

8 Discussion and conclusions

8.1 Key findings

This study has provided the first comprehensive assessment of the health status of the Australian population. Mortality, disability, impairment, illness and injury arising from 176 diseases, injuries and risk factors were measured using a common metric, the disability-adjusted life year or DALY. As discussed in the first chapter, one DALY is a lost year of 'healthy' life. This report provides estimates of the contribution of fatal and non-fatal health outcomes to the total burden of disease and injury measured in DALYs in Australia in 1996.

The study uses the methods developed for the Global Burden of Disease Study, adapted to the Australian context and drawing extensively on Australian sources of population health data. These methods are described in some detail in Chapter 2.

Key findings—mortality

Life expectancy at birth in 1996 was 75.6 years for Australian males and 81.3 years for Australian females. Male life expectancy is six years shorter than female life expectancy. Australia ranks around 10th in the world in terms of total life expectancy at birth. Australia ranks fifth lowest in the world, behind Japan, Greece, Sweden and Italy, in terms of the probability of dying between ages 15 and 59.

As discussed in Chapter 3, premature mortality was responsible for 1.35 million years of life lost (discounted at 3% per annum) in Australia in 1996. Males lost 26% more years of life than females. Cardiovascular disease, cancers and injury were responsible for 72% of the total mortality burden in both males and females. In people aged 75 years and over, cardiovascular diseases account for more than half the years of life lost, whereas cancers are a more important cause than CVD for all ages below 75. Injuries are the main cause of lost years of life in young adults and children aged 5–14 years, and neonatal conditions the main cause in children aged under five.

Overall, the age-adjusted mortality burden in Australia has declined by 44% in the 15 years between 1981 and 1996. There have been substantial declines in the mortality burden of cardiovascular diseases, road traffic accidents, low birthweight, and stomach cancer for both males and females. The burden of smoking-related diseases (lung cancer, COPD) has decreased in males but increased substantially in females. The largest increases in mortality burden have occurred for HIV/AIDS, suicide and prostate cancer in males, for senile dementias and heroin dependence and abuse in both sexes, and for lung cancer and chronic obstructive pulmonary disease in women.

Socioeconomic disadvantage is an important predictor of premature mortality. The most disadvantaged quintile of the Australian population lost 35% more years of life than the least disadvantaged quintile in 1996. Among Australians aged less than 65, the differential burden between lowest and highest quintile is even greater, at 60% excess burden in the most disadvantaged group. The overall inequality in mortality burden is 50% larger for males than females in Australia. The inequality in mortality burden is greatest for maternal

mortality, followed by ill-defined conditions (sudden infant death syndrome) in both sexes, followed by digestive system diseases and injuries in males.

Men in the bottom quintile of socioeconomic disadvantage have a 40% higher chance of dying between ages 25 and 64 than men in the top quintile. There is a 3.6-year gap in life expectancy at birth for males between the bottom and top quintiles, and a 1.9-year gap for females. Between 1986 and 1996, these socioeconomic differentials have remained similar for females and for adult and older males, but have widened for boys and young men aged 15–24 years, particularly for motor vehicle accidents and suicide. They have narrowed for drug overdose deaths (rates have increased faster in the top quintile than the bottom between 1986 and 1996).

Key findings—disability

As discussed in Chapter 4, mental disorders are the leading cause of years of life lost due to disability, accounting for nearly 30% of the non-fatal burden (YLD) in Australia. The next leading main cause group is nervous system and sense organ disorders, responsible for 16% of the disability burden.

In terms of specific conditions, depression is the leading cause of non-fatal disease burden in Australia, causing 8% of the total YLD in 1996. Hearing loss and alcohol dependence and harmful use are the second and third leading contributors to non-fatal burden for males. Dementia and osteoarthritis are the second and third leading contributors for females.

In contrast, to the mortality burden, the disability burden is almost identical for males and females. The non-fatal burden of nervous system disorders, mental disorders and musculoskeletal disorders are all higher for females than for males. The male burden is higher for cardiovascular disease, diabetes, chronic respiratory diseases and cancers. This confirms previous conclusions based on health survey data that females have greater incidence and prevalence of the more common non-fatal health problems, whereas males have greater incidence of the major diseases and injuries associated with high case fatality (such as cardiovascular diseases, cancers, chronic respiratory conditions and injuries).

As well as estimating the burden of non-fatal conditions using the standard DALY incidence-based approach (with 3% discounting), this study also produced undiscounted YLL, YLD and DALYs and prevalence-based YLD. The latter counts each lost year of good health at the age it is lived, rather than discounting it back to the time of incidence and counting it as an incident loss of health at that age. As expected, the prevalence-based YLD are lower in childhood and higher at older ages than the incidence-based YLD. The overall prevalence of 'disability' measured in terms of the prevalence YLD rate is reasonably consistent with the prevalence of disability as measured in the 1998 Survey of Disability, Ageing and Carers (ABS 1999a).

Section 4.7 illustrated the potential of the burden of disease methods to estimate the total burden attributable to impairments such as amputation or cognitive impairment. Cognitive impairment (including congenital and childhood-acquired impairment) is responsible for an estimated 16% of the non-fatal disease burden in Australia. If the disability weights are defined in terms of a multi-attribute health state descriptor such as the EuroQol (see Section 2.5, Box 2.1), there is also the potential to apportion the burden of disease across the single attributes. This is also illustrated in Section 4.8, which presented provisional estimates of the non-fatal burden attributable to several types of disability.

Inequality in disability burden was assessed for selected mental disorders among Australians aged 18 years and over. These included substance abuse disorders, affective disorders, anxiety disorders and borderline personality disorder. Overall, for these

conditions, the most disadvantaged quintile of the Australian population lost 45% (males) and 41% (females) more years of 'healthy' life than the least disadvantaged quintile.

Australian males born in 1996 can expect to live the equivalent of 68.7 years of good health, compared to 73.6 years for females. Approximately 9% of total life expectancy at birth is 'lost' due to disability for both males and females in Australia.

Key findings—burden of disease and injury

Inclusion of non-fatal health outcomes provides a substantially different picture from that provided by traditional mortality statistics: mental disorders are now the third leading cause of burden after cardiovascular diseases and cancers (see Chapter 5). Central nervous system and chronic respiratory conditions are almost as large a contributor to total burden as injuries. The leading main disease groups contributing to the burden of disease were cardiovascular disease (22%), followed by cancer (19%) and then mental disorders (14%).

The total burden of disease and injury in Australia in 1996 was estimated to be 2.5 million DALYs or 137 DALYs lost per 1,000 population. In other words, among each 1,000 people in the Australian population, during 1996 the lost years of healthy life represented 13.7% of the total life years lived. The male burden (in total DALYs) is 13% higher than the female burden.

In terms of specific conditions, ischaemic heart disease and stroke lead the list, together causing nearly 18% of the total disease burden. Chronic obstructive pulmonary disease and lung cancer (also smoking-related diseases) are the third and fifth leading cause of disease burden, accounting for another 7.3% of the total burden. Depression is the fourth leading cause of disease burden in Australia, accounting for 3.7% of the total burden. If the attributable burden of suicide and self-inflicted injury is included, then depression accounts for an overall 5% of the total burden of disease and injury in Australia.

Diabetes is the sixth leading cause of disease burden in Australia, accounting for more DALYs lost than colorectal cancer. Inclusion of the attributable burden of cardiovascular disease due to diabetes increases the burden of diabetes from 3% to 5% of total DALYs. Depression and diabetes then share equal third place as leading cause of disease burden, after ischaemic heart disease and stroke.

The six National Health Priority Areas account for 70% of the total burden of disease and injury in Australia, comprising 81% of the YLL and 57% of the YLD (Chapter 6).

The burden per 1,000 population in the most disadvantaged quintile of the population is 37% higher for males and 27% higher for females than the burden for males and females in the least disadvantaged quintile. The excess mortality burden associated with socioeconomic disadvantage is almost 20% of total male burden and around 15% of total female burden.

Key findings—attributable burden of risk factors

Risk factors, including lifestyle behaviours (such as tobacco smoking, physical inactivity, alcohol consumption, diet, unsafe sex), physiological states (such as obesity, high blood pressure, high cholesterol) and societal conditions (such as occupational exposures and socioeconomic disadvantage) are responsible for a sizable proportion of the total burden of disease in Australia—and for much of the inequality in the burden falling on different population groups. Chapter 7 provides estimates of the attributable burden for ten risk factors for which prevalence and relative risk data were available. The combination of these ten risk factors may account for between one-third and one-half of the burden of disease and injury in Australia in 1996.

Tobacco smoking is the risk factor responsible for the greatest burden of disease in Australia: about 12% of the total burden of disease in males and 7% in females. Physical inactivity is responsible for about 8% of the total burden of disease, and obesity a somewhat lower proportion at around 4.4%.

Hypertension causes over 5% of the total burden of disease and injury, and high blood cholesterol nearly 3%. Inadequate fruit and vegetable intake is also responsible for around 3% of the total disease burden.

The net harm associated with alcohol consumption is around 2.2% of the total burden, as the injury and chronic disease burden associated with harmful and hazardous levels of alcohol consumption are offset by the burden of cardiovascular disease prevented by alcohol consumption. The protective effect is only relevant after age forty-five, whereas the harmful effects of alcohol are apparent at all ages.

Illicit drugs are responsible for a level of harm similar to that of alcohol for males, at 2.1% of total male burden. Just over half this burden is due to premature mortality, the other half to YLD resulting from drug dependence or harmful use. Illicit drugs account for about 1% of the total female burden.

Unsafe sex is responsible for around 1% of the total burden of disease in Australia in 1996. HIV/AIDs accounts for 61% of the total burden of disease that is attributable to unsafe sex, followed by cervix cancer (24%) and other sexually transmitted diseases (8%).

Occupational exposures to toxic chemicals and injury risks were responsible for an estimated total of 2,005 deaths in Australia in 1996—1.6% of total deaths. Because many of these deaths occur at younger ages, the mortality burden is a somewhat higher proportion (2.0%) of the total mortality burden. The total attributable burden of occupational exposures is 1.7% of total DALYs lost in 1996. Cancers are responsible for 41% of this attributable burden, followed by injuries (33%) and other chronic diseases (25%).

8.2 Precision of estimates

The calculation of YLL is straightforward, and the precision of the estimates is almost entirely dependent on the quality of the data on underlying cause of death. As discussed in Section 3.1, there are several ICD-9 categories ('garbage' codes, and ill-defined or unknown categories) for which deaths have been redistributed to disease and injury causes based on disease registry data and expert opinion. These redistributions do not involve large numbers of deaths and have little effect on the precision of the YLL estimates.

Extensive epidemiological modelling drawing on a very wide range of data sources, research findings and expert opinion was required to estimate YLD. Thus the precision of the YLD estimates is not really quantifiable in the usual statistical sense of deriving a confidence interval. The precision varies between diseases and depends on the specific disease model applied and the source and nature of the data underlying the disease model.

Furthermore, the disease weights have not been derived in the Australian context and so may not completely reflect Australian societal preferences for disease states. This is discussed further in Section 8.4. For both these reasons, the YLD estimates (and hence the DALY estimates) should be regarded as provisional and developmental. The analyses carried out for this study will provide a framework for more detailed analysis of particular conditions and guidance in identifying data gaps and deficiencies. It is hoped that further improvements over time in methods, models and data will result in step by step improvements in the accuracy and certainty in estimates of burden of disease in Australia.

It has not been possible in the timeframe of this first report to carry out full sensitivity analyses for each disease and injury category. This has been done for YLL, but only for a few diseases for YLD. Using simulation methods (Section 2.10), it is possible to quantify the uncertainty interval for each YLD estimate to take into account the confidence intervals around incidence or prevalence data, and the uncertainties associated with the various assumptions and estimates also used. The example worksheet for dementia in Appendix B includes an uncertainty analysis for dementia YLD.

Among major causes of disease burden, the uncertainty is probably highest for YLD estimates for hearing loss, osteoarthritis, and alcohol dependence and harmful use. Although population data on measured hearing loss thresholds were used to estimate YLD for hearing loss, there was considerable uncertainty associated with the modelling of the effects of hearing aids in reducing disability and in the average durations associated with progression through mild to moderate to severe hearing loss. Additionally, the large burden for hearing loss is the product of high prevalence with low disability weights. Trade-off methods generally produce greater degrees of uncertainty for very mild conditions and uncertainty in the hearing loss weights will contribute to greater uncertainty in the YLD estimates. YLD for osteoarthritis are based on overseas studies which measured incidence and severity of osteoarthritis. These estimates are lower than would be suggested by the Australian self-report population data on osteoarthritis. The uncertainty in YLD for alcohol dependence and harmful use relates mainly to assessing levels of disability for younger people classified in the National Mental Health Survey as having an alcohol problem.

Broader sensitivity analyses suggest, however, that the uncertainty in the estimates of disease burden for many conditions may not be excessive. Overall, about half the burden is contributed by YLL, where estimates are generally fairly precise. Around 40% of the YLD burden is contributed by a small number of diseases (including ischaemic heart disease, cancers, stroke, diabetes, and affective and anxiety disorders) for which reasonably good Australian data were available. This leaves around 30% of the total disease burden with varying higher levels of uncertainty.

It should also be noted that precise values of the DALY burden for many of the conditions lower down in the overall rankings of causes will fluctuate from year to year due to variations in the incidence and mortality of such conditions. In particular, the estimates for many of the infectious diseases will vary from year to year depending on whether the year is an epidemic year or not. For this reason, precise ordering of the smaller causes of burden is not very useful.

8.3 Data gaps and deficiencies

The extensive epidemiological modelling carried out in this study for over 1200 disease and sequelae categories has enabled us to identify many data gaps and deficiencies in Australian population health data (even given the high quality and extensive availability of such data in Australia compared to many other countries). Some of the major gaps and deficiencies are listed below:

- Incidence or prevalence data for some diseases (e.g. cancer, some infectious diseases) is relatively complete but data for many others is unavailable or has severe limitations. The most important of these in terms of their contribution to YLD are:

Osteoarthritis and rheumatoid arthritis: The only population-level data we are aware of for Australia is self-reported data from the National Health Surveys. The self-reported prevalence of both types of arthritis is considerably higher than the best

estimates from epidemiological studies. YLD estimates for this study were thus based on overseas population-based epidemiological studies using clinical criteria to define incident cases.

Asthma: Self-reported asthma prevalence from the National Health Surveys is two to three times higher than the prevalence of asthma measured in population samples based on a history of wheezing in the last 12 months and a positive airway hyperresponsiveness test. These samples are only available for a restricted set of age groups.

Diabetes: There is no recent Australian population data on the ratio of undiagnosed to diagnosed Type 2 diabetes (see Section 4.2). YLD estimates in this report assume the ratio is 0.5:1 based on a recent US study.

Vision disorders: The prevalence of vision impairment is derived from the Blue Mountains Eye Study (see Section 4.2). It is not known how representative this is for all Australians.

Hearing loss: The prevalence of hearing impairment with use of usual aids (if any) is not known in Australia. YLD estimates for adult-onset hearing loss are based on a recent population survey of measured hearing loss (Wilson et al. 1998, 1999) together with assumptions about the effectiveness of hearing aids.

Chronic obstructive pulmonary disease: Prevalence and severity estimates are based on the Busselton Study. It is not known how representative these are of the Australian population.

Ischaemic heart disease: The only available prevalence data for angina in Australia is self-report data on treated angina from the 1989 National Heart Foundation Risk Factor Survey. Information on the prevalence and severity of heart failure is not available.

Other heart diseases: No population-level data is available on the incidence or prevalence of rheumatic heart disease, hypertensive heart disease or inflammatory heart diseases such as cardiomyopathy.

Stroke: No recent population-level studies of stroke incidence or prevalence have been carried out in Australia.

- Information on the distribution of severity of disease is inadequate or lacking for many important conditions. These include asthma, angina, heart failure, stroke, peripheral arterial disease, osteoarthritis and dementia.
- Case fatality rates are not available for the vast majority of conditions. Improvements in record linkage and retention of identifiers in population surveys should allow this to be addressed at relatively low cost using the AIHW National Death Index.
- There is a need for data which will allow monitoring of the course of a disease (e.g. ability to identify different hospital records relating to a single person and ability to track disease outcomes and relate disease/injury to subsequent disability). Information is available on the average progression times through severity levels for vision and hearing loss, or the average time for development of complications for diseases such as diabetes.
- There are inconsistencies between commonly quoted incidence, prevalence and mortality estimates for a number of important diseases such as Type 1 diabetes and dementia.
- There are inconsistencies between self-reported health data from population surveys and best estimates from epidemiological studies for a number of important diseases (e.g.

arthritis, asthma, upper and lower respiratory conditions). The major limitations of self-reported data on health conditions relate to:

- under-reporting of undiagnosed conditions (e.g. many mental health problems, diabetes);
 - over-reporting of some conditions (e.g. where symptoms such as joint pain are incorrectly labelled as osteoarthritis, or occasional wheezing as asthma); and
 - lack of information on condition severity (resulting in high prevalences due to inclusion of very minor conditions or minor symptoms).
- This study made some attempts to harmonise impairment, disability and epidemiological data for a few conditions (e.g. intellectual disability, cerebral palsy, stroke). There are severe limitations in the available Australian population survey data relating disability to underlying disease and injury causes due to the limitations of self-report data on causes, and the mixing of impairments, diseases, and risk factors in the reporting categories for main causes of disability. There is a need for population epidemiological studies of the causes of disability that use consistent and well-defined criteria for identifying diseases, injuries and risk factors.

8.4 Methodological issues and developments

In the course of undertaking this study, it has become apparent that there are a number of methodological issues which require further thinking and development in order to improve the validity and applicability of the DALY metric. Efforts are already underway internationally in some of these areas. We briefly summarise the major areas where methods need to be improved. A more detailed paper on these issues is planned.

Comorbidities – the Australian studies have made the first attempts to take comorbidities into account in estimating the total burden of disease. This was done for comorbidities between congenital malformations, between mental disorders and between physical disorders at older ages. We did not attempt to adjust for comorbidities between mental and physical disorders – although Australian data is available that would allow analyses of mental-physical comorbidities to be undertaken. There are a number of issues which need to be addressed, including how to model the effect of comorbidities on combined disability weights, how to deal with comorbidities that arise from common causes, and how to manage the potentially large number of comorbidity combinations.

Discounting – this makes YLD analysis very complex for diseases with long-term sequelae as we then need to get precise estimates of progression times. Also, discounting is not currently carried out entirely consistently, e.g. YLL are not discounted back to the point of disease incidence. The latter would require complex and uncertain modelling for many conditions at present.

DISMOD – the first version of DISMOD uses cross-sectional mortality rates to model duration of diseases. This means that estimation of disease duration takes into account only the current period life expectancy of the population, whereas the YLL take into account either cohort life expectancies or use an ideal standard life table with greater life expectancies than currently observed. It is not possible to simply insert cohort projected mortality rates into the DISMOD data files. Version 2 of DISMOD is currently under development and will incorporate a number of methodological improvements.

Numerical valuation of health states—a substantial program of research and development is required to address the following issues:

- what are the key domains to include in summary health state instruments for use to obtain population data on health outcomes and for use in valuation exercises;
- obtaining disability weights using more panels which are more representative of the general population;
- inclusion of the experience of people with particular conditions in valuation exercises;
- comparability of weights across cultures and between socioeconomic groups; and
- the need for development of Australian-specific weights.

On the one hand, Australian specific weights would lead to estimates which may best suit the needs of Australian health policy development. On the other hand, an international standard may provide weights which are close enough to Australian preferences so that the differences from Australian specific weights are negligible in terms of policy development while allowing direct international comparisons. Internationally derived weights would also mean the weights could be based on more and more extensive studies without requiring large resource input from the Australian health budget.

Population disability data—This study has taken some steps towards developing consistency between DALY estimates and population data on impairments and functional limitations. The development of standard validated summary health state measures for inclusion in population surveys and for use in longitudinal epidemiological studies will be an important step.

Microsimulation methods—data analysis requirements for a complex burden of disease study with many disease categories and population subgroups can rapidly exceed the capabilities of spreadsheet or database software. Microsimulation methods potentially allow a very flexible approach to dealing with many disease and population categories and with the interactions between them (e.g. differing incidence rates for different groups, and comorbidities and interactions between conditions).

Cost-effectiveness analysis—there are a number of issues in using DALYs as health outcome measures in cost-effectiveness analyses which need to be addressed.

8.5 Future directions

The initial analyses carried out for this study will provide a framework for more detailed analysis of particular conditions, for burden of disease estimates for priority subpopulations and for analysis of the impact of risk factors and health determinants to inform health policy making and priority setting. Further improvements over time in methods, models and data will result in step-by-step improvements in accuracy and certainty in estimates of burden of disease in Australia. The Australian Institute of Health and Welfare is continuing work in this area.

Some of the potential priorities for future work in Australia may include:

1. Analysis of the Indigenous burden of disease and injury in Australia as a first step towards assessing Indigenous needs for health service provision and as a tool to monitor national progress in this important area. A recent report on Indigenous health expenditure (Deeble et al. 1998) outlined the potential to use burden of disease analysis in addressing questions of Indigenous need for health services and equity of health funding. The National Indigenous Health Information Plan has also identified Indigenous burden of disease analysis as a priority.
2. More detailed modelling of incidence, prevalence, mortality and burden of disease for specific diseases and injuries to support planning and evaluation for National Health Priority Areas and national strategies for specific conditions or health determinants.
3. A full analysis of the attributable burden of socioeconomic disadvantage in Australia to support national public health planning and monitoring of inequality in health status
4. State-level analyses of burden of disease, building on the Victorian and national studies but using state-specific population and health data. Local area analyses and urban/rural/remote analyses may also be of interest.
5. Estimation of Australian social preferences for a comprehensive set of conditions and sequelae. Two Australian research groups have already commenced work in this area.
6. Linkage of burden of disease analysis and marginal cost-effectiveness analysis of potential interventions. Estimation of the potential for cost-effective reduction of disease burden at the population level could be carried out for a number of case studies in order to inform priority setting processes for health policy and research.
7. More broadly, the usefulness of burden of disease analyses for policy makers and health planners remains to be fully evaluated. It is hoped that this initial report will provide useful information that may allow such applications to be explored.

8.6 Conclusions

This report has addressed the need for comprehensive and comparable information on the causes of loss of health in the Australian population. This study provides the first detailed and internally consistent estimates for Australia of the incidence, prevalence, duration, mortality and disease burden for an exhaustive and mutually exclusive set of disease and injury categories. It has also taken first steps towards quantifying the burden associated with a range of risk factors and health determinants, including socioeconomic disadvantage. While every attempt has been made to identify the best available information in relation to each disease, injury and risk factor category, and to consult as widely as possible, it must be emphasised that the estimates published here should be seen as provisional and developmental. It is hoped that others will contribute to future improvements in data, disease models and disability weights.

One fundamental goal in constructing summary measures is to identify the relative magnitude of different health problems, including diseases, injuries and risk factors. There are two dominant traditions in widespread use for causal attribution: categorical attribution and counterfactual analysis. Burden of disease analysis uses categorical attribution to attribute the fatal and non-fatal burden of diseases and injuries to an exhaustive and mutually exclusive set of disease and injury categories. It generally uses counterfactual analysis to attribute the burden of disease to health determinants and risk factors. The DALY methodology provides a conceptual framework linking determinants to disease and injury, through to impairments, disability and other health outcomes. It brings together a

range of concepts and data sources to present internally consistent information on the origins, patterns, nature and consequences of disability and related health conditions.

The DALY methodology also provides a way to link information on disease causes and occurrence to information on both short-term and long-term health outcomes, including impairments, functional limitations (disability) and, potentially, restrictions in participation in usual roles (handicap). The burden of disease methodology is designed to inform health policy in relation to the prevention and treatment (cure or reduction in severity) of these health outcomes. In principle, consistent use of measurement instruments and classification categories for impairments and functional limitations in epidemiological studies of the sequelae of diseases and injuries and in population disability surveys should enable burden of disease analysis to provide DALY estimates consistent with the overall prevalence of impairments and disabilities in the population.

It would then be possible to measure and monitor the health of Australians 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, etc. The two families of summary health measures—health gaps (DALYs) and health expectancies—could be measured in such a way as to make them not only conceptually but also quantitatively complementary. This would require using consistent health state descriptors and valuations for both indicators.³⁴

This coherent system of health statistics would represent a major advance in our ability to monitor population health (both levels and distributions), and to accumulate knowledge about causal factors. The use of a common metric such as the DALY for burden of disease analysis, measurement of clinical outcomes, and cost-effectiveness analyses would allow existing or prospective interventions to be judged both in terms of cost-effectiveness, and their relative impacts in reducing the burden of disease and ill-health. This study, together with the parallel Victorian study (Department of Human Services 1999a, 1999b) are a first step towards exploring the usefulness of these methods to provide information to assist in health planning and priority setting.

In summary, burden of disease analysis provides a unique perspective on health—one that integrates fatal and non-fatal outcomes, yet allows the two classes of outcomes to be examined separately as well. Additionally, the burden can be readily disaggregated by cause for analysis at the level of diseases and risk factors, and can be estimated for any subgroup of the population for which data are available. Causal analysis needs to be extended from the proximal biological and behavioural factors to more distal social, economic and cultural determinants of health, including health care and welfare support services. Perhaps also the outcome measure may need to be expanded to include wider aspects of disease burden such as non-health domains of wellbeing and the impact on family and society. Until these analyses can be done, however, the results reported here may provide a valuable insight into the scope for further health gain in Australia.