbert, Stewart & Gibberd 1992). The calculation of ILE for each region will not guarantee that it would be a better surrogate variable: in fact it will be worse, as the best mortality variable is the SMR for ages less than 70.

The article suggests that the analysis of trends in ILE and LE in the Maori and non-Maori population will be an important indicator for health policy. Analysing trends will be difficult because of the changing definitions of Maori in both the Census, health surveys and the death certificates. The original definition of Maori required 50% or more of Maori blood but, as in Australia and the changing definition of Aborigines, a Maori is now determined by whether the person regards themselves as Maori. This will increase both the numerator and denominator, but probably not at the same rate. How these changes can be incorporated into the trend analysis is not clear.

Ageing is raised as an important issue in the article. Again it is important to put this in context: other factors such as the changing medical technology and practices, the shift from the public to the private sector and population growth all exceed the impact of ageing. For New Zealand and Australia, ageing is not a major issue for the next 15 years, and overemphasis could lead to wasted effort.

The cause-deleted results presented in the article are of interest in that they quantify the magnitude of injury on LE and ILE. However, it is interesting to note that the effect, while claimed to be large (1.9 and 3.8 years respectively for LE and ILE for males), is not so large when compared to the gain in LE of three years every ten or so years. To achieve this gain in life expectancy, most improvement has been in heart disease, which has been achieved by changes in lifestyle and medical practice. Thus, the importance of injury, while real, needs to be put in perspective.

Despite these caveats on the potential to use such broad indicators as LE and ILE for health policy, the authors have provided valuable data that can be used to motivate more research into whether ILE is increasing over the next ten years. As mentioned above, this is an important matter.

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Commentary

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Independent life expectancy in New Zealand, 1996–97

Martin Tobias and Jit Cheung present a summary measure of population health – independent life expectancy – which combines information on morbidity and mortality into a single summary measure. They have used this measure to highlight differences between the health of New Zealand males and females and between Maori and non-Maori in New Zealand.

In the past decade, there has been a marked increase in interest in the development, calculation and use of summary measures (Field & Gold 1998). Two classes of summary measure have been developed: health expectancies (for example, disability-free life expectancy, independent life expectancy) and health gaps (disability-adjusted life years or DALYs, healthy life years, and so on). Both classes of summary measure use time (lived in health states or lost through premature death) as an appropriate common metric for measuring the impact of mortality and non-fatal health outcomes.

Health expectancies extend the concept of life expectancy to refer to expectations of various states of health, not just of life per se. During the last ten years, the International Network on Health Expectancy (REVES) has promoted and developed the concept and methods and it is now widely used at national level and by the Organization for Economic Cooperation and Development to report on population health (Mathers & Robine 1993; Organization for Economic Cooperation and Development 1998).

Health gaps extend the notion of mortality gaps (such as potential years of life lost to age 65) to include time lived in states other than excellent health. The most widely known of these is the DALY, developed for the Global Burden of Disease project (Murray & Lopez 1996). DALY calculations start from information on diseases and injuries (incidence, prevalence and duration) and estimate the associated impairments and disability in order to quantify the total burden of disease.

Health expectancy calculations, on the other hand, generally start with population data on disabilities in order to estimate expectations of years lived in various health states. Attempts have been made to relate health expectancies back to disease and risk factor causes using data from population disability surveys on the health conditions contributing to the disability (Nusselder et al. 1996; Mathers 1999). However, as illustrated by Tobias and Cheung, there are generally severe problems with the quality and comparability of self-reported data on the disease and injury causes of disability which limit the usefulness of such data for analysis of the non-fatal outcomes for most diseases and injury (Mathers 1999).

All summary measures of population health involve explicit or implicit social value choices. Various value choices such as discounting and age weights incorporated into the DALY have caused considerable controversy (Anand & Hanson 1997). It is less commonly recognised that health expectancies also involve value choices. For example, disability-free life expectancy indicators do not place any positive value on years lived with disability. Tobias and Cheung refer to and discuss this problem in terms of the reliance of the independent life expectancy on a somewhat arbitrary threshold for disability. They point to the use of preference weights (or QALY weights) to calculate disability-adjusted life expectancies as a way to overcome this problem.

They also argue that the choice of a fairly high theshold requiring the help of another person or complex assistive devices is statistically robust. I have also argued in the past that disability-free life expectancies that use a high threshold for disability are more stable and robust than those that use a low threshold which are more sensitive to changes in reporting behaviour, social expectations and norms (Mathers 1991). This argument has appeared to be supported by time series data from a number of countries which have shown fairly stable prevalences of disability defined using a severe threshold (such as requiring assistance for self-care activities) and expanding prevalence of disability according to less severe thresholds (Robine et al. 1997). In particular, for Australia between 1981 and 1993, expectation of life with severe handicap has remained relatively constant, whereas total expectation of years with disability has grown faster than total life expectancy (Mathers 1996).

Unfortunately, recently available data from Australia's latest national disability survey (carried out by the Australian Bureau of Statistics in 1998) has found a significant expansion in the expected years with severe handicap. A number of factors suggest that this increase may be due to changes in survey methodology and represent predominantly a shift in classification from moderate to severe handicap rather than a real increase in handicap severity. The data suggests that there is an increasing prevalence of severe and profound handicap among boys and that this may reflect an increased labelling and recognition of particular disabilities for this group, such as specific learning disabilities, attention deficit disorder or autism, but this needs further investigation. There have been increases in the rates of autism in Europe and North America, which are possibly due to changes in diagnostic criteria and a wider recognition of its expression.

It may thus be overly optimistic to assume, as have Tobias and Cheung, that choice of a high disability threshold for calculating health expectancies will result in statistically robust measures that are comparable across sub-populations and over time. The lack of comparability of population survey data on disability is the major obstacle which must be solved before health expectancy measures can be truly useful to guide health policy and evaluate social progress. In principle, consistent use of measurement instruments and classification categories for disability in population surveys and in epidemiological studies of the sequelae of diseases and injuries should enable burden of disease analysis to provide DALY estimates consistent with health expectancies calculated from the overall prevalence of impairments and disabilities in the population. This would avoid the problems highlighted by Tobias and Cheung of mapping disability back to disease and injury causes from self-report data.

It would then be possible to measure and monitor the health of populations within a coherent and integrated statistical framework, with a summary measure of population health status at the apex of a hierarchy of related measures, rather than a piecemeal set of unconnected measures. The macro measures at the apex of the system, such as health-adjusted life expectancies, would provide a broad population-based overview of trends and patterns. At the next level, health gap measures such as the DALY would provide cause-specific summary measures of burden for use in quantifying the causes of health losses, in identifying the potential for health gain and in linking health interventions to changes in population health. At a lower level again would be the component parts of the picture: incidence rates, prevalence rates, severity distributions, case fatality rates, effectiveness and cost-effectiveness of interventions, and so on.

A coherent system of health statistics would represent a major advance in our ability to monitor population health (both levels and distributions), to accumulate knowledge about causal factors and to quantify the value of health services in terms of their production of health gain in the population.

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