

# **The burden of disease and injury in Australia**

The Australian Institute of Health and Welfare is an independent health and welfare statistics and information agency. The Institute's mission is to inform community discussion and decision making through national leadership in the development and provision of authoritative and timely information on the health and welfare of Australians.

# **The burden of disease and injury in Australia**

**Colin Mathers  
Theo Vos  
Chris Stevenson**

**November 1999**

Australian Institute of Health and Welfare  
Canberra

AIHW cat. no. PHE 17

© Australian Institute of Health and Welfare 1999

This work is copyright. Apart from any use as permitted under the *Copyright Act 1968*, no part may be reproduced without prior written permission from the Australian Institute of Health and Welfare. Requests and enquiries concerning reproduction and rights should be directed to the Head, Communication and Public Affairs, Australian Institute of Health and Welfare, GPO Box 570, Canberra ACT 2601.

A complete list of the Institute's publications is available from the Publications Unit, Australian Institute of Health and Welfare, GPO Box 570, Canberra ACT 2601, or via the Institute's web site (<http://www.aihw.gov.au>).

ISBN 1 74024 019 7

### **Suggested citation**

Mathers C, Vos T, Stevenson C 1999. The burden of disease and injury in Australia. AIHW cat. no. PHE 17. Canberra: AIHW.

### **Australian Institute of Health and Welfare**

Board Chair  
Professor Janice Reid

Director  
Dr Richard Madden

Any enquiries about or comments on this publication should be directed to:

Colin Mathers  
Australian Institute of Health and Welfare  
GPO Box 570  
Canberra ACT 2601

Phone: (02) 6244 1138  
E-mail: [bod@aihw.gov.au](mailto:bod@aihw.gov.au)

Published by Australian Institute of Health and Welfare

Printed by Ausdoc on Demand

# Foreword

This report presents the first national burden of disease study for Australia. It uses the disability-adjusted life year or DALY to measure the total impact of mortality and non-fatal health outcomes in a consistent way across a comprehensive range of diseases and illnesses. The DALY was developed for the Global Burden of Disease Study (GBD), undertaken in the first half of the 1990s by researchers at the Harvard School of Public Health and the World Health Organization. The GBD has generated considerable interest among health policy makers and researchers, and an increasing number of national burden of disease studies are now underway.

Over the last 18 months, AIHW has undertaken an Australian burden of disease study with the assistance of funding from the Commonwealth Department of Health and Aged Care. This study builds on Australian and international work to generate summary population health information using the DALY metric and provide inputs on the size and causes of health problems in Australia to assist national and State planning and priority setting for public health, health services and research.

This report addresses the need for comprehensive and comparable information on the causes of loss of health in the Australian population. The study provides the first detailed and internally consistent estimates for Australia of the incidence, prevalence, duration, mortality and disease burden for more than 175 disease and injury categories. It has also taken first steps towards quantifying the burden associated with a range of risk factors and health determinants, and with socioeconomic disadvantage.

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. This study is a first step towards exploring the usefulness of burden of disease methods for Australia. The estimates published here should be seen as provisional and developmental. If the types of information provided by burden of disease analysis are seen to be useful, there will need to be further work to refine and further develop these analyses, and to explore how to assess the disability associated with health conditions in the Australian context.

Richard Madden

Director

November 1999



# Contents

- Foreword..... v
- List of tables..... x
- List of figures..... xiv
- Acknowledgments ..... xix
- Abbreviations ..... xx
- Highlights ..... xxiii
- 1 Introduction ..... 1
  - 1.1 Purpose and background..... 1
  - 1.2 Australian Burden of Disease and Injury Study ..... 4
  - 1.3 Disability-adjusted life years ..... 5
  - 1.4 Summary measures of health ..... 6
  - 1.5 Comparing time lived in different health states ..... 9
  - 1.6 Discounting ..... 13
  - 1.7 Age weights..... 14
- 2 Methodology..... 14
  - 2.1 Overview ..... 14
  - 2.2 Analysis categories ..... 15
  - 2.3 Discounting and age weights ..... 15
  - 2.4 Years of life lost due to mortality ..... 15
  - 2.5 Disability weights ..... 17
  - 2.6 Years lost due to disability ..... 21
  - 2.7 Adjustments for comorbidity ..... 22
  - 2.8 Socioeconomic inequalities ..... 23
  - 2.9 Burden attributable to risk factors..... 25
  - 2.10 Uncertainty analyses ..... 26
- 3 Years of life lost due to mortality ..... 27
  - 3.1 Estimating deaths due to each cause ..... 27
  - 3.2 Deaths in Australia 1996 ..... 29
  - 3.3 Mortality burden in Australia 1996..... 30
  - 3.4 Recent trends in mortality burden ..... 34

	3.5 Socioeconomic disadvantage and mortality .....	36
4	Years lost due to disability.....	41
	4.1 Overview .....	41
	4.2 Data and methods.....	42
	4.3 Incidence, prevalence and duration of conditions.....	49
	4.4 Leading causes of the disability burden .....	50
	4.5 Disability burden – patterns by age and sex .....	52
	4.6 Prevalent burden of disability .....	53
	4.7 Attributable burden of selected impairments and disabilities.....	57
	4.8 Socioeconomic disadvantage and disability.....	59
	4.9 Disability-adjusted life expectancy.....	60
5	Burden of disease and injury.....	63
	5.1 Overview .....	63
	5.2 Leading causes of disease burden.....	65
	5.3 Age and sex patterns of disease burden.....	68
	5.4 Attributable burden: diabetes, depression, osteoporosis, firearms and sporting injuries.....	74
	5.5 The undiscounted burden of disease and injury .....	75
	5.6 Socioeconomic disadvantage and the burden of disease .....	78
6	National Health Priority Areas.....	81
	6.1 Cardiovascular disease.....	82
	6.2 Cancers .....	84
	6.3 Mental health .....	88
	6.4 Injury .....	91
	6.5 Diabetes .....	94
	6.6 Asthma .....	96
7	Attributable burden for ten major risk factors .....	101
	7.1 Overview .....	101
	7.2 Tobacco .....	104
	7.3 Alcohol.....	107
	7.4 Illicit drugs .....	112
	7.5 Obesity .....	115
	7.6 Hypertension.....	119

7.7 High blood cholesterol .....	121
7.8 Physical inactivity .....	124
7.9 Unsafe sex.....	127
7.10 Occupational exposures and risks.....	128
7.11 Inadequate fruit and vegetable consumption .....	129
8 Discussion and conclusions .....	133
8.1 Key findings .....	133
8.2 Precision of estimates .....	136
8.3 Data gaps and deficiencies.....	137
8.4 Methodological issues and developments.....	139
8.5 Future directions.....	140
8.6 Conclusions .....	141
References .....	143
Appendix A Technical notes .....	148
Appendix B YLD worksheet example: senile dementia .....	157
Appendix C YLD worksheet example: stroke.....	162
Annex tables .....	171

# List of tables

Table 1.1:	Some examples of disability weights from the Dutch study .....	9
Table 2.1:	Projected cohort life expectancies at selected exact ages and discounted YLL due to a death at each age used in the Australian Burden of Disease and Injury Study .....	17
Table 2.2:	Sources of disability weights used in the Australian Burden of Disease and Injury Study .....	21
Table 3.1:	Deaths coded to cardiovascular 'garbage' codes, Australia, 1996.....	28
Table 3.2:	Redistribution of deaths coded to cardiovascular 'garbage' codes .....	28
Table 3.3:	Ten leading causes of death, Australia, 1996 and developed regions of the world, 1990.....	30
Table 3.4:	Probability of dying (%) between ages 15 and 59, by sex, Australia and selected developed countries, 1998.....	31
Table 3.5:	Top twenty causes of the mortality burden, by sex, Australia, 1996.....	32
Table 3.6:	Causes with largest increase or decrease in mortality burden per 1,000 population, Australia, 1981-1996.....	35
Table 3.7:	Differentials and inequality in mortality burden, by main disease categories and sex, Australia, 1995-97 .....	38
Table 3.8:	Probability of dying between various exact ages, by quintile of socioeconomic disadvantage, by sex, Australia 1995-97.....	39
Table 3.9:	Life expectancy at birth and at age 65, by quintile of socioeconomic disadvantage, Australia 1995-97.....	39
Table 3.10:	Trends in mortality differentials and inequality in mortality rates for selected disease and injury categories, by broad age group and sex, Australia, 1985-87 to 1995-97.....	40
Table 4.1:	YLD/YLL ratios for cardiovascular diseases, Australia and EME .....	48
Table 4.2:	Estimated total incidence and prevalence of selected conditions, by sex, Australia, 1996 .....	50
Table 4.3:	Top twenty causes of disability burden: YLD by sex, Australia, 1996 .....	51
Table 4.4:	Percentage distribution of YLD by main disease category, sex and age group, Australia, 1996 .....	53
Table 4.5:	Total prevalence YLD by main disease category, sex and age group, Australia, 1996 .....	56
Table 4.6:	Total YLD for selected impairments, by sex and age group, Australia, 1996.....	57
Table 4.7:	Differentials and inequality in disability burden for selected mental disorders, by sex, Australians aged 18 years and over, 1996 .....	59
Table 4.8:	Total life expectancy, disability-adjusted life expectancy, and expected years lost to disability as a proportion of total life expectancy, by sex and age, Australia, 1996 .....	60

Table 5.1:	Total burden of disease for males and females in Australia, 1996.....	64
Table 5.2:	The ten leading causes of disease burden (DALYs), Australia 1996 and Established Market Economies 1990.....	65
Table 5.3:	Leading causes of disease burden: DALYs by sex, Australia, 1996.....	66
Table 5.4:	Distribution of DALYs by life cycle stage and sex, Australia, 1996.....	68
Table 5.5:	Percentage distribution of DALYs by main disease category, sex and age group, Australia, 1996.....	69
Table 5.6:	Leading causes of burden of disease and injury in children aged 0–14 years: DALYs by sex, Australia, 1996.....	70
Table 5.7:	Leading causes of burden of disease and injury in young adults aged 15–24 years: DALYs by sex, Australia, 1996.....	71
Table 5.8:	Leading causes of burden of disease and injury in adults aged 25–64 years: DALYs by sex, Australia, 1996.....	72
Table 5.9:	Leading causes of burden of disease and injury in adults aged 65 years and over, by sex, Australia, 1996 .....	73
Table 5.10:	Attributable disease burden for selected diseases and injuries, by sex, Australia, 1996 .....	74
Table 5.11:	Attributable disease burden for selected diseases and injuries: deaths, YLL, YLD and DALYs, Australia, 1996.....	75
Table 5.12:	Leading causes of disease burden: undiscounted DALYs by sex, Australia, 1996 .....	75
Table 5.13:	Percentage distribution of undiscounted DALYs by main disease category, sex and age group, Australia, 1996.....	77
Table 5.14:	Differentials in the burden of disease and injury between top and bottom quintiles of socioeconomic disadvantage, age-standardised YLL, YLD and DALYs per 1,000 population, Australia 1996 .....	78
Table 5.15:	Differentials in the burden of disease and injury between top and bottom quintiles of socioeconomic disadvantage, by selected main disease categories and sex, Australia, 1996 .....	80
Table 6.1:	The burden of disease attributable to cardiovascular disease, Australia, 1996.....	82
Table 6.2:	Cardiovascular disease: health system costs (\$ million) by health sector, Australia, 1993–94 .....	84
Table 6.3:	The burden of disease attributable to cancer, Australia, 1996.....	85
Table 6.4:	Cancer: health system costs by health sector, Australia, 1993–94.....	87
Table 6.5:	The burden of disease attributable to mental illness, Australia, 1996 .....	88
Table 6.6:	Mental health: health system costs by health sector, Australia, 1993–94 .....	90
Table 6.7:	The burden of disease attributable to injury, Australia, 1996.....	91
Table 6.8:	Injury: health system costs by health sector, Australia, 1993–94 .....	93
Table 6.9:	The burden of disease attributable to diabetes, Australia, 1996.....	94

Table 6.10:	Diabetes and its sequelae: health system costs by health sector, Australia, 1993–94 .....	96
Table 6.11:	The burden of disease attributable to asthma, Australia, 1996 .....	96
Table 6.12:	Chronic respiratory diseases: health system costs by health sector, Australia, 1993–94 .....	99
Table 7.1:	The attributable burden of tobacco smoking by condition, Australia, 1996.....	106
Table 7.2:	The burden of disease attributable to tobacco, Australia, 1996 .....	107
Table 7.3:	Classification and prevalence of alcohol intake levels used in this report .....	109
Table 7.4:	The attributable burden of alcohol consumption by condition, Australia, 1996 .....	111
Table 7.5:	The burden of disease attributable to alcohol consumption, Australia, 1996 .....	111
Table 7.6:	The attributable burden of illicit drugs by condition, Australia, 1996.....	114
Table 7.7:	The burden of disease attributable to illicit, Australia, 1996 .....	114
Table 7.8:	Relative risks associated with overweight and obesity.....	117
Table 7.9:	The attributable burden of overweight and obesity by condition, Australia, 1996 .....	118
Table 7.10:	The burden of disease attributable to overweight and obesity, Australia, 1996 .....	118
Table 7.11:	The attributable burden of hypertension by condition, Australia, 1996.....	120
Table 7.12:	The burden of disease attributable to hypertension, Australia, 1996 .....	121
Table 7.13:	Average blood cholesterol levels for persons aged 25-64 by sex, 1980-1989.....	122
Table 7.14:	The attributable burden of high cholesterol by condition, Australia, 1996 .....	123
Table 7.15:	The burden of disease attributable to high cholesterol, Australia, 1996.....	123
Table 7.16:	Relative risks for diseases and injuries associated with physical inactivity .....	125
Table 7.17:	The attributable burden of physical inactivity by condition, Australia, 1996 .....	126
Table 7.18:	The burden of disease attributable to physical inactivity, Australia, 1996.....	126
Table 7.19:	The attributable burden of unsafe sex by condition, Australia, 1996 .....	127
Table 7.20:	The burden of disease attributable to unsafe sex, Australia, 1996 .....	127
Table 7.21:	The attributable burden of occupational exposures by condition, Australia, 1996 .....	128
Table 7.22:	The burden of disease attributable to occupational exposures, Australia, 1996 .....	128
Table 7.23:	Relative risks associated with inadequate fruit and vegetable consumption ...	129
Table 7.24:	The burden of disease attributable to inadequate fruit and vegetable consumption, Australia, 1996.....	130

Table 7.25: The attributable burden of inadequate fruit and vegetable consumption by condition, Australia 1996 .....	130
Table A.1: Comparison of disability weights for GBD indicator conditions with Dutch weights .....	157
Table A.2: Mapping of HUI3 levels to EQ-5D+ levels for Figure 2.5.....	159
Table A.3: Comorbidity adjustments for diseases with low disability weights and high prevalence at older ages.....	161
Annex Table A: Disease and injury categories and ICD-9 codes.....	180
Annex Table B: Disease categories and disability weights.....	186
Annex Table C: Principal data sources for estimation of YLD.....	203
Annex Table D: Incidence and prevalence by sex and cause, Australia, 1996 .....	206
Annex Table E: Deaths by age, sex and cause, Australia, 1996 .....	211
Annex Table F: YLL by age, sex and cause, Australia, 1996 .....	218
Annex Table G: YLD by age, sex and cause, Australia, 1996.....	225
Annex Table H: DALYs by age, sex and cause, Australia, 1996.....	232
Annex Table I: Undiscounted DALYs by age, sex and cause, Australia, 1996.....	239

# List of figures

Figure 1.1:	Population survival curves, health expectancies and health gaps.....	6
Figure 1.2:	Relating causes to outcomes.....	7
Figure 2.1:	Years of life lost according to age at death, Australian cohort life expectancies 1996 and GBD standard life expectancies.....	16
Figure 2.2:	Effect of discounting on YLL for deaths at various ages. ....	17
Figure 2.3:	Comparison of GBD and Dutch weights for 54 comparable disease and injury categories .....	19
Figure 2.4:	Comparison of EQ-5D+ weights (from fitted multiplicative model) with Dutch weights for 153 disease stages or sequelae.....	20
Figure 2.5:	Comparison of single attribute regression weights for EQ-5D+ with single attribute weights for the Health Utility Index version 3.....	21
Figure 2.6:	DISMOD modelling of incidence, prevalence and duration of disease.....	22
Figure 2.7:	Lorenz curve for inequality in mortality burden.....	24
Figure 3.1:	Deaths by broad cause groups, Australia 1996 compared with developed and developing regions in 1990 .....	29
Figure 3.2:	Mortality burden by sex and broad disease group, Australia 1996.....	31
Figure 3.3:	Years of life lost by age, sex and broad disease group, Australia 1996 .....	32
Figure 3.4:	Leading causes of mortality burden, by sex, Australia 1996.....	33
Figure 3.5:	Years of life lost per 1,000 population by State and Territory, 1996 .....	33
Figure 3.6:	Potential years of life lost to age 75 and years of life lost, top twenty causes of mortality burden, Australia, 1996.....	34
Figure 3.7:	Mortality burden per 1,000 population by quintile of socioeconomic disadvantage and major causes, 1995–97.....	36
Figure 3.8:	Differentials in mortality burden top and bottom quintiles of socioeconomic disadvantage, main causes and selected causes, by sex, 1995–97.....	37
Figure 3.9:	Probability of dying between exact ages 15 and 25, and ages 25 and 65, by quintile of socioeconomic disadvantage and sex, Australia, 1995–97 .....	39
Figure 4.1:	Non-fatal burden of disease for major disease groups, Australia, 1996.....	41
Figure 4.2:	General model for cancer YLD estimation, including disability weight and duration ranges .....	42
Figure 4.3:	Comparison of estimated total burden (undiscounted DALYs) for mental disorders in Australia, 1996 and EME, 1990 .....	46
Figure 4.4:	Non-fatal burden of disease for major disease groups, Australia, 1996.....	52
Figure 4.5:	Severity-weighted incidence and prevalence of disability, 1996.....	54
Figure 4.6:	Severity-weighted prevalence of short-term and long-term disability, by age, 1996.....	54

Figure 4.7: Comparison of severity-weighted prevalence of disability from 1998 ABS Disability Survey with prevalence YLD (per cent), by age, 1996.....	55
Figure 4.8: Causes of prevalent YLD, by age, 1996 .....	55
Figure 4.9: Non-fatal burden of disease and injury associated with mobility limitations, self-care limitations and cognitive disability, Australia, 1996 .....	58
Figure 4.10: Differentials in YLD rates between top and bottom quintiles of socioeconomic disadvantage, selected mental disorders, Australians aged 18 years and over, 1996.....	60
Figure 4.11: Expected years of healthy life and expected years lost due to disability at birth, 15, 40 and 65 years of age, by sex, Australia, 1996.....	61
Figure 5.1: Burden of disease (YLL, YLD and total DALYs) for major disease groups, Australia, 1996.....	63
Figure 5.2: Total burden of disease and injury (YLL, YLD and DALYs), by sex, Australia, 1996 .....	64
Figure 5.3: Comparison of total deaths and burden of disease (DALYs) for main disease groups, Australia, 1996 (highest rank is the largest cause).....	64
Figure 5.4: Burden of disease (DALYs) by sex and main disease groups, Australia, 1996 ..	68
Figure 5.5: Main causes of disease burden (DALYs) in children aged 0–14 years, Australia, 1996 .....	70
Figure 5.6: Main causes of disease burden (DALYs) in young people aged 15–24 years, Australia, 1996 .....	71
Figure 5.7: Main causes of disease burden (DALYs) in adults aged 25–64 years, Australia, 1996 .....	72
Figure 5.8: Main causes of disease burden (DALYs) in older Australians, Australia, 1996.....	73
Figure 5.9: Leading causes of disease burden (undiscounted DALYs), by sex, Australia, 1996 .....	76
Figure 5.10: Comparison of discounted and undiscounted DALYs for 150 disease and injury categories, Australia, 1996 .....	76
Figure 5.11: Estimated burden of disease and injury (age-standardised DALYs per 1,000 population) by quintile of area socioeconomic disadvantage, by sex, 1996.....	79
Figure 6.1: Contribution of NHPAs to total burden of disease and injury in Australia, 1996 .....	81
Figure 6.2: The burden of cardiovascular disease by type and condition, 1996 .....	82
Figure 6.3: The burden of cardiovascular disease by sex and condition, 1996 .....	83
Figure 6.4: The burden of cardiovascular disease by sex, age and condition, 1996 .....	83
Figure 6.5: The burden of cancer by site for males, 1996 .....	85
Figure 6.6: The burden of cancer by site for females, 1996 .....	85
Figure 6.7: The burden of cancer by site, all persons, 1996 .....	86

Figure 6.8: The burden of cancer by site, age and sex, 1996 .....	86
Figure 6.9: The burden of mental illness by major category of mental disorder, 1996 .....	88
Figure 6.10: The burden of mental illness by sex and major category of mental disorder, 1996.....	89
Figure 6.11: The burden of mental illness by age and sex, 1996 .....	89
Figure 6.12: The burden of injury by external cause of injury, 1996.....	91
Figure 6.13: The burden of injury by sex and external cause, 1996 .....	92
Figure 6.14: The burden of injury by age, sex and leading cause, 1996 .....	93
Figure 6.15: The total attributable burden of diabetes by type and condition, 1996 .....	94
Figure 6.16: The attributable burden of diabetes per 1,000 population by type of disease, age and sex, 1996 .....	95
Figure 6.17: Prevalent YLD due to asthma and to all other causes by age, 1996 .....	97
Figure 6.18: The burden of chronic respiratory disease by disease type, 1996.....	97
Figure 6.19: The burden of chronic respiratory disease by disease type and sex, 1996.....	98
Figure 6.20: The burden of chronic respiratory disease per 1,000 population by disease type, age and sex, 1996 .....	98
Figure 7.1: Proportion of total burden attributed to selected risk factors, by sex, Australia, 1996 .....	102
Figure 7.2: Proportion of total burden attributed to selected risk factors, YLL and YLD contributions, Australia, 1996.....	104
Figure 7.3: Proportion of persons who are current smokers, 1974 to 1995 .....	105
Figure 7.4: Proportion of Australians who were smokers in 1995, by sex and age.....	105
Figure 7.5: The attributable burden of tobacco smoking by age and sex, 1996 .....	107
Figure 7.6: Trends in the apparent consumption of alcohol per capita, Australia, 1940-1996 .....	108
Figure 7.7: Prevalence of abstinence, low risk, harmful and hazardous alcohol consumption, comparison of recent surveys, Australia .....	109
Figure 7.8: The burden of disease and injury attributable to the harmful and beneficial effects of alcohol, by age and sex, Australia, 1996.....	110
Figure 7.9: Proportion of people who have used cannabis in the past year by age and sex, Australia, 1995 .....	112
Figure 7.10: Trends in the prevalence of cannabis use by age, Australia, 1988-95 .....	113
Figure 7.11: Death rates from opiate abuse, dependence or poisoning by age, Australia, 1986-96 .....	113
Figure 7.12: The attributable burden of illicit drugs by age and sex, 1996.....	115
Figure 7.13: Prevalence of overweight and obesity, by sex, Australians aged 25-64, 1980-95.....	116
Figure 7.14: Prevalence of obesity, by age and sex, Australia, 1995 .....	116

Figure 7.15: The attributable burden of obesity by age and sex, 1996.....	118
Figure 7.16: Rates of hypertension by sex, Australia, 1980–95.....	119
Figure 7.17: Rates of hypertension by age and sex, Australia, 1995.....	120
Figure 7.18: The attributable burden of hypertension by age and sex, 1996.....	121
Figure 7.19: Rates of high blood cholesterol by age and sex, Australia, 1989.....	122
Figure 7.20: The attributable burden of high cholesterol by age and sex, 1996.....	124
Figure 7.21: Physical activity levels of Australian adults aged 18–75, by sex and age group, 1997 .....	125
Figure 7.22: Attributable burden of physical inactivity: YLL, YLD and DALYs, by age and sex, Australia 1996 .....	126
Figure 7.23: Attributable burden of occupational exposures: YLL, YLD and DALYs, by age and sex, Australia 1996.....	129
Figure 7.24: The proportion of people aged 25 and over who consume less than five servings of fruit or vegetables per day by age and sex, 1995.....	130
Figure 7.25: YLL and YLD attributable to inadequate fruit and vegetable consumption, by age and sex, Australia, 1996.....	131



# Acknowledgments

The Commonwealth Department of Health and Aged Care contributed financial resources to assist AIHW to carry out this study. We thank Dr Richard Madden, Director of AIHW, and Mr Geoff Sims, Head of the Health Division, for support, encouragement and advice in carrying out this study.

The Steering Committee for the AIHW project oversaw the project and provided valuable inputs. It comprised: Dr Richard Madden (Chair), Dr Colin Mathers, Ms Liz Furler (DHAC), Dr Theo Vos (Department of Human Services, Victoria), Dr David Roder (NHMRC), Dr Martin Tobias (NZ Ministry of Health), Professor Jeff Richardson (Monash University) and Assoc. Professor Richard Taylor (University of Sydney).

We also wish to acknowledge the encouragement and advice of Professor Chris Murray (WHO) and Dr Alan Lopez (WHO), who carried out the Global Burden of Disease Study. The Global Forum for Health Research provided financial assistance to enable Colin Mathers to present results from this study at its 3rd Forum in June 1999 and to discuss methodology and approaches to burden of disease analysis with other researchers. The International Burden of Disease network provided a valuable forum for exchanging ideas and information with people involved in other burden of disease studies around the world.

We thank Bruno Ridolfo for advice on tobacco and alcohol attributable fractions analyses and for provision of revised estimates for some of the aetiological fractions based on his work to update the meta-analyses of English et al. (1995). We also thank the many people in Australia, too numerous to mention individually, who provided advice and information to assist in the analyses reported here or who reviewed aspects of the analyses. This includes staff in the Australian Institute of Health and Welfare, in the Commonwealth Department of Health and Aged Care and in State and Territory health authorities, as well as health researchers and clinical experts, who provided advice to either the AIHW study or the Victorian Burden of Disease Study.

The principal work in conceiving and developing the Australian Burden of Disease and Injury Study was carried out by Colin Mathers. Methodology and analyses were developed jointly with the Victorian Burden of Disease project led by Theo Vos. Without his experience in the use of burden of disease methodology and contributions to the analysis of many disease groups, it would not have been possible to carry out the Australian study in the available time. Theo Vos played a major role in the analysis of many of the disease groups, and particularly mental disorders and injuries.

The Australian Institute of Health and Welfare project team comprised Colin Mathers, Chris Stevenson, Simon Eckermann and James Morris. Chris Stevenson contributed substantially to the analyses of cancers, cardiovascular diseases, digestive diseases and injuries. Simon Eckermann and James Morris provided invaluable assistance with literature reviews, data collection, liaison, report preparation and other aspects of the study.

# Abbreviations

ABS	Australian Bureau of Statistics
AIDS	Acquired Immune Deficiency Syndrome
AIHW	Australian Institute of Health and Welfare
AMI	Acute myocardial infarction
ANZDATA	Australian and New Zealand Register of Dialysis and Transplant Patients
BDQ	Brief Disability Questionnaire (used in MHS'97)
BEACH	Bettering the Evaluation and Care of Health: A study of general practice activity
BMES	Blue Mountains Eye Study
BMI	Body Mass Index
CD`	Collector's District
CIDI	Composite Diagnostic Interview
COPD	Chronic obstructive pulmonary disease
CVD	Cardiovascular disease
DALE	Disability-adjusted life expectancy
DALY	Disability-adjusted life year
DASETT	Department of the Arts, Sport, the Environment, Tourism and Territories
dBHTL	Decibels Hearing Threshold Level
DFLE	Disability-free life expectancy
DHAC	Department of Health and Aged Care
DHFS	Department of Health and Family Services
DHS	Department of Human Services (Victoria)
DISMOD	Disease modelling software package (refer to note 26 in Appendix A)
DSM-III	Diagnostic and Statistical Manual of Mental Disorders – 3rd Edition
ELD	Expected years lived with disability
EME	Established Market Economies
EQ-5D+	EuroQol-5 dimensions plus additional cognitive impairment dimension
GAD	Generalised anxiety disorder
GBD	Global Burden of Disease Study
GHQ	General Health Questionnaire
HDL	High-density lipoprotein
HIV	Human Immunodeficiency Virus
HUI3	Health Utilities Index Version 3
ICD-10	International Classification of Diseases, 10th revision
ICD-9	International Classification of Diseases, 9th revision
ICIDH	International Classification of Impairments, Disabilities, and Handicaps
IHD	Ischaemic heart disease

IRSD	Index of Relative Socioeconomic Disadvantage
kHz	Kilohertz
l	Litres
LDL	Low density lipoprotein
LE	Life expectancy
MHS'97	ABS National Mental Health Survey 1997
NCSCCH	National Cancer Statistics Clearing House
Nec	Not elsewhere classified
NHMRC	National Health and Medical Research Council
NHPA	National Health Priority Area
NMSC	Non-melanoma skin cancer
NZMOH	New Zealand Ministry of Health
OCD	Obsessive-compulsive disorder
OECD	Organization for Economic Co-operation and Development
PAF	Population attributable fraction
PTO	Person trade-off valuation method
PTSD	Post-traumatic stress disorder
PVD	Peripheral vascular disease
PYLL	Potential years of life lost
QALY	Quality-adjusted life year
REVES	International Network on Health Expectancy (Réseau Espérance de Vie en Santé)
RR	Relative risk
SAS	Statistical Analysis System software package
SEIFA	Socio-economic Indexes for Areas
SF-12	Medical Outcomes Study 12 Item Short-Form Health Survey
SF-36	Medical Outcomes Study 36 Item Short-Form Health Survey
SG	Standard gamble valuation method
SLA	Statistical Local Area
STD	Sexually transmitted disease
TTO	Time trade-off valuation method
WHO	World Health Organization
YLD	Years lost due to disability
YLL	Years of life lost ( due to mortality)



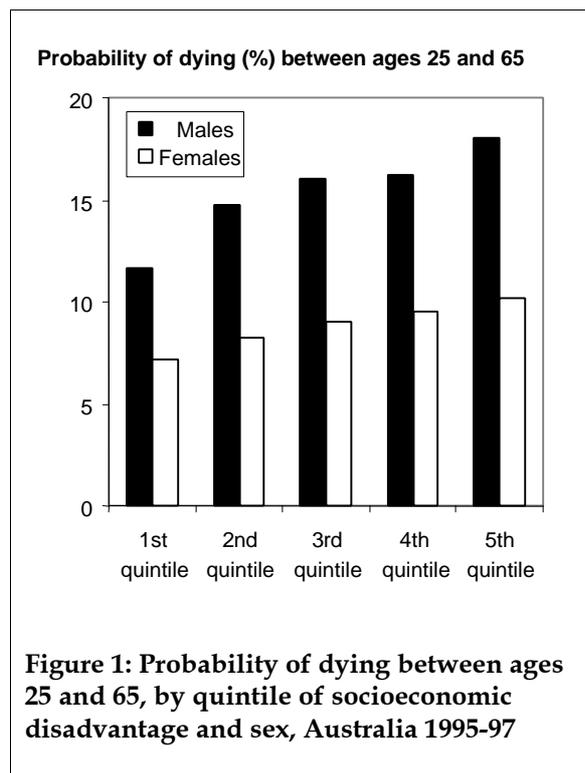
# Highlights

This report provides an overview of results from the Australian Burden of Disease and Injury Study undertaken by the AIHW during 1998 and 1999. 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. It provides a comprehensive assessment of the amount of ill health and disability, the 'burden of disease' in Australia in 1996.

Mortality, disability, impairment, illness and injury arising from 176 diseases, injuries and risk factors are measured using a common metric, the Disability-Adjusted Life Year or DALY. One DALY is a lost year of 'healthy' life and is calculated as a combination of years of life lost due to premature mortality (YLL) and equivalent 'healthy' years of life lost due to disability (YLD). 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.

## Key findings—mortality (YLL)

- 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 lower than female life expectancy.
- Australia ranks around 10th in the world in terms of total life expectancy at birth. Australia ranks fifth best in the world, behind Japan, Greece, Sweden and Italy in terms of the probability of dying between ages 15 and 59.
- 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 cardiovascular disease 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 27% 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 has decreased in males but increased substantially in females. In the 15 years from 1981 to 1996, the per capita mortality burden for lung cancer and chronic obstructive pulmonary disease (COPD) decreased by 15% and 16% respectively for males, but increased by 62% and 70% respectively for females.
- The largest increases in mortality burden have occurred for HIV/AIDS, suicide and prostate cancer in males, and for senile dementias and heroin dependence and abuse in both sexes, and for lung cancer and COPD in women.
- The mortality burden is significantly higher among socioeconomically disadvantaged people. The most disadvantaged quintile of the Australian population lost 35% more years of life than the least disadvantaged quintile in 1996.

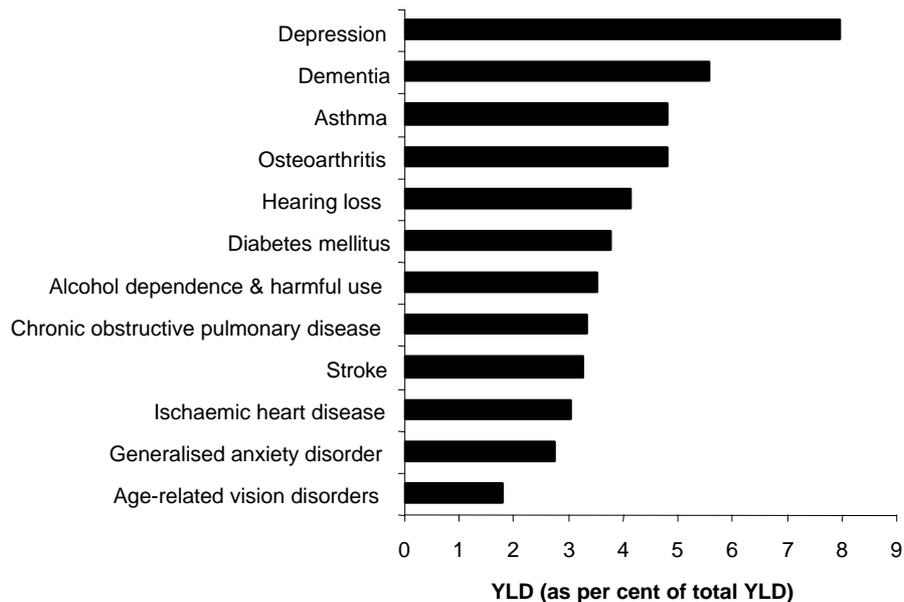


- For Australians aged less than 65, the differential burden between the lowest and highest quintile is even greater, with a 60% excess burden in the most disadvantaged group.
- The overall inequality in mortality burden is 50% larger for males than females in Australia. When analysed by disease group, 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

- 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 (YLD)

- Mental disorders are the leading cause of years of life lost due to disability (YLD), accounting for nearly 30% of the non-fatal burden of disease in Australia.
- Nervous system and sense organ disorders are each responsible for 16% of the disability burden.
- 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 (Figure 2).
- 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.
- 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.



**Figure 2: Leading causes of years of life lost due to disability (YLD), Australia 1996**

### Key findings—burden of disease and injury (DALYs)

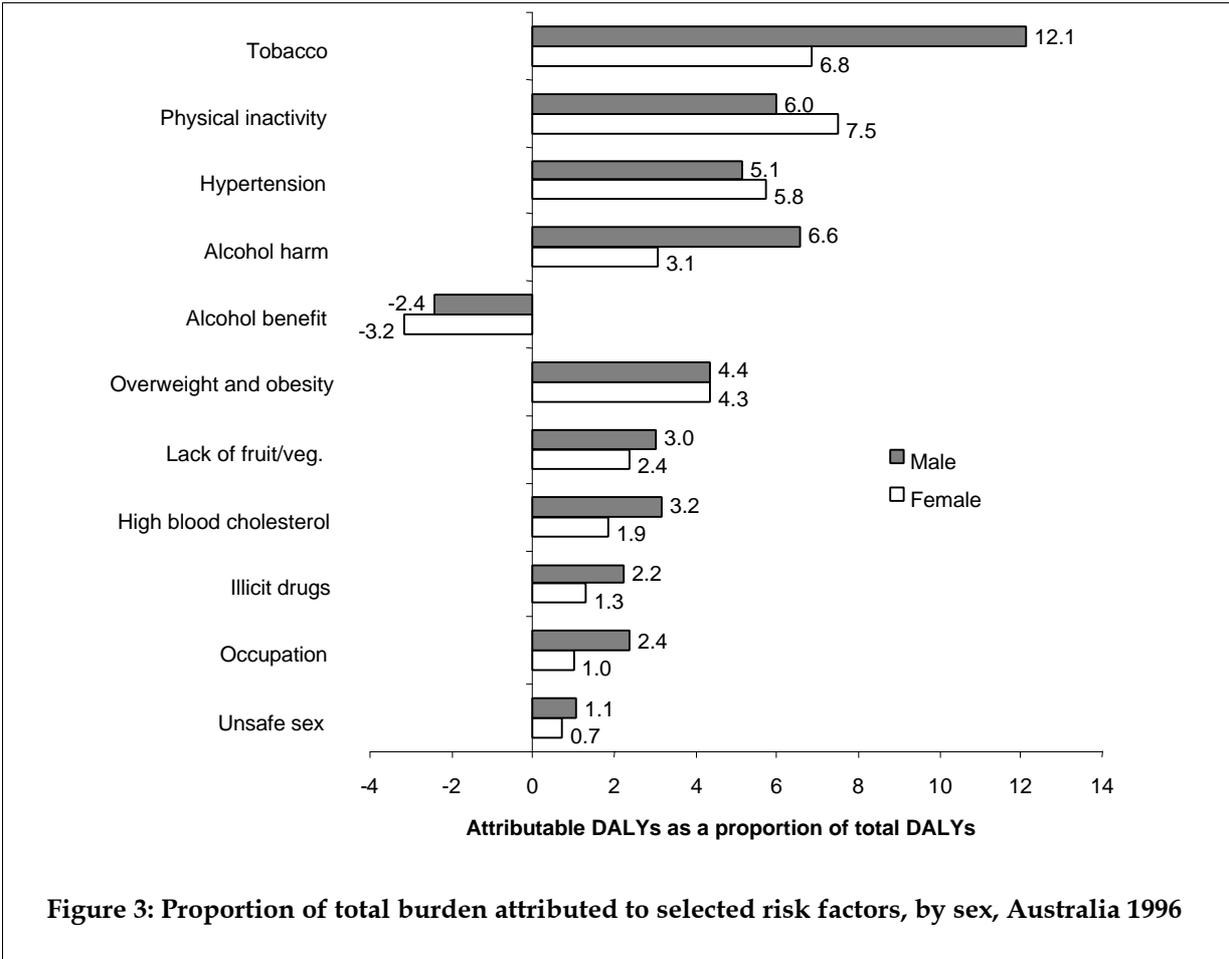
- Inclusion of non-fatal health outcomes provides a substantially different picture to that provided by traditional mortality statistics: mental disorders are now the third leading cause of overall burden (14% of total) after cardiovascular diseases (20%) and cancers (19%). Central nervous system and chronic respiratory conditions are almost as large a contributor to total burden as injuries.
- The male burden (in total DALYs) is 13% higher than the female burden.
- The ten leading causes of the burden of disease in Australia for males and females are shown below.

Males	Contribution to total burden (per cent of total DALYs)	Females	Contribution to total burden (per cent of total DALYs)		
1	Ischaemic heart disease	13.6	1	Ischaemic heart disease	11.1
2	Stroke	4.8	2	Stroke	6.1
3	Lung cancer	4.5	3	Depression	4.8
4	COPD	4.2	4	Dementia	4.7
5	Suicide and self-inflicted injuries	3.3	5	Breast cancer	4.6
6	Road traffic accidents	3.0	6	COPD	3.2
7	Diabetes mellitus	3.0	7	Asthma	3.1
8	Depression	2.7	8	Diabetes mellitus	3.0
9	Colorectal cancer	2.7	9	Osteoarthritis	2.9
10	Dementia	2.5	10	Colorectal cancer	2.7

- The total burden of disease and injury in Australia in 1996 is 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.
- 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 nearly 4% of the total burden.
- Inclusion of the attributable burden of cardiovascular disease due to diabetes increases the burden of diabetes from 3% to 5% of total DALYs. Inclusion of the attributable burden of suicide and ischaemic heart disease increases the total burden of depression also from 3% to 5%, so that depression and diabetes are equal third leading causes of burden of disease in Australia.
- 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.
- Seven cancers have been identified as the focus of the cancer priority area – lung cancer, skin cancer, cancer of the cervix, breast cancer, colorectal cancer, prostate cancer and non-Hodgkin’s lymphoma. These cancers together account for around 61% of the burden of cancer (DALYs) for men and 63% for women.
- The burden of mental disorders in Australia is dominated by affective disorders, substance use disorders and anxiety disorders. Substance use disorders are the leading cause of mental disorder for males, accounting for 33% of their mental health DALYs. Alcohol abuse accounts for 59% of male substance use disorder DALYs. The major cause of mental disorder for women is affective disorders, accounting for 39% of women’s mental health DALYs. This is almost entirely depression (87%).
- The injury burden in Australia is dominated by suicide and self-inflicted injuries and road traffic accidents, each of which accounts for 27% of the total injury burden. These two causes, together with accidental falls, account for 64% of the total injury burden.
- Overall, diabetes causes almost as much disability burden (43% of total DALYs) as mortality burden. The burden is relatively evenly shared between males and females, with males responsible for 54% of the total burden of diabetes. Below age 55, the burden is predominantly due to diabetes and its complications. Over age 55, more than 60% of the burden is due to cardiovascular disease (heart disease, stroke and peripheral vascular disease) attributable to diabetes.
- Asthma is responsible for 4.8% of YLD (non-fatal burden) and 2.6% of DALYs (total burden) in Australia. The majority of the asthma burden is incident in childhood.

### Key findings—attributable burden of risk factors

- Risk factors such as smoking, physical inactivity, obesity, high blood pressure and high cholesterol are responsible for a sizable proportion of the total burden of disease in Australia as shown in Figure 3.
- To the extent possible, these estimates are based on studies that examined each risk factor independent of other risk factors, but it is likely that the complexity of the interaction between risk factors has not been captured fully. Therefore, caution is warranted in the interpretation of these results. Despite these reservations, the conclusion remains that each of these risk factors is responsible for large amounts of ill health, ranking in size with the top-ten diseases. This suggests that large health gains can be expected from effective public health interventions.
- Tobacco smoking is the risk factor responsible for the greatest burden of disease in Australia, responsible for about 12% of the total burden of disease in males and 7% in females.
- Physical inactivity is responsible for about 7% of the total burden of disease and overweight and obesity for more than 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. This burden relates to average consumption of less than 5 serves of fruit or vegetables per day. Inadequate fruit and vegetable intake causes an estimated 11% of the total cancer burden in Australia.
- The net harm associated with alcohol consumption is around 2.2% of 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 similar level of harm to alcohol for males, at 2.2% 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 1.3% 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 58% of the total burden of disease that is attributable to unsafe sex, followed by cervix cancer (23%) and other sexually transmitted diseases (8%). Table 7.18 shows the proportion of the total for males (1.1%) and females (0.8%).
- 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 attributable burden of occupational exposures is 1.7% of the total burden of disease and injury in 1996. Cancers are responsible for 41% of this attributable burden, followed by injuries (33%) and other chronic diseases (25%).

## Conclusions

This report has addressed the need for comprehensive and comparable information on the causes of loss of health in the Australian population.

- The 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.

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. This study, together with the parallel Victorian study (DHS 1999) are a first step towards exploring the usefulness of burden of disease methods to provide information to assist in health planning and priority setting in Australia.