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Western Australia Burden of Disease Study

Mortality 2000

July 2003

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Epidemiology Branch
Health Information Centre
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Western Australia

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Executive summary

Years of Life Lost (YLL), calculated from death statistics, and Years Lost to Disability (YLD) are the two additive components of the Disability Adjusted Life Year (DALY), a new measure of population disease burden promoted by the World Health Organisation. This report summarises the first work in determining the burden of disease for the Western Australian population and focuses on the mortality component. Age–standardised rates of mortality burden adjust for different age structures over time and between populations, and this is the main health measure estimated in this report. Quantification of mortality burden allows assessment of the disease burden resulting from risk factors. Thus, estimates of the mortality burden due to selected risk factors were calculated to support public health policy in Western Australia.

Key findings

Burden of mortality: 1996 to 2000

- In WA 2000, premature mortality was responsible for 112,950 years of life lost, with more years being lost by males than females. This represents a 4.2% YLL reduction in WA since 1996.
- Cardiovascular disease, cancers and injuries & poisoning accounted for over 70% of the total mortality burden. Cardiovascular disease accounted for most of the reduction in burden.
- There was a substantial fall in national and WA age-standardised mortality burden. WA 2000 rates were marginally lower than those for Australia.
- Male all–cause age–standardised mortality burden decreased by 13% and 16% for Australia and WA respectively, while the female burden decreased by just under 10% for both Australia and WA. The mortality burden for all broad disease groups decreased except for injury, which increased in females nationally and in WA. This increase was due to increases in injury and poisoning death rates in younger women and requires monitoring.

WA 2000: profile of mortality burden

- In 2000, between a quarter and a third of the total mortality burden was due to each of cardiovascular disease, cancer and conditions classified as ‘other’. Injury & poisoning accounted for a tenth of the female and just under a fifth of the male age-standardised mortality burden.
- The female all–cause age–standardised mortality burden was a third less than that for males.
- An analysis of the WA health regions found that the age–standardised mortality burden for all causes was highest in remote regions, especially the Kimberley region, where the impact of poor Aboriginal health is substantial. North and South Metro regions experienced the lowest age-standardised mortality burden for males and females.
- Midwest-Murchison had the highest male cancer age–standardised mortality burden, while the Wheatbelt, South West and Great Southern regions had the lowest cancer burden. East Metro, Midwest-Murchison, Goldfields-South East Coastal and Great Southern regions had the highest female cancer age mortality burden, while Kimberley and Pilbara-Gascoyne had the lowest.
- Male age–standardised cardiovascular mortality burden was highest in the Kimberley, Midwest-Murchison, Goldfields-South East Coastal and East Metro regions. Female age–standardised cardiovascular YLL rates were highest in the Kimberley, Midwest-Murchison and East Metro regions. North and South Metro had the lowest cardiovascular rates for males and females.

- The metropolitan regions had lower male age–standardised mortality burden from injury than non-metropolitan regions. Remote regions, especially Kimberley, had male injury YLL rates substantially above that of WA. The Kimberley female injury mortality burden was five times that of the State.
- The age-standardised mortality burden for conditions classified as 'other' was highest for the four most remote regions. For these areas, this group of diseases contributed a much higher percentage of the total age-standardised mortality burden than other regions.

Burden of mortality attributable to risk factors

- For both sexes, tobacco, physical inactivity, hypertension and alcohol were responsible for the highest mortality burden across all age groups, with tobacco having the highest burden by a substantial margin for men.
- The mortality burden attributable to inadequate fruit and vegetable intake had a fairly high ranking, even though the number of diseases considered was limited. Because of the complexity of dietary intake and the lack of data for all dietary components, it was not possible to do a risk factor analysis for diet as a whole.
- The proportions of the total mortality burden attributed to physical inactivity, hypertension and unsafe sex were higher for females. The proportion of total burden of mortality was higher for men in all the other risk factors studied.
- Low risk alcohol drinking and hazardous/high risk alcohol drinking had different effects on the mortality burden. In the under 45–year age group, low risk drinking had little effect (either positive or negative) and high risk drinking imparted substantial burden. In the 45–years and older age group, low risk drinking had a substantial benefit, offset by a relatively small burden while high risk drinking had minimal benefit and a relatively high burden. The beneficial effect of alcohol was higher for women.
- In the under 45–year age group, the harmful effects of alcohol and other drug use dominates the profile of mortality burden for males and females. The female mortality burden from unsafe sex was also significant in this age group.
- The profile of risk factor burden in the 45–64 year age group differs from the all–age distribution in that the burden from drug use and hypertension, and benefit from alcohol, is reduced, while the burden is higher from inadequate fruit and vegetable intake, overweight and obesity and (especially) tobacco use.
- In the 65 years and older age group, tobacco remained a significant risk factor for males. Hypertension and physical inactivity burden and alcohol benefit were substantial for males and (especially) females.

Conclusion

This report highlights the main diseases, demographic groups and risk factors responsible for the burden of mortality in Western Australia. Measuring the burden attributed to risk factors estimates the potential of prevention and as such is a powerful tool in the development of public health policy. The identification of groups that can be targeted for intervention further strengthens this process.

The findings in this report confirm WA's favourable profile of mortality burden relative to Australia as a whole. The pattern of disease evident in the profile of mortality burden for WA as a whole is typical of that seen in industrialised regions, as is the distribution of burden of disease attributable to the ten selected risk factors. The pattern of mortality burden seen in the more remote WA regions reflects a less favourable epidemiological pattern and requires innovative public health and other health system approaches.

How to read this report

In this report, the burden of mortality for WA is estimated for the first time using the Years of Life Lost (YLL) metric. The introduction provides the background to the global burden of disease (BOD) project, and how the WA health information can be enhanced using methods developed by this project. This section is useful for those readers who are being introduced to burden of disease work for the first time.

The methodology follows that used in the Australian and Victorian studies, and this is summarised briefly in four steps. The 'Specific Issues' section is recommended as an introduction to technical concepts referred to in the remainder of the report. Readers who require further methodological detail are referred to the Australian and Victorian BOD reports. Appendix tables provide details of the composition of disease groupings and how deaths were converted to years of life lost.

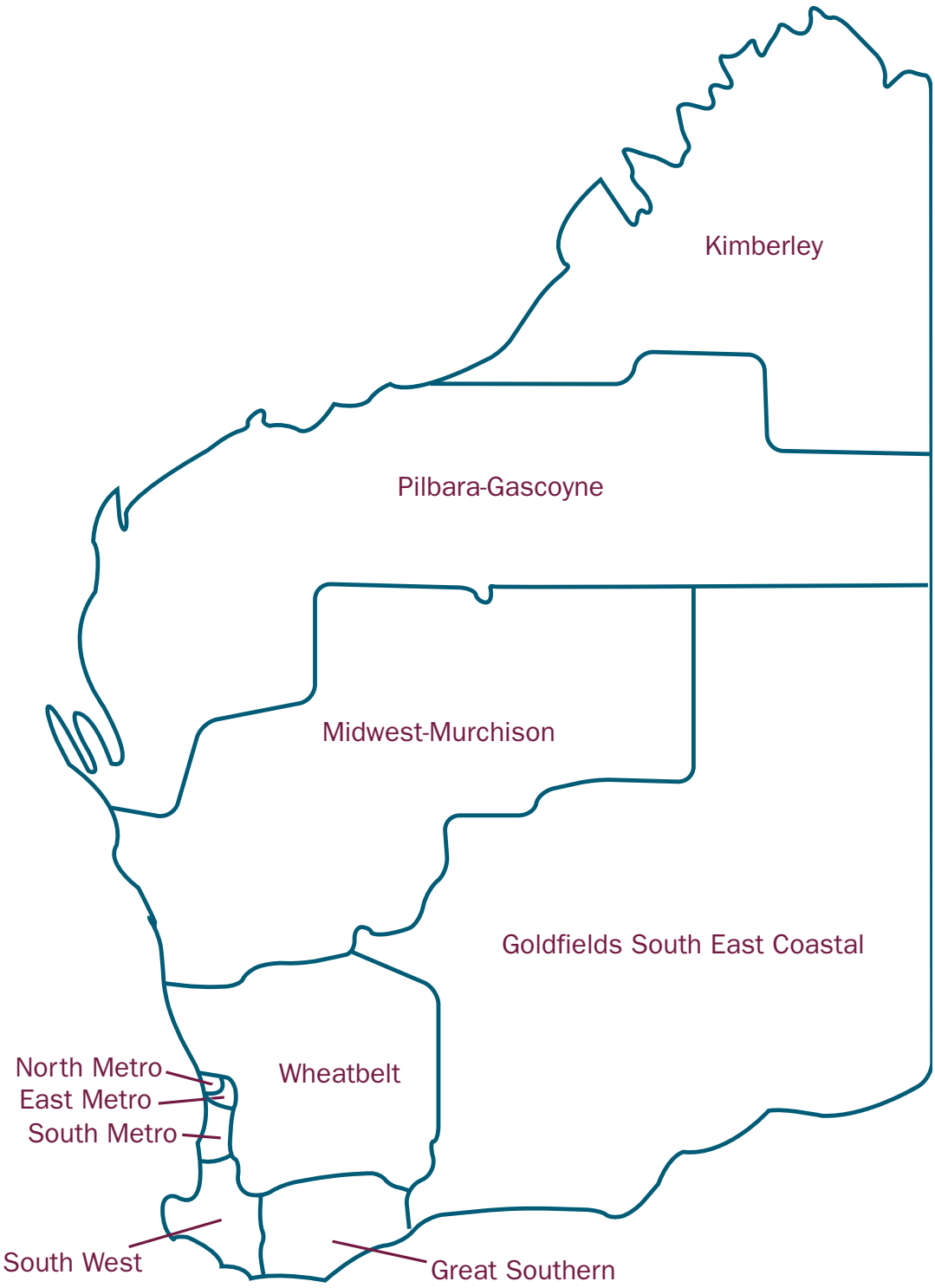
The results section presents findings in terms of deaths (including life expectancy), mortality burden (YLL) and the mortality burden attributable to selected risk factors. The majority of the results refer to State-wide data. Age-standardised death and YLL rates by broad disease group of the ten WA regions (see Map depicting regions on next page) are included in Section 3.2.4. More detailed regional information is available from the Health Information Centre on request.

The risk factor section forms the bulk of the results, and starts with an overview of the contribution of the selected risk factors to total WA mortality burden in each of three age groups. This is followed by a more detailed look at each risk factor, including prevalence of the risk factor in the WA population, the contribution of each condition to the burden attributable to that risk factor and the age distribution of the mortality burden.

For reference, appendix tables provide detailed results for deaths, years of life lost and age–standardised rates for each of the 184 disease groupings. Results for WA regions are in four broad disease groups. Appendix tables can be accessed on the Health Department website www.health.wa.gov.au or are available on request.

The significance of the results and methodological issues are discussed at the end of the report.

Health Regions of Western Australia, 2002



1. Introduction

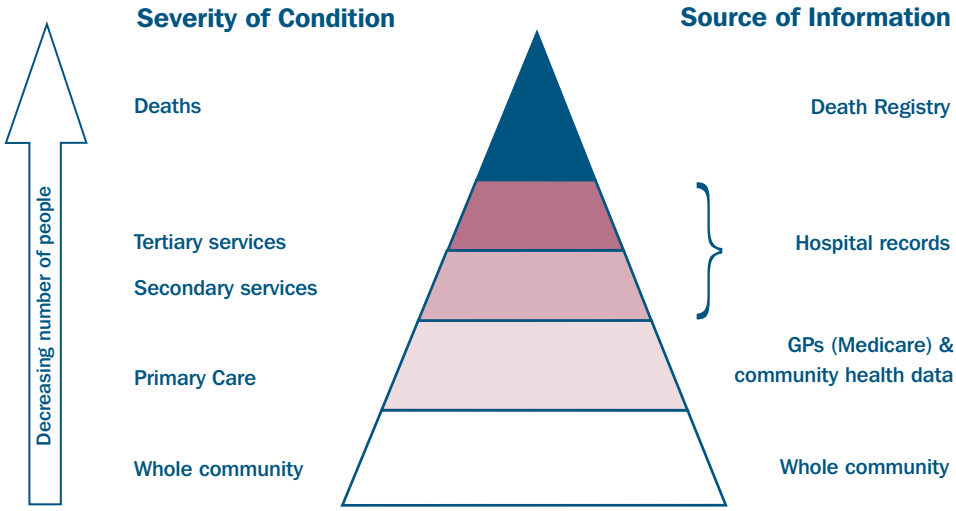
1.1 Background

Information needs and sources in the Department of Health, Western Australia

With the change in the Western Australian government's policy following the HARC report to more preventative activity in the health sector, health information needs are changing.[1]

Health information can be obtained through a range of data sources and methods (Figure 1), but administrative data sets such as the death and hospital registers provide incomplete information about conditions and the people suffering from them. While primary health care providers such as GPs and community health staff provide the largest number of services, many people manage their acute and chronic illness themselves. Consequently, surveys and databases that record people's public health behaviours are important additional sources of information to describe the health status and health outcomes of a population, although these data sources also have their limitations.

Figure 1: Sources of health information used to measure health status



Source: Summary of population characteristics and the health and wellbeing of residents of the State. Health Information Centre, Department of Health, December 2002.

In general, composite indices combine variables from a range of sources to give a more complete summary index of the issue of concern. Mortality indices (for example, standardised mortality ratios) are often used as indicators of the health of populations despite the fact that they reflect the extreme of ill-health, namely death. With the increase in longevity and the prevalence of chronic conditions in today's society, quality of life indices are required. The challenge for the health sector has been to develop a summary population health status index that combines both quality (usually based on morbidity and disability data) and quantity (usually based on mortality data) of life components, while also enabling comparisons across health conditions. Such an index could estimate the relative impact of different disease groups and risk factors to population health, thereby guiding general policy and service development.

DALY: the metric of the Global Burden of Disease Project

One such composite health index, the Disability Adjusted Life Year (DALY), was developed in the last decade by the Harvard School of Public Health and the World Health Organisation, as part of the Global Burden of Disease Project. In this document, this index is described and burden of mortality estimates for WA are estimated for the first time, adding to the range of indices available for health policy development and planning.

The DALY aims to quantify the amount of full health lost due to illness or injury occurring in the reference period.[2] It does this by adding the burden arising from deaths in that period (Years of Life Lost or YLL) to the burden of incident (new) cases of disease occurring in that same period (Years Lived with Disability or YLD).

The formula is shown below:

$$DALY = YLL + YLD$$

One DALY represents the loss of one year of healthy life.

The DALY falls within the group of 'health gap' measures, which determine the gap (in years) between a population's actual health status and some reference health status. In terms of mortality, it compares the mortality experience of a study population/region with a stated ideal (the standard). In choosing the reference standard many value choices need to be made. The Global Burden of Disease Project used a standard based on the life expectancy in Japan, although the Australian study standard was based on the 1996 Australian cohort life expectancy.

Calculation of DALYs is data intensive, requiring detailed age-specific information for each disease relating to incidence, stages, duration, quality of life estimates (disability weights), and deaths. The DALY for a cause of disease or injury is calculated separately for each age group defined in the study and for both sexes. The sum of all the DALYs gives the total burden for that condition.

The mortality burden component (YLL) represents years of life lost due to premature death. The morbidity burden component (YLD) represents years of life lived with disability resulting from non-fatal incidence of a condition. The rationale and methods are described in detail in Murray and Lopez (1996).[2]

The DALY's advantages over more traditional population health measures are that it integrates quantity and quality of life measures and allows the aggregation and disaggregation of disease burden in many different ways, for example, by age, sex, cause, risk factor or geography.

BOD analysis indicates the relative impact of disease groups (including non-fatal conditions) on the health of populations, and thus the main health problems at a global, national and sub-national level. It also provides information about the contribution of risk factors to the burden of disease profile, highlighting the preventable proportion. In this way it can guide policy and decision-making processes.

However, the DALY review group cautioned that, although the DALY methodology represents a step forward in the development of summary population health measures, its use to allocate health resources should be discouraged in its present form.[3] DALY data can be used as an input for techniques such as cost effectiveness analyses which are used to allocate health resources.

The burden of disease (BOD) approach involves many assumptions and less than ideal data sources, for which it has been criticised.[3,4,5,6,7,8,9,10] Despite these criticisms and ongoing debate in the literature, its usefulness has been acknowledged.[11,12] At this stage, no credible alternative has been proposed and the WHO remains committed to the approach.

BOD analysis nationally and internationally

Having been initiated and encouraged by the WHO, BOD output is now being published more widely. Australian estimates were published for 1996 by the Australian Institute of Health and Welfare in 1999[11] and global DALY estimates for 2000 were published by WHO in 2002.[12]

Increasingly, the methodology is being applied at a sub-national level, with Victoria completing the first State BOD estimates and adapting the methodology for local area applications for the first time globally.[13,14,15,16] Queensland, the Northern Territory, South Australia and New South Wales[17] have also initiated their own BOD studies. Recently, the Australian Institute of Health and Welfare established a Summary Measures Unit, which will be involved in supporting burden of disease studies at the national and State level. The Unit is planning to update the 1996 national estimates, and support State-specific estimates (Goss J, AIHW, Personal Communication 2002). In addition, the University of Queensland is establishing a BOD Centre of Excellence, which will be directed by Professor Alan Lopez, one of the main developers of the methodology.

Methodological development is ongoing, with significant refinement taking place locally and internationally. One such area is the further extension of risk factors (for example, those related to lifestyle and the environment) for which BOD can be estimated.[11,12] The World Health Report 2002 has published the results of 20 risk factors, including underweight, unsafe water, sanitation and hygiene, indoor smoke from solid fuels, iron deficiency, zinc deficiency, Vitamin A deficiency, lead exposure, unsafe health care injections, lack of contraception, childhood sexual abuse, risk factors for injury and most of the factors covered in this report.[12]

The burden of disease methodology has not been applied to WA population data before. Summary population health indicators in the State have been limited to hospitalisation and mortality rates, with little or no disability/quality of life component. The availability of national BOD estimates assists in identifying national health priorities and in developing national policy. In addition, the Commonwealth Government proposes to use DALYs in their national health performance framework.[18] Estimates for the WA population have the potential to bring these applications to the state level, where they can feed into more local policy development and population monitoring. Extension into local area analysis means that data may be used for smaller geographical aggregations so that within-State regional comparisons can be made.

1.2 Objective and scope of this report

This report summarises the first work in determining the BOD for the WA population. It focuses on the findings of the mortality component of DALYs, namely the years of life lost due to mortality (YLL). In addition, estimates of the mortality burden due to selected risk factors including tobacco, alcohol, other drug use, unsafe sex, obesity, inadequate fruit and vegetable intake, physical inactivity, occupational causes, high blood cholesterol and hypertension are calculated. The morbidity component of the burden of disease for WA, namely the estimation of Years Lost to Disability (YLD), is to be determined in the near future.

2. Methodology

2.1 Overview

The methods used in this study closely follow those used in the 1996 Australian and Victoria studies estimating YLLs.[11,13] These studies in turn, broadly followed the Global BOD project methodology, although their approach departed from the global approach to adjust for the Australian context.

The analysis for this report was done in four steps:

Step 1:	Collation of death counts into disease codes, by age group and sex
Step 2:	Calculation of YLL conversion factor and conversion of deaths into corresponding YLL counts
Step 3:	Calculation of YLL rates
Step 4:	Calculation of YLL attributable to risk factors.

Table 1 gives a broad outline of the data required for each stage of the WA 2000 analysis, the sources of the data and the approach taken to process the raw data into Years of Life Lost. Appendix Table 1 provides the detailed disease group codes with their corresponding ICD–10 codes.

Table 1: Outline of data requirements and processing for calculating years of life lost (YLL)

Data required	Data processing
Step 1: Collation of death counts	
Death data: Death counts for selected geographical area by age, sex and ICD–10 code. ***Source:*** Australian Bureau of Statistics (ABS) counts of WA deaths registered in 2000, including WA residents whose deaths were registered in other states.	1. All ICD–10 codes were allocated to 184 burden of disease group codes. These disease codes can be aggregated to 22 chapters/categories and 3 broad groups, namely communicable diseases, non-communicable diseases and injuries. 2. Death counts were tabulated in a spreadsheet format by age, sex and burden of disease codes. Age categories included <1, 1–4, and all 5 year age intervals until 94 years. 95+ was the oldest group. 3. Despite some ICD–10 codes not being specific or meaningful, there was an attempt to allocate each death to an exact, well-defined cause of death. Death counts from ill-defined codes were redistributed proportionally to well-defined codes. Both between-chapter and within-chapter redistribution was done. 4. Deaths from selected codes were redistributed from a particular cause to underlying causes, for example, liver cancer lost a proportion of deaths to Hepatitis B and renal failure lost a proportion of deaths to diabetes mellitus. ***Output:*** Spreadsheet containing death counts in each of the 184 burden of disease codes, with no ill-defined categories.

Step 2: Calculation of years of life lost

YLL conversion factor:

- Life expectancies for males and females, by single year intervals from birth.
- Average age at death within each 5 year age interval.

Source:

- YLL conversion figures used actual age-at-death distribution for WA 2000. Cohort lifetable 1996 used projected death rates from ABS population projections. Death rates: ABS population projections (1997–2051).
- See also Appendix Tables 2 & 3.

1. The life expectancy was calculated at exact average age at death for each 5 year age group. This was based on the life expectancy for the population, by single year intervals from birth.
2. This provided an estimate of the number of years that those who died in each age group would be expected to live, had they not died. This is also the unadjusted YLL conversion factor without age weighting or discounting.
3. The formula used to calculate the unadjusted conversion factor allows for a range of values for age weighting and discounting.
4. Age-sex specific YLL factors were applied to the corresponding age-sex death counts to estimate YLL by age, sex and burden of disease code.

Output:

YLL conversion factors, by age and sex under different assumptions of discounting and age weighting. YLL counts, by age, sex and all burden of disease categories, and combined.

Step 3: Calculation of rates of years of life lost

Denominator data for the calculation of rates:

Population estimates, by age and sex for:

- The geographical areas (WA and WA regions
- For Australia as a whole
- For World standard population.

Source:

ABS population estimates for 2000.

1. Calculation of age and sex specific mortality and YLL rates for WA.
2. Calculation of age-standardised mortality and YLL rates for WA, using Australia 1991 as the standard.
3. Calculation of age-standardised mortality and YLL rates for WA, using world standard, if required.

Output: Age-standardised YLL rates for WA.

Step 4: Calculation of years of life lost attributable to risk factors

Data for calculation of Attributable (Aetiological) Fractions:

- Measures of strength of association between diseases and selected risk factors.
- Prevalence of risk factors in the population, by age and sex: obtained from a range of local and national surveys.

Source:

- Relative risks and selected aetiological fractions: Ridolfo and Stevenson, AIHW 1998 and Victorian Burden of Disease Project.
- Prevalence of risk factors: WA Health and Well-being survey 2000 and AUSDIAB study 2000.

1. Calculation of Attributable Fractions for selected risk factors and diseases with known relationship with the risk factors.
2. For each selected risk factor, the deaths and YLLs from diseases known to have a relationship with the risk factor, were extracted by age and sex.
3. Aetiological fractions were applied to the corresponding deaths and YLLs.

Output:

1. Number of deaths attributable to each risk factor, by age and sex.
2. Number of YLLs attributable to each risk factor, by age and sex.
3. Proportion of total YLLs attributable to each risk factor.

2.2 Specific issues

Completeness of death registration

Australia has almost complete registration of deaths and relatively good information on causes of death. The Australian Bureau of Statistics (ABS) collates the central death database.

Coding of cause of death

The ABS codes the cause of death, using the ICD classification system.

In 1997 the ABS introduced multiple causes of death reporting and automatic coding of individual cases. The change from manual to automatic coding resulted in significant changes in the coding of the underlying causes of death. For example, while the number of pneumonia deaths has increased, the number of deaths due to dementia, Alzheimer's disease, cardiovascular diseases, cancers, chronic obstructive pulmonary disease and renal failure have decreased. In 1999, the ABS commenced coding death records according to the ICD-10 classification system resulting in changes to the interpretation and resultant coding of causes. Under ICD-10, reporting of asthma, hypertension and pneumonia deaths is decreased, whilst deaths due to Alzheimer's disease and dementia increased. The effect of this on Burden of Disease results is that there might be some changes in the distribution of causes of death that are a result of coding practice rather than changes in causes of death.

Ill-defined causes of death

Of the 10,624 WA deaths registered in 2000, 105 (less than 1%) were either ill-defined or had no code allocated. In addition, some deaths were coded to ill-defined categories of chapters. There were also some deaths allocated to codes that are known to be vague (for example, heart failure) and which have a high probability of belonging to specific categories.

All deaths with ill-defined codes were redistributed to specific codes. 'Ill-defined signs and symptoms' were redistributed proportionally by age and sex to all other non-injury disease groups. In addition, within-chapter ill-defined deaths were redistributed to groups within that chapter; for example, ill-defined malignancies were distributed across the different cancers. Some non-specific codes, for example, heart failure and gastric haemorrhage, were redistributed to specific disease groups. Where it was not determined whether injuries were accidental or intentional, 90% of such deaths over 15 years of age were allocated to suicide and 10% to accidental injury. In children, 90% were allocated to homicide. A proportion of renal failure and liver cancer deaths were re-allocated to their underlying causes. More detailed descriptions of how these and other ill-defined deaths were redistributed across disease group can be found elsewhere.[11]

Life Expectancy (LE)

In this report, life expectancy was calculated for single years using the abridged life table method with the highest age group set to 85 years and older. This differs from the ABS approach, which uses an unabridged life table and the age cut-off is 100 years. The ABS also calculates an aggregated life expectancy over a three-year period. This means that our LE results may differ from those published by the ABS. However, comparisons within the report are consistent and changes should reflect real trends.

Confidence intervals were calculated for life expectancy, using simulation methods in the @RISK software program.[19] Such statistical comparisons allow the ascertainment of whether changes are real or chance observations.

In order to calculate years of life lost, a reference standard (or ideal) life expectancy has to be selected. The method used to generate the results in this report is in accordance with the decision of the Australian Burden of Disease Steering Committee to use the 1996 Australian cohort life expectancy as the standard. If the standard is changed in the future, comparisons over time will require the recalculation of past estimates using the new standard.

Comparative data

Australian and WA mortality burden for 1996,[11] and Australian mortality burden for 2000 (calculated by WA Department of Health for this study) have been used for comparative purposes.

Regional analysis

The mortality burden was calculated for 10 WA regions, including three metropolitan and seven rural regions, whose boundaries were defined by the Health Department in 2002. Because of the small population sizes in these regions, the results are often based on small numbers of deaths and should be interpreted with caution.

Discounting

Discounting is a method whereby the value of a future benefit or loss is adjusted in order to estimate current value of the future benefit/loss. This adjusts future outcomes for society's preference for results to happen sooner rather than later.[20] Discounting of future benefits is standard practice in economic analysis, but rare in epidemiological and demographic analysis.[11]

The Global Burden of Disease methodology uses a discount rate of 3% (compounded), so that a year of healthy life gained in 10 years' time is worth 24% less than one gained at the current time.[11] A discount rate of 3% is considered low for economic analyses but is frequently used in health economic analysis.[11] Both discounted and undiscounted YLLs were calculated for the WA analysis. In this document, we report the discounted YLLs. Appendix Table 2 shows the influence of discounting on the YLL conversion factor.

Age weighting

A number of studies have indicated that in some societies a year lived by a young adult is valued more highly than a year lived by a young child or at older ages.[2] As a result, the global study weighted a year of healthy life lived at young ages and older ages lower than for other ages. All Australian studies, including the WA study, use uniform age weights so that a year of healthy life is valued equally at all ages.

Estimating burden attributable to risk factors

The calculation of the proportions of the burden of disease attributable to risk factors uses the population attributable fraction (PAF) method. The PAF is the proportion of the burden of a particular disease that could be avoided if a particular risk factor was absent in the population. The PAF is multiplied by the number of deaths or YLLs from a condition to obtain the number of deaths or YLLs that could have been avoided, had the risk factor been absent. For a given risk factor, the attributable burdens from all diseases known to be associated with it, are summed, giving the total burden attributable to that risk factor.

The PAF for a risk factor is based on the prevalence of the risk factor in the population (by age and sex) as well as the strength of association between the risk factor and the disease (as measured by the relative risk).[21] The risk factor prevalence rates for Western Australia used in this analysis were obtained from the results of the WA Health and Wellbeing Survey (2000) and the State-specific results of the AUSDIAB study (1999). Relative risk estimates, originally obtained from a review of the literature and from expert opinion, were sourced for this study from the Victoria study[13] and an AIHW report quantifying the drug-caused mortality and morbidity burden in Australia.[21] For some risk factors, for example, unsafe sex, estimated national PAFs were used that were not based on the WA prevalences. If the national PAFs are applied to the WA death data, then this is mentioned in the results section of those risk factors.

The risk factors selected for this study were based on those selected by the 1996 Australian and Victorian Burden of Disease studies.[11,13] They were selected on the basis of their strong relationship with diseases that contribute significantly to the disease burden in Australia, the availability of relative risks based on good quality international studies, and the availability of recent estimates of risk factor prevalence in the population. The full list of risk factors includes: alcohol, tobacco, physical inactivity, hypertension, overweight and obesity, insufficient intake of fruit and vegetables, high blood cholesterol, other drug abuse, occupation risks and unsafe sex.

The PAFs estimated in this study can thus be interpreted as the proportion of current disease burden attributable to current and past exposure to the selected risk factors. The methodology for calculating burden attributable to risk factors continues to develop and broaden. The range of risk factors for which attributable burden can be calculated is increasing.[11,12] The method used in this study does not allow the attributable burden to be aggregated over different risk factors. While this may be preferable, the current method does not adjust for the fact that many risk factors occur together and their effects may interact in complex ways. Methods are being developed to address this problem.[12]

Additionally, attempts are being made to address the time lag between current deaths and past exposures. The current method estimates the impact of risk factors on the incidence of disease and the deaths that occur in the year under examination. For some diseases, for example lung cancer, where there are long time lags between tobacco exposure and the disease incidence, the exposure 30 years prior must be estimated. Methods are also being developed to estimate the proportion of current disease burden that would be prevented in the future if exposure to the risk factor were eliminated.

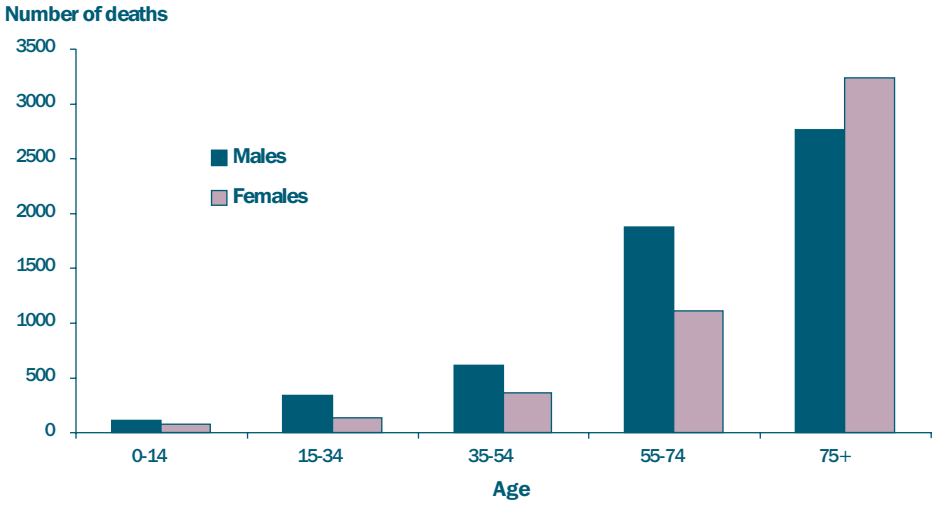
3. Results

3.1 Deaths

3.1.1 Number and age distribution of deaths

Of the 10,624 deaths registered for WA residents either in WA or out-of-state in 2000, 5,696 (53.6%) were male and 4,928 (46.4%) were female. Age was known for all but one death. The number of deaths increased with age, and male deaths were higher in all age groups except among people 75 years of age and older (Figure 2).

Figure 2: Deaths by age and sex, Western Australia, 2000



3.1.2 Leading causes of death

Table 2 lists the ten leading causes of death for WA in 2000. Ischaemic heart disease (IHD) was by far the most common cause of death for males and females, with more than one in five deaths being from this cause.

Stroke, colorectal cancer, lung cancer, type 2 diabetes and chronic obstructive pulmonary disease rank highly for both males and females. In females, the most common reproductive cancer resulting in death was breast cancer. Prostate cancer was the most common reproductive cancer for males. Road traffic accidents and suicide were common causes of death for males but not for females. Alzheimer's and other dementias had a higher relative ranking for females than for males.

Table 2: Ten leading causes of death, by sex in Western Australia, 2000

Males				Females			
	Cause	No of deaths	% of Total		Cause	No of deaths	% of Total
1	Ischaemic Heart Disease	1185	21	1	Ischaemic Heart Disease	1022	21
2	Lung cancer	442	8	2	Stroke	547	11
3	Stroke	380	7	3	Alzheimer's & other dementias	273	6
4	Colorectal cancer	244	4	4	Lung cancer	246	5
5	Chronic Obstructive Pulmonary Disease	228	4	5	Breast cancer	218	4
6	Prostate cancer	225	4	6	Colorectal cancer	204	4
7	Suicide	208	4	7	Chronic Obstructive Pulmonary Disease	162	3
8	Road traffic accidents	158	3	8	Type 2 Diabetes Mellitus	126	3
9	Type 2 Diabetes Mellitus	144	3	9	Lower respiratory tract infection	109	2
10	Alzheimer's & other dementias	139	2	10	Other cardiovascular disease	106	2

3.1.3 Life expectancy

WA compared to Australia

The profile of deaths translates into the life expectancies shown in Table 3. In 2000, on average, males at birth in WA could be expected to live for 77.1 years and females for 81.5 years. Since 1996, WA life expectancy at birth has increased by 1.9 years for men and 0.5 years for women. The 95% confidence intervals indicate that the increase in life expectancy at birth was statistically significant for men and of borderline significance for women. Compared to Australia, the increase in life expectancy at birth in WA was slightly higher for males, but slightly lower for females.

Since 1996, life expectancy at age 65 years increased by 1.1 years for males and 0.4 years for females in WA, so that in 2000 men of 65 years in WA could be expected to live an additional 17.0 years and women an additional 19.8 years. Both increases were statistically significant.

Table 3: Life expectancy at birth and age 65 years, by sex for Western Australia and Australia, 1996 and 2000

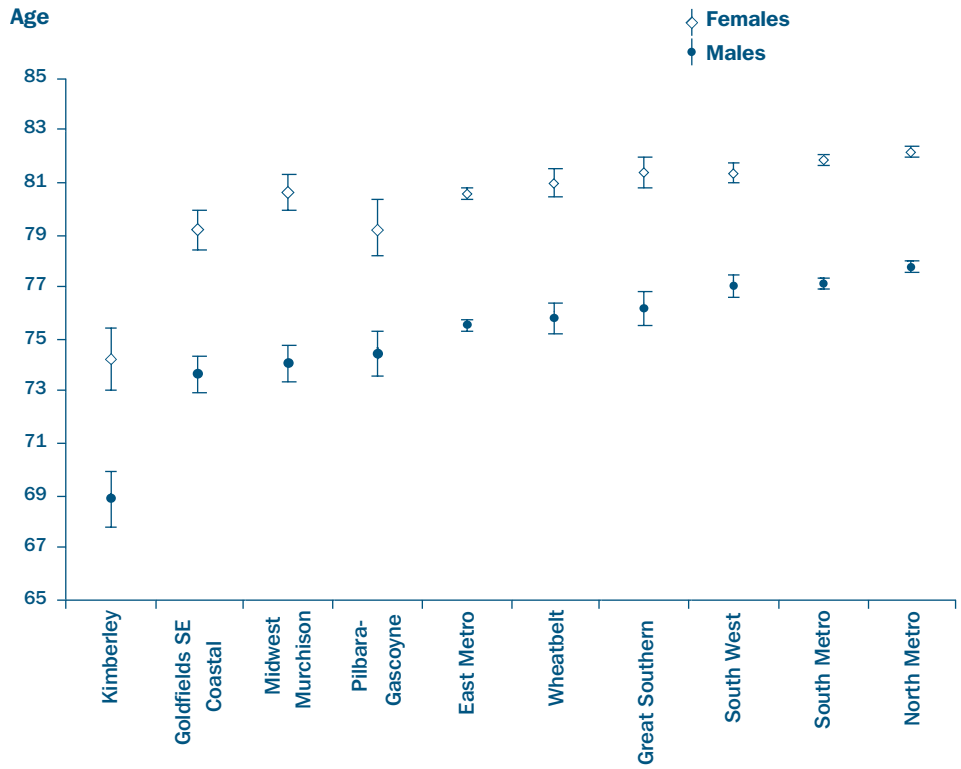
	WA						Australia					
	At birth	LCI	UCI	At 65 yrs	LCI	UCI	At birth	LCI	UCI	At 65 yrs	LCI	UCI
Males												
1996	75.2	75.0	75.5	15.9	15.7	16.3	75.2	75.2	75.3	15.8	15.7	15.8
2000	77.1	76.8	77.3	17.0	16.8	17.1	76.7	76.6	76.8	16.7	16.6	16.7
Females												
1996	81.0	80.7	81.2	19.4	19.2	19.5	80.4	80.3	80.4	18.8	18.7	18.8
2000	81.5	81.2	81.7	19.8	19.6	19.9	81.2	81.2	81.3	19.4	19.4	19.5

Source: ABS mortality database, Palisade @RISK software
LCI: Lower estimate of 95% confidence interval
UCI: Upper estimate of 95% confidence interval

WA Inter-regional comparison

Figure 3 shows the male and female life expectancy at birth (and their 95% confidence intervals) for the 10 WA regions for the years 1996–2000. North Metro male estimates are significantly higher and Kimberley estimates for males and females are significantly lower than all other regions. The substantial male–female differential remains true across all regions.

Figure 3: Life expectancy at birth, by sex and region for Western Australia: 1996–2000



3.2 Mortality burden: Years of life lost (YLL)

In 2000, premature mortality was responsible for 112,950 years of life lost, discounted at 3% per annum, with more years being lost by males than females. This represents a 4.2% decrease in YLL in WA since 1996 when the YLL was 117,990 and reflects the reduction in the risk of mortality in the population. Cardiovascular disease accounts for most of the reduction in burden, so that by 2000 cardiovascular disease accounted for 25% of the YLL in males (down from 28%) and 29% of YLL in females (down from 32%).

Numbers of WA deaths and YLL by age group, sex and disease grouping can be found in Appendix Tables 4 & 5. Data for each of the 10 WA regions are available by age, sex and broad disease group, (Appendix Table 6) although these will not be discussed here.

3.2.1 YLL by age, sex and broad disease groups

Figures 4(a) and 4(b) show the distribution of mortality burden by broad disease groups for WA males and females in 2000. Cardiovascular disease, cancers and injuries accounted for over 70% of the mortality burden in both men and women.

Figure 4(a): Mortality burden (YLL) by broad disease groups for males, Western Australia, 2000

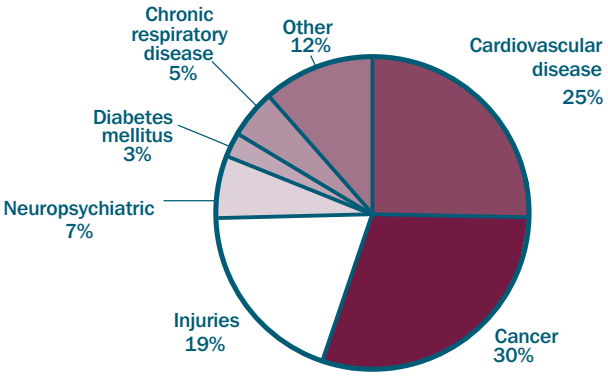
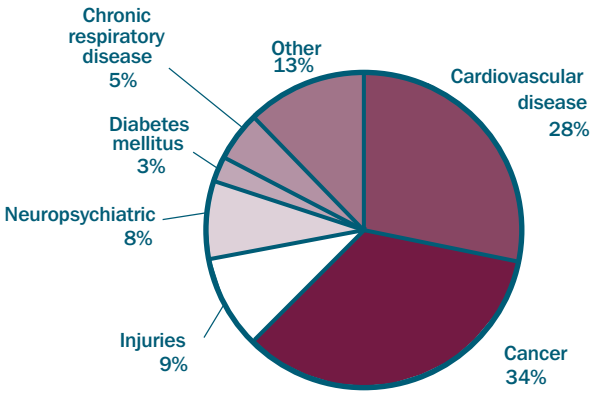


Figure 4(b): Mortality burden (YLL) by broad disease groups for females, Western Australia, 2000



As with deaths, the years of life lost increased with age (Figure 5). This is due to the larger number of deaths that occurred with increasing age although the contribution per death to YLL diminishes with age. Male YLLs were higher than that for females at all ages, except the 75-year and older age group. Injuries contributed the bulk of YLLs for children and young adults (the burden is particularly marked for males at these ages), while cardiovascular diseases accounted for over a third of the burden in the 75-year and older age group. Cancers were an important cause of mortality burden from 45 years for males and 35 years for females.

Figure 5(a): Years of life lost by age and broad disease group for males, Western Australia, 2000

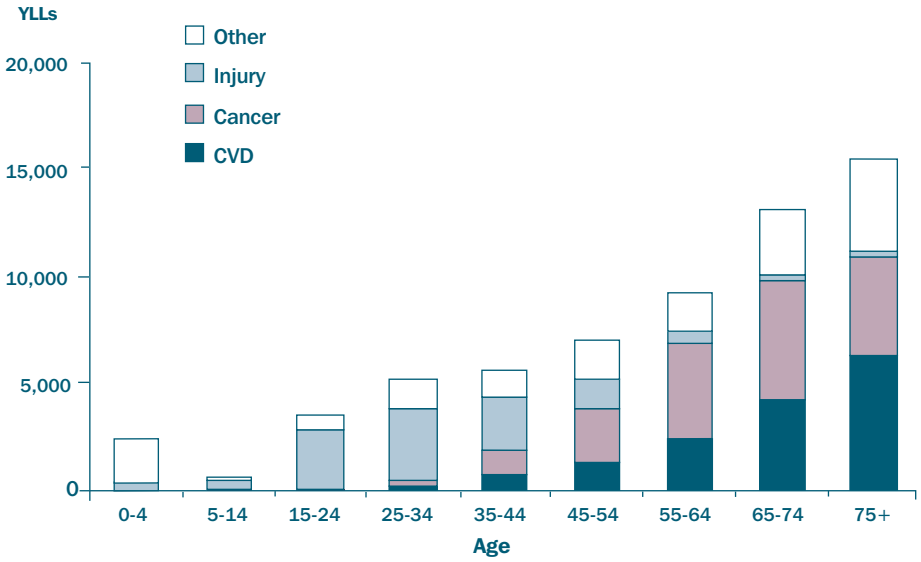
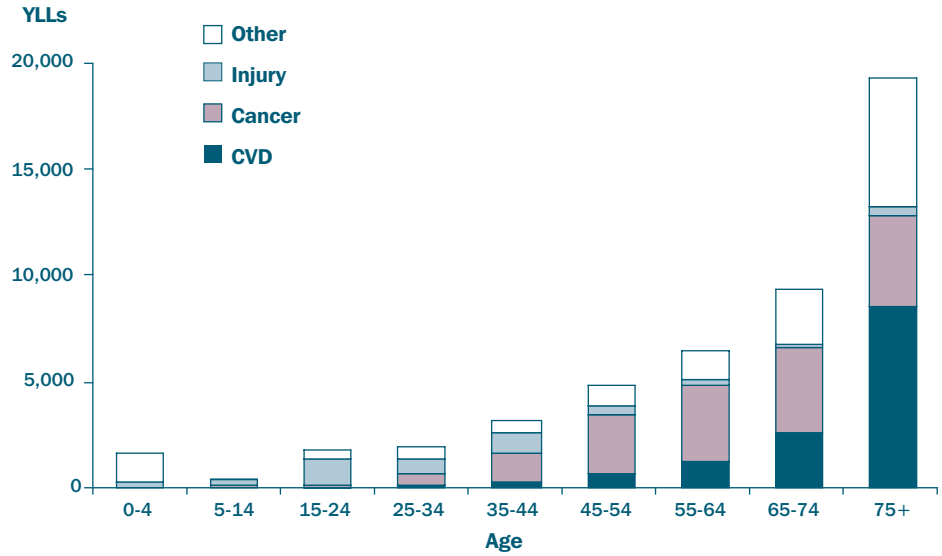


Figure 5(b): Years of life lost by age and broad disease group for females, Western Australia, 2000



3.2.2 Top twenty causes of years of life lost

As with deaths, IHD imparted the greatest burden in terms of YLL. For males, this was followed by suicide and self-inflicted injuries, lung cancer, road traffic accidents and stroke. For females, stroke, breast, lung and colorectal cancers imparted the next highest burden. Lower respiratory tract infection was the only infectious disease to reach the top 20 causes of disease burden (Table 4). Other drug dependence reached the top 10 conditions for males and the top 20 conditions for females, partly reflecting the allocation of accidental poisoning due to selected drugs as 'Other drug dependence and use,' a mental health category.

The category 'Other malignant neoplasms' was the eleventh leading cause of YLL for males. This is due to the fact that mesothelioma, a cancer that has a higher mortality in WA than nationally, accounts for almost two–thirds of the male deaths in this category.

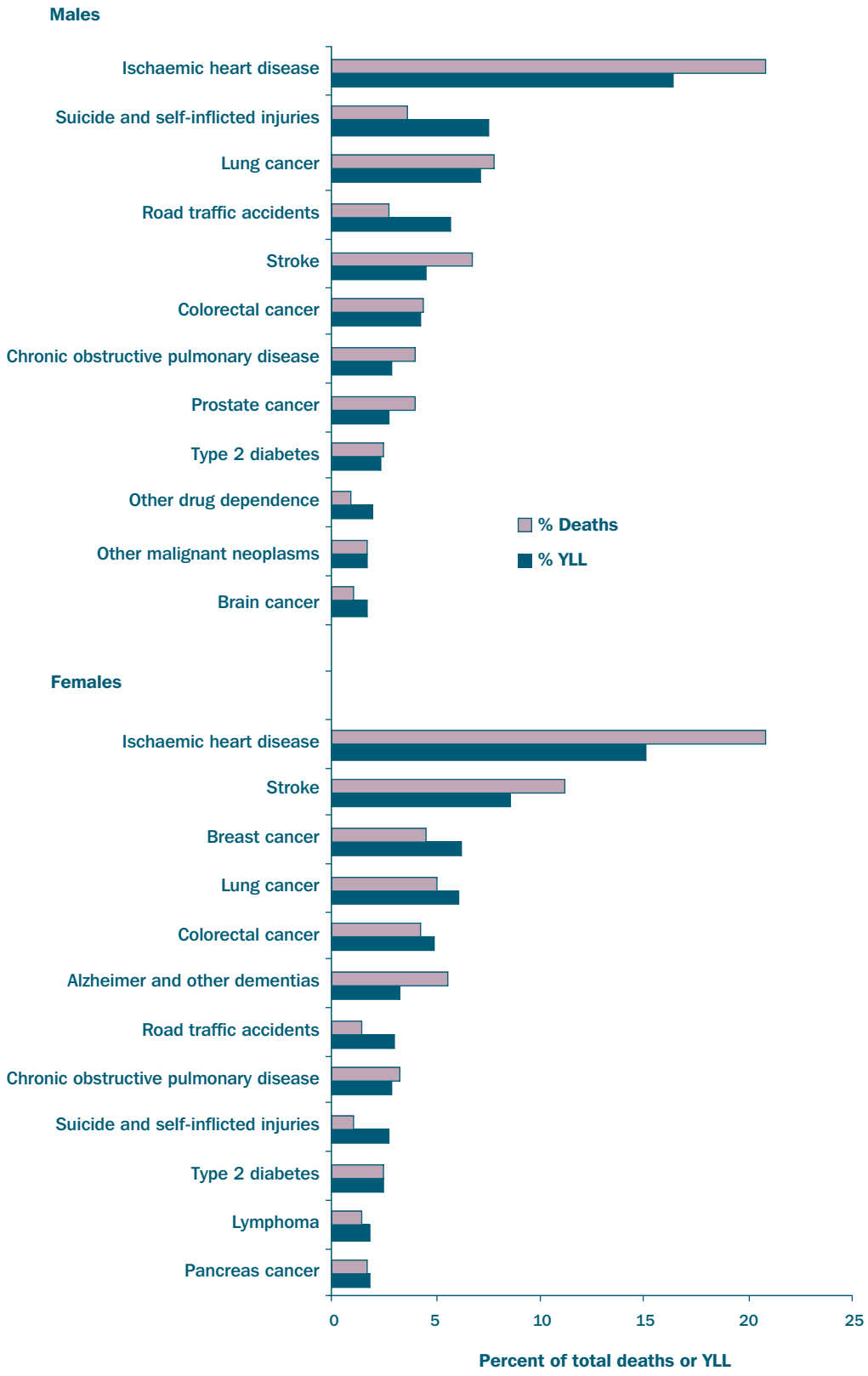
Besides IHD, the leading causes of male burden tended to be those affecting younger people. Females survive to older ages, which puts them at risk for diseases of old age such as stroke and dementia.

The percentage of burden by leading cause of death using deaths compared to YLLs (Figure 6), shows that conditions that affect older people, for example, IHD, stroke and dementia, are weighted less in YLLs compared to deaths.

Table 4: Top twenty causes of discounted mortality burden (YLL), by sex, Western Australia, 2000

	Males		Females		Persons	
1	Ischaemic heart disease	10,387	Ischaemic heart disease	7,403	Ischaemic heart disease	17,790
2	Suicide and self-inflicted injuries	4,772	Stroke	4,175	Lung cancer	7,499
3	Lung cancer	4,506	Breast cancer	3,019	Stroke	7,050
4	Road traffic accidents	3,590	Lung cancer	2,992	Suicide and self-inflicted injuries	6,163
5	Stroke	2,875	Colorectal cancer	2,392	Colorectal cancer	5,102
6	Colorectal cancer	2,711	Alzheimer and other dementias	1,596	Road traffic accidents	5,102
7	Chronic obstructive pulmonary disease	1,852	Road traffic accidents	1,512	Chronic obstructive pulmonary disease	3,262
8	Prostate cancer	1,740	Chronic obstructive pulmonary. disease	1,410	Breast cancer	3,037
9	Type 2 diabetes	1,502	Suicide and self-inflicted injuries	1,391	Type 2 diabetes	2,733
10	Other drug dependence and use	1,276	Type 2 diabetes	1,231	Alzheimer and other dementias	2,411
11	Other malignant neoplasms	1,083	Pancreas cancer	921	Other drug dependence and use	1,909
12	Brain cancer	1,066	Lymphoma	893	Other cardiovascular disease	1,900
13	Other cardiovascular disease	1,032	Other cardiovascular disease	868	Brain cancer	1,829
14	Leukaemia	993	Other chronic respiratory diseases	774	Prostate cancer	1,740
15	Stomach cancer	971	Brain cancer	763	Lymphoma	1,731
16	Cirrhosis of the liver	964	Ovary cancer	762	Pancreas cancer	1,691
17	Lower respiratory tract infections	915	Lower respiratory tract infections	724	Leukaemia	1,645
18	Lymphoma	838	Leukaemia	652	Other malignant neoplasms	1,643
19	Poisoning	831	Other drug dependence	632	Lower respiratory tract infections	1,640
20	Other chronic respiratory diseases	825	Other malignant neoplasms	560	Other chronic respiratory diseases	1,599

Figure 6: Leading causes of YLL and deaths, by sex, Western Australia, 2000



3.2.3 Age-standardised YLL rates (ASR YLL)

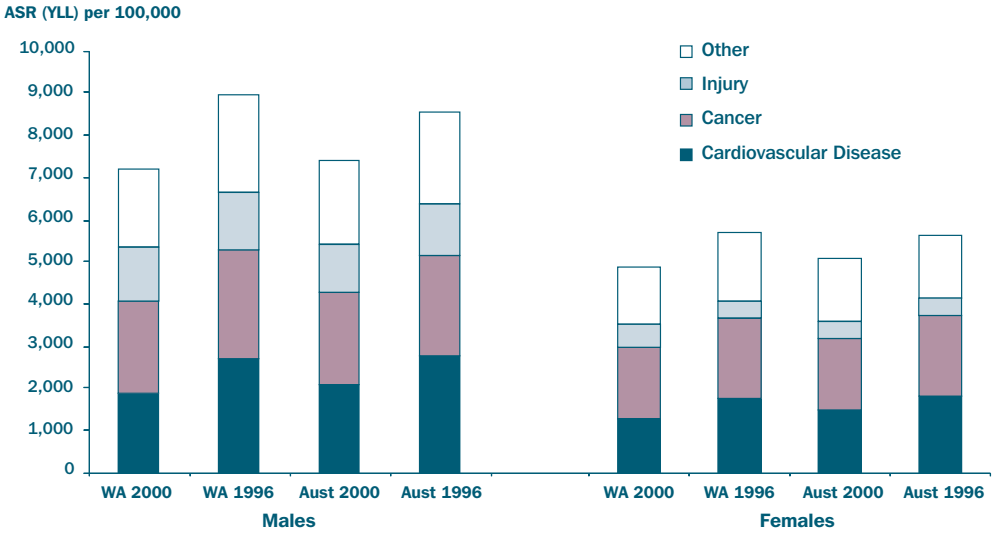
Figure 7 compares WA and Australian YLL age-standardised rates per 100,000 for 1996 and 2000, using the Australian 1991 population as the standard. In 1996, the WA ASR YLL was just above that for Australia. Results for 2000 show a substantial reduction in both national and WA ASR YLL, with the ASR YLL for WA being below that for Australia.

Male all-cause YLL rates decreased by 13% and 16% for Australia and WA respectively, while female rates decreased by just under 10% for both Australia and WA.

ASR YLL for all disease groups decreased except for the injury YLL rate, which increased among Australian (11%) and WA (19%) women. The greatest ASR YLL reduction was for cardiovascular diseases, where the male reduction (24% for WA) was greater than that for females (20% for WA). The national drop in ASR YLL for cancer was about the same (9%) for both sexes, while for WA the male reduction (13%) was greater than that for females (5%).

WA age-standardised YLL rates for more specific disease groupings can be found in Appendix Table 7.

Figure 7: Age–standardised years of life lost per 100,000, by sex, Western Australia and Australia, 1996 and 2000



3.2.4 WA regional age-standardised YLL rates

Overview

The analysis of the age–standardised regional mortality burden reflects the different epidemiological and demographic profiles of the regions across Western Australia.

As with WA as a whole, male age–standardised YLL rates were substantially higher than female rates across all regions and showed more variation across the State than female rates. (Figure 8 and Appendix Table 8)

In the Kimberley region the all-cause age–standardised mortality burden was considerably higher, with the female rate being higher than the male rates for most other regions. Midwest-Murchison, Goldfields and Pilbara-Gascoyne had the next highest age-standardised mortality burden, with the remaining regions showing less variation. North and South Metro experienced the lowest mortality rates for males and females.

The percentage distribution of age-standardised mortality burden across broad disease groups varied by WA region. Cancer accounted for between 25% and 33% of the male mortality burden in all regions except for the Kimberley region where it contributed only 17%. For females, cancer accounted for between 30.0% and 38.8% of the mortality burden in all regions except for the Kimberley (6.1%) and Pilbara-Gascoyne (17.1%).

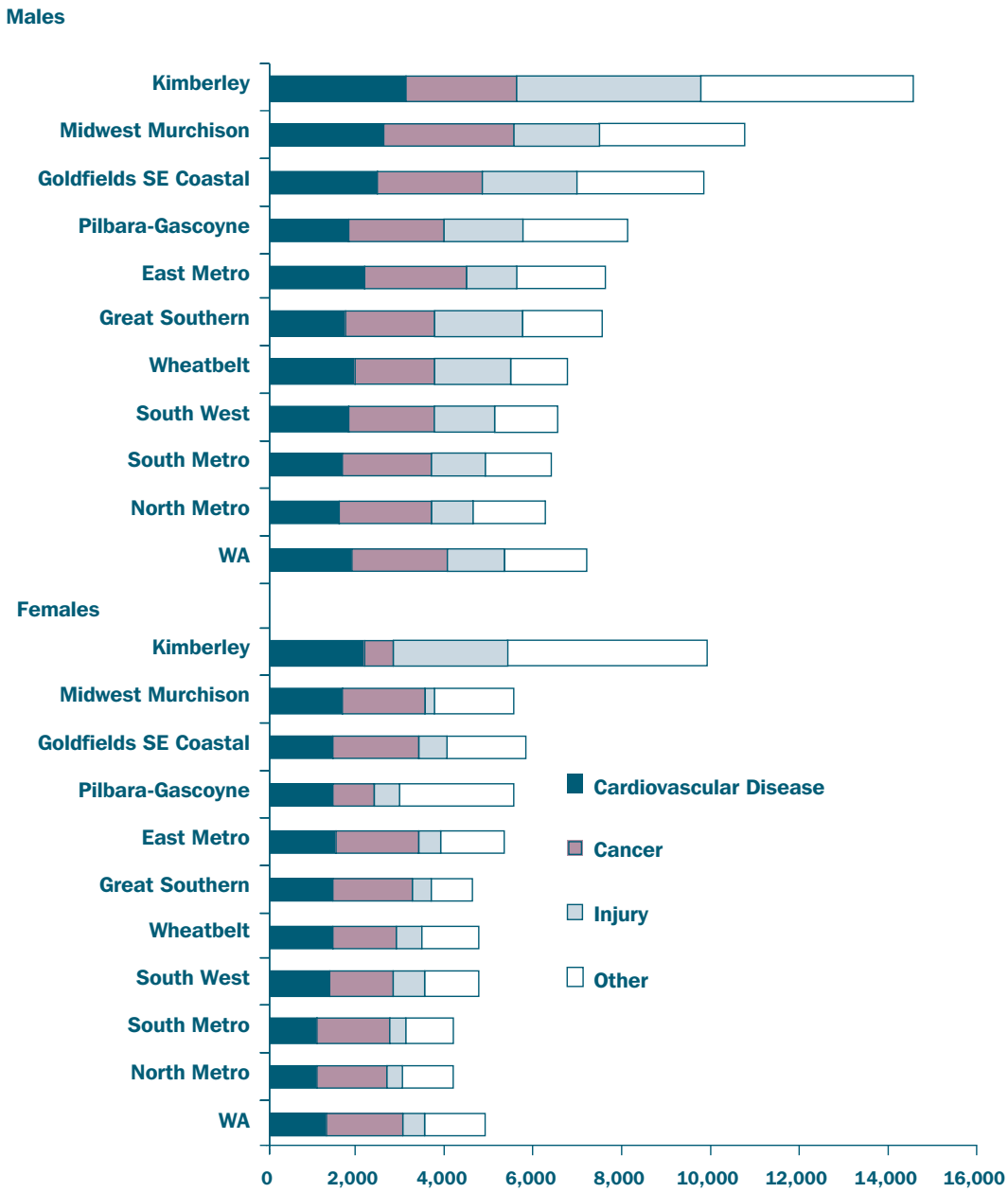
Injury accounted for between 21% and 29% of the male mortality burden in most non-metropolitan regions, but less than 20% for metropolitan regions. For females, injury accounted for between 8.8% and 15.7% for all regions. The exception was the percentage of Kimberley female injury mortality burden (26.4%), which was substantially higher than the ranges given above, being similar to the proportion for males in the region (28.8%).

Of the disease groups analysed, the percentage of age-standardised cardiovascular disease mortality burden showed the least variation across the regions. All remaining conditions were classified as 'other'. The percentage of the total regional age-standardised rates due to this group of diseases varied between 19.3% and 30.6% for males and 21.2% and 46.4% for females.

a) North Metro

Of all the WA regions, North Metro had the lowest all-cause age–standardised YLL rate for males and the second lowest rate for females. In addition, the rates for each of the broad disease groups were among the lowest in WA. As a proportion of its all-cause rate, cancers were a slightly higher proportion than those for WA as a whole.

Figure 8: Age–standardised years of life lost per 100,000, by sex and WA regions, 2000



b) South Metro

South Metro had the lowest all-cause age–standardised YLL rate for females and the second lowest rate for males. As a proportion of its all-cause rate, cancers were a slightly higher proportion and rates for conditions classified as 'other' a slightly lower proportion than those for WA as a whole.

c) East Metro

The East Metro mortality burden was different from that of the other regions in the metropolitan area. The all-cause male and female age–standardised YLL rates for East Metro were higher than those for the State. East Metro male rates were higher than State rates for cardiovascular disease and cancer, but lower for injury and 'other' diseases. East Metro female rates were higher for all broad disease groupings except for injuries. The percentage distribution of disease groupings was similar to those for the State.

d) South West

The mortality burden for the South West region was different from that of the other rural regions. South West had the third lowest all-cause age–standardised YLL rate in the State for males and the fourth lowest rate for females. However, male and female injury rates were higher for this region than those of the State. These elevated rates are reflected in the percentage distribution of mortality burden attributable to injury in the region. Female cardiovascular disease rates were also marginally higher than WA.

e) Wheatbelt

The all-cause age–standardised YLL rate for the Wheatbelt region was marginally below that of the State for males and females, and was the lowest of the rural, predominantly agricultural areas in WA. The percentage distribution of mortality burden attributable to the major disease groups was similar to that of the State for males, but the percentage of cardiovascular disease was higher and that of cancers was lower than the State for females.

f) Great Southern

In the Great Southern region, the male and female age–standardised YLL rates deviated from that of WA in different ways. The all-cause age–standardised YLL rate for the Great Southern region was above that of the State for males but below for females. The rates for cardiovascular disease and cancer were lower than the State for males but higher for females. The injury rate for males was substantially above that for the State, and accounted for over a quarter of the male all-cause YLL rate.

g) Pilbara-Gascoyne

The all-cause age–standardised YLL rate for the Pilbara-Gascoyne region was fourth highest in the State for males and third highest for females. Injury and 'other' disease rates for males and females were higher than those for the State as a whole, with the female rate for conditions classified as 'other' being almost double the State rate and constituting just under a half of the mortality burden in the region. Extremely high female rates of infectious and parasitic diseases, neonatal conditions, digestive diseases, genito-urinary diseases, diabetes mellitus and other endocrine diseases were responsible for the high rate of this large group of diseases. The cancer rate for females was substantially lower than that for the State.

h) Goldfields-South East Coastal

The all-cause age–standardised YLL rate for the Goldfields South East Coastal region was third highest in the State for males and second highest for females. The rates for all disease categories were higher than those for the State as a whole. Injury rates were two-thirds and one-third higher for males and females respectively, while male rates for cardiovascular

disease and conditions classified as 'other' were also substantially higher than those for the State. Extremely high male rates for acute respiratory infections, diabetes mellitus, other endocrine/metabolic diseases, mental conditions and genito-urinary diseases were responsible for the high rate of 'other' conditions.

i) Midwest-Murchison

Midwest-Murchison had the second highest all-cause age–standardised YLL rate for males and the fourth highest rate for females. The male rates for all disease groupings (especially conditions classified as 'other') were substantially higher than those for the State, while the female rates were higher in all but the injury rates, which were the lowest in the State by a substantial margin. Very high male rates of infectious and parasitic diseases, acute respiratory infections, neonatal conditions, diabetes mellitus, other endocrine diseases, chronic respiratory diseases, musculo-skeletal and genito-urinary diseases were responsible for the high rate of 'other' conditions.

j) Kimberley

The all-cause age–standardised YLL rates for the Kimberley region were the highest in the State for males and females by a large margin, being more than double the State rates. The female all-cause rate was similar to the other highest regional male rates.

The age–standardised YLL rates for injury were over 3 times and 5 times the State rate for males and females respectively, with the female injury rate being higher than all other male regional rates. Injury accounted for over a quarter of the burden of mortality in the region. The rates for 'other' diseases were more than twice and three times the corresponding State rates for males and females respectively.

Conditions classified as 'other' contributed about a third and just under half of the male and female mortality burden in the region. Rates of infectious and parasitic diseases, acute respiratory infections, neonatal conditions, diabetes mellitus, nervous system disorders, genito-urinary diseases and congenital abnormalities were extremely high in males and females. In females, musculo-skeletal disease rates were high, while in males, chronic respiratory diseases and digestive disease rates were very high relative to the State.

Female cancer rates were about a third of the State rate, contributing only 6% of the total female mortality burden in the region.

3.3 Mortality burden attributable to selected risk factors

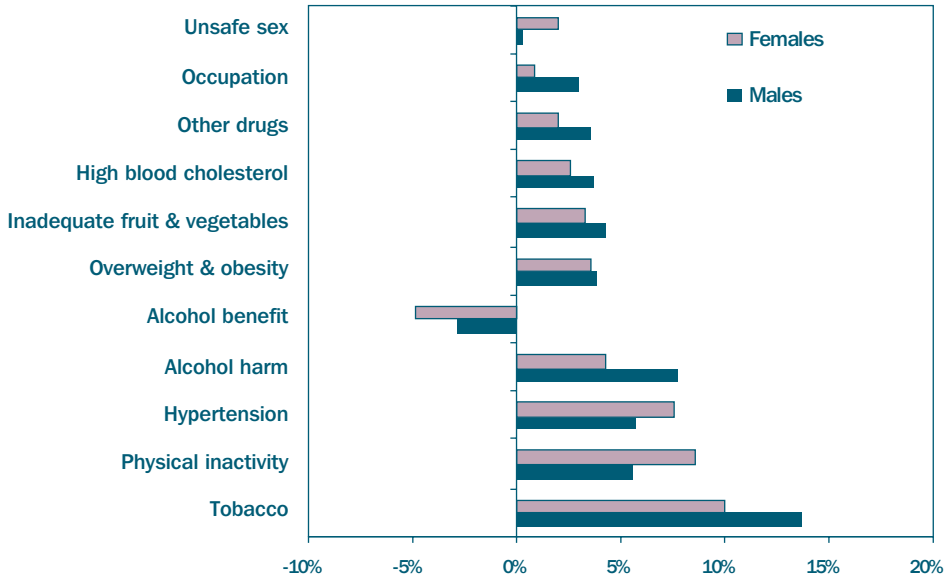
3.3.1 Overview of risk factors

This section provides an overview of all selected risk factors and is followed by more detailed results for each risk factor in turn.

Figure 9 summarises the proportion of mortality burden attributable to each of the risk factors. Tobacco, physical inactivity, hypertension and alcohol were responsible for the highest mortality burden across all age groups, with tobacco having the highest burden by a substantial margin for men.

Proportions of the mortality burden were higher for females in the cases of physical inactivity, hypertension and unsafe sex. The beneficial effect of alcohol was also higher for women. The burden of mortality was higher for men in all the other risk factors studied.

Figure 9: Proportion of YLL attributable to selected risk factors, all ages combined, by sex, Western Australia 2000



Figures 10 to 12 show how the distribution of mortality burden for the risk factors differs with age. While the profile of risk factor burden in the 45–64 year and 65 years and older age groups resemble the all-age distribution, that for the under 45 year age group is very different. In this younger age group, the harmful effects of alcohol and other drug use dominate the profile of mortality burden for men and women. The female mortality burden from unsafe sex is also significant in this age group.

Further disaggregation of the 0–44 year age group results shows that the 25–44 year age group profile is similar to that of the overall 0–44 year age group. For the 0–24 year age group, alcohol and other drug use are the only risk factors that contribute a substantial proportion of YLL, with the effect of tobacco on infant and child mortality also being evident.

Figure 10: Proportion of YLL attributable to selected risk factors, ages 0–44 years, by sex, Western Australia, 2000

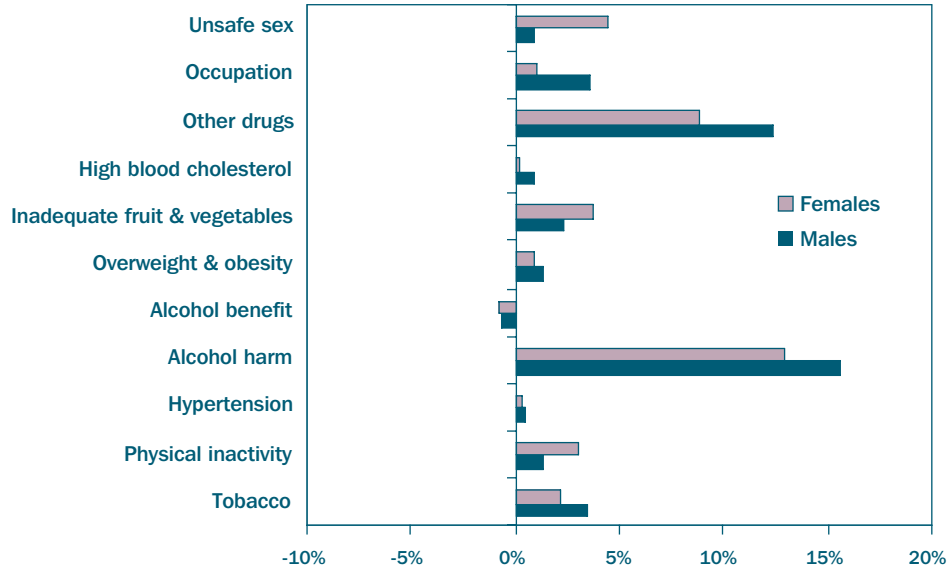
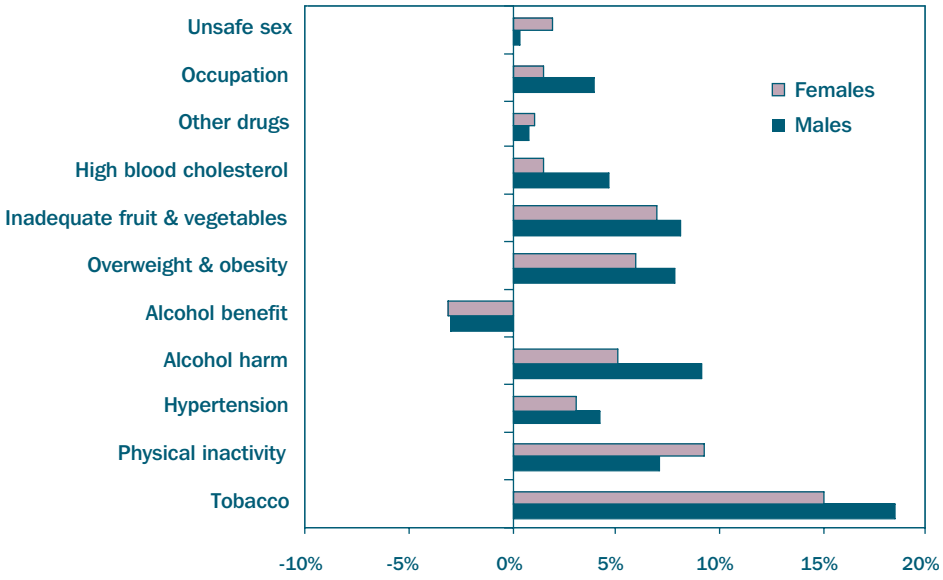
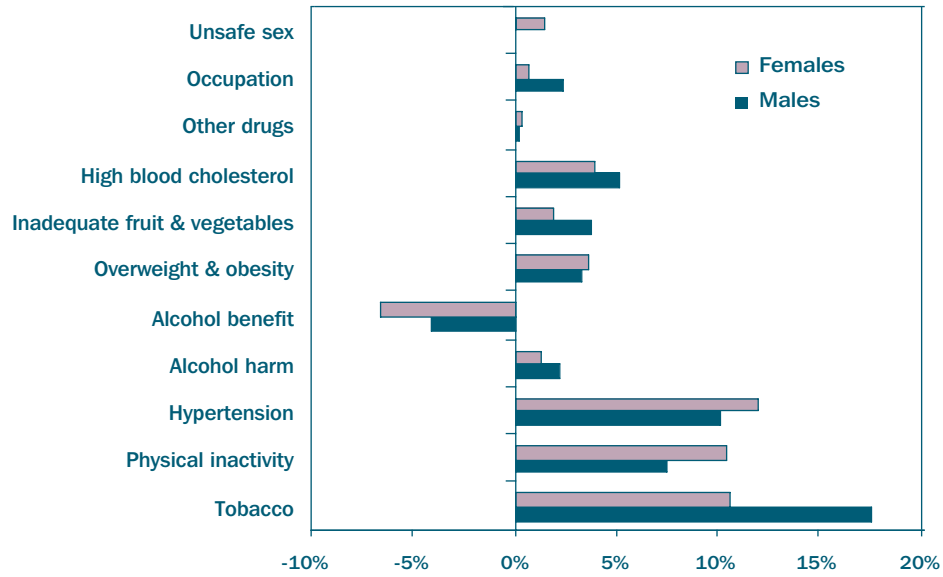


Figure 11: Proportion of YLL attributable to selected risk factors, ages 45–64 years by sex, Western Australia, 2000



Tobacco use and insufficient fruit and vegetable intake contribute larger mortality burdens in the 45–64 year age group than in other age groups. The burden of alcohol harm is much reduced by the age of 65 years and the benefits of alcohol are most marked at the age of 65 years and over. Unsafe sex remains a relatively high risk factor for women over all the age groups. For those women 65 years and over, the unsafe sex burden is mediated mainly through cervical cancer.

Figure 12: Proportion of YLL attributable to selected risk factors, aged 65 years and older by sex, Western Australia, 2000



This series of graphs shows the relative contribution of the studied risk factors overall, as well as in the different age groups. Table 5 presents the same data in a different format, highlighting the age groups most affected by particular risk factors. The findings are important in terms of policy development as well as the provision of public health messages to people of different ages.

Table 5: Proportion of YLLs attributable to selected risk factors by age and sex, Western Australia, 2000

	Males				Females			
	0-44 %	45-64 %	65+ %	All ages %	0-44 %	45-64 %	65+ %	All ages %
Tobacco	3.3	18.4	17.6	13.7	2.1	15.0	10.6	10.0
Physical inactivity	1.2	7.0	7.5	5.6	2.9	9.2	10.4	8.7
Hypertension	0.4	4.2	10.1	5.8	0.3	3.0	11.9	7.7
Alcohol harm	14.4	8.4	2.2	7.3	12.1	4.8	1.4	4.2
Alcohol benefit	-0.7	-3.0	-4.1	-2.9	-0.9	-3.2	-6.6	-4.8
Overweight & obesity	1.3	7.8	3.2	3.9	0.8	5.9	3.7	3.7
Inadequate fruit & vegetables	2.2	8.1	3.7	4.4	3.7	6.9	1.9	3.4
High blood cholesterol	0.8	4.6	5.1	3.8	0.2	1.4	3.9	2.6
Other drug use	12.3	0.6	0.2	3.7	8.7	1.1	0.3	2.1
Occupation	3.6	3.9	2.4	3.1	1.0	1.4	0.7	0.9
Unsafe sex	0.9	0.3	0.0	0.3	4.4	1.9	1.4	2.1

3.3.2 Tobacco

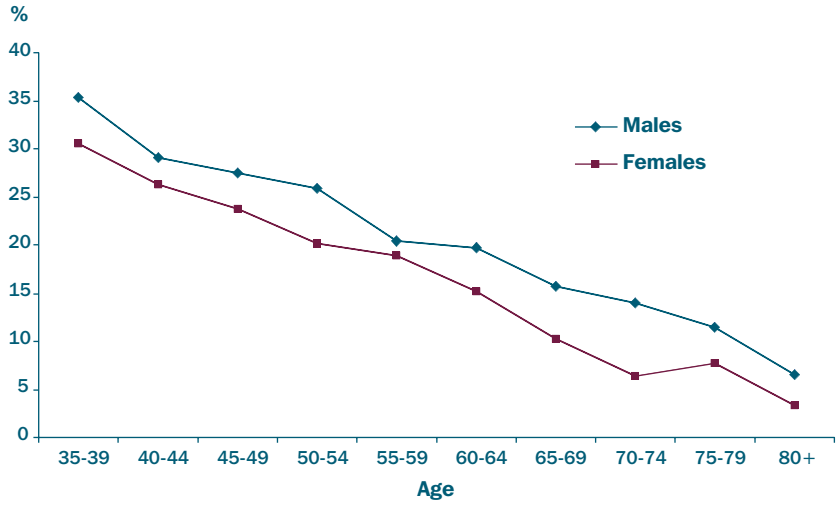
Of all the risk factors studied, tobacco was associated with the greatest mortality burden in Western Australia in 2000. It was responsible for 13,698 years of life lost (12.1% of the total) in the population.

A significant decrease in the prevalence of smoking among people 18 years and over has been demonstrated for WA and Australia as a whole since the 1970s. However, in recent years the rate of decline has slowed.[22]

There were no significant changes reported in the prevalence of smoking over the five-year period between 1995 and 2000.[23] Despite the proportion of current smokers in WA remaining steady over the past five years, the proportion of West Australians who have never smoked has declined, while the proportion of ex-smokers has increased.[23]

Figure 13 shows the pattern of current smoking in WA by sex for ages 35 years and over. The percentage of current smokers decreased with age and female rates were consistently lower than those for males over all ages.

Figure 13: Prevalence of current smoking, by age and sex, Western Australia, 2000



Source: 2000 Collaborative Health and Wellbeing Survey, Health Department of WA

The YLL attributable to tobacco was calculated using the general approach described in the methods section. However, the prevalence of current smoking is not relevant when calculating population attributable fractions (PAF) for conditions that are related to cumulative exposure to smoking, due to the long lead time for the development of these conditions. To accommodate this difficulty, past smoking prevalence was calculated using an alternative method for such conditions. This method uses the Smoking Impact Ratio based on the excess lung cancer rate calculated from past epidemiological studies.[24] For the other tobacco-related conditions, current prevalence information was used in the PAF calculation.

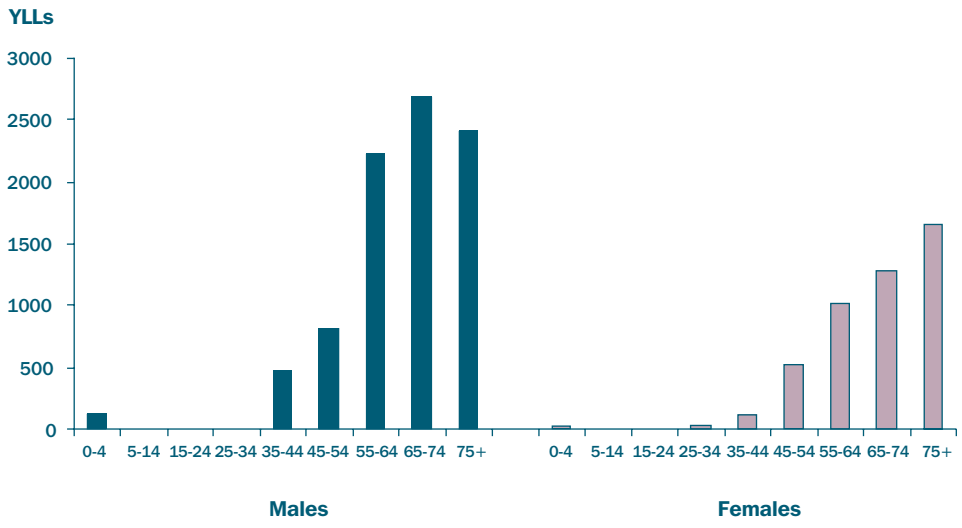
Table 6 lists all the conditions that are known to have an association with tobacco smoking, as well as the number of YLL associated with tobacco for that condition, by sex. Tobacco was responsible for a greater proportion of the male mortality burden (13.7%) than that for females (10.0%). Over three–quarters of the YLL attributed to smoking were from lung cancer, chronic obstructive pulmonary disease and ischaemic heart disease.

Table 6: Burden attributable to tobacco use for West Australians, 2000

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
Mouth cancer	28	320	0.5	8	107	0.2	0.4
Oesophagus cancer	23	227	0.4	11	106	0.2	0.3
Lung cancer	394	3894	6.1	193	2305	4.7	5.5
Larynx cancer	14	173	0.3	1	17	0.0	0.2
Pancreas cancer	16	152	0.2	19	192	0.4	0.3
Bladder cancer	21	163	0.3	11	75	0.2	0.2
Kidney cancer	25	234	0.4	12	118	0.2	0.3
Stomach cancer	12	111	0.2	5	44	0.1	0.1
Cervix cancer	0	0	0.0	6	65	0.1	0.1
Uterus cancer	0	0	0.0	-5	-52	-0.1	0.0
Chronic obstructive pulmonary disease	176	1396	2.2	124	1057	2.1	2.2
Ischaemic heart disease	122	1551	2.4	44	515	1.0	1.8
Stroke	30	332	0.5	25	313	0.6	0.6
Peripheral vascular disease	3	17	0.0	1	5	0.0	0.0
Lower respiratory tract infection	6	67	0.1	2	27	0.1	0.1
Parkinson's disease	-2	-16	0.0	-1	-4	0.0	0.0
Low birth weight	1	16	0.0	0	7	0.0	0.0
Sudden infant death syndrome	3	93	0.1	1	21	0.0	0.1
Fire injuries	1	11	0.0	0	9	0.0	0.0
Inflammatory bowel	1	15	0.0	1	7	0.0	0.0
Asthma	0	4	0.0	0	2	0.0	0.0
Otitis media	0	0	0.0	0	0	0.0	0.0
Vision disorders	0	0	0.0	0	0	0.0	0.0
Total	**872**	**8761**	**13.7**	**459**	**4937**	**10.0**	**12.1**

The mortality burden due to tobacco consumption increased with age, and was higher for males than females at all ages (Figure 14). The burden was highest among men in the 65–74 year age group but for women it peaked in the 75-years and older age group. Passive smoking was responsible for the years of life lost in children from conditions such as sudden infant death syndrome and low birth weight.

Figure 14: Mortality burden (YLL) due to tobacco consumption, by age and sex, Western Australia, 2000



3.3.3 Alcohol

Alcohol has a beneficial effect on some conditions but a harmful effect on others. The burden of mortality in Western Australia 2000 averted by alcohol intake was 3.7% of the total burden and almost two–thirds of the burden caused by alcohol consumption (5.9% of the total YLL). On the surface it may appear that more years of life are saved than lost from alcohol consumption and that there is a net benefit. However, this interpretation does not take into account that the YLL profiles for alcohol harm and benefit differ substantially for different age groups and differ according to whether alcohol intake is at levels imparting low risk or hazardous/harmful risk.[26]

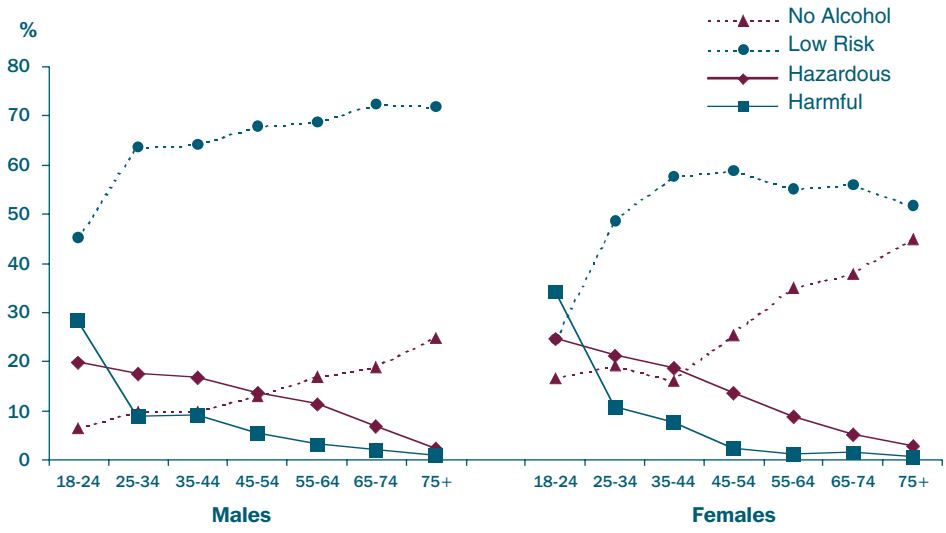
The consumption of alcohol in terms of absolute alcohol per person aged 15 years and older in WA decreased from 11.25 litres in the 1988–89 financial year to 10.40 litres in the 1997–98 financial year. The reduction in the total quantity of alcohol consumed in Australia since the 1970s has been attributed to consumption of more low-alcohol beer and less beer overall.[22,25]

In 2000, over 27% of Western Australians reported drinking over the recommended NHMRC guidelines of two standard drinks for women and four standard drinks for men on a usual drinking day.[23]

Figure 15 shows the prevalence of different alcohol drinking patterns, by age and sex for WA 2000 based on the WA Health and Wellbeing Survey (2000). Abstinence increased with age, and was higher for women than men especially after the age of 44 years. From the age of 25 years, low risk drinking was the most common drinking pattern for females and (especially) males. Low risk drinking increased with age for men, but decreased for females after 45 years when the prevalence of abstinence increased.

Harmful and hazardous drinking decreased with age for males and females, with a substantial decrease in harmful drinking after the age of 25 years. Due to differences in the NHMRC recommended levels of alcohol consumption for men and women, female harmful drinking rates were higher than those for males until the age of 34 years. Hazardous drinking was higher for females until the age of 44 years.

Figure 15: Prevalence of alcohol intake, by age and sex, Western Australia, 2000



Source: 2000 Collaborative Health and Wellbeing Survey, Health Department of WA

Table 7 lists separately all the conditions in the study that were considered to have a positive or negative relationship with alcohol consumption. The conditions on which alcohol has a beneficial effect include IHD (which is the leading cause of mortality for both men and women) and other cardiovascular diseases. These conditions affect mainly people over the age of 45 years. The beneficial effect is higher in women (4.8% of total YLL) than men (2.9% of total YLL).

The conditions on which alcohol has a harmful effect include a number of cancers, some cardiovascular diseases, specific alcohol–related conditions and injuries. Alcohol harm can be attributed to 7.3% of all male YLL and 4.2% of all female YLL. Accidental and non-accidental injuries and poisoning accounted for over half the YLL due to harmful effects of alcohol in males and about a quarter of that in women.

Table 7: Burden attributable to alcohol use by sex, Western Australia, 2000

Alcohol Benefit

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
Hypertension	0	0	0.0	-7	-50	-0.1	0.0
IHD	-191	-1715	-2.7	-115	-866	-1.8	-2.3
Stroke	-13	-92	-0.1	-187	-1419	-2.9	-1.3
Gallstones	-2	-12	0.0	-1	-5	0.0	0.0
Total	**-206**	**-1819**	**-2.9**	**-310**	**-2340**	**-4.8**	**-3.7**

Alcohol Harm

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
Mouth/pharynx cancer	19	252	0.4	4	62	0.1	0.3
Oesophagus cancer	20	214	0.3	8	89	0.2	0.3
Liver cancer	6	83	0.1	3	32	0.1	0.1
Larynx cancer	10	136	0.2	1	25	0.1	0.1
Breast cancer	0	0	0.0	23	364	0.7	0.3
Hypertension	3	28	0.0	1	13	0.0	0.0
Stroke	23	248	0.4	12	221	0.4	0.4
Cirrhosis	36	576	0.9	17	250	0.5	0.7
Suicide	32	771	1.2	10	266	0.5	0.9
Alcohol dependence	23	424	0.7	7	121	0.2	0.5
Pancreatitis	2	23	0.0	2	22	0.0	0.0
Road Traffic Accidents	47	1144	1.8	9	253	0.5	1.2
Falls	12	161	0.3	3	24	0.0	0.2
Fires	1	22	0.0	1	17	0.0	0.0
Drowning	7	144	0.2	2	48	0.1	0.2
Violence	9	219	0.3	8	185	0.4	0.4
Occupational	0	3	0.0	0	2	0.0	0.0
Inflammatory heart disease	4	51	0.1	1	19	0.0	0.1
Poisoning	4	101	0.2	1	21	0.0	0.1
Suffocation and inhalation	1	30	0.0	1	8	0.0	0.0
Total	**259**	**4628**	**7.3**	**115**	**2043**	**4.2**	**5.9**

The age distribution of harmful/hazardous drinking (mainly in young adults) coupled with the conditions listed above (disproportionately affecting young adults) resulted in the harmful effects of alcohol being experienced mainly by younger people, particularly males. This is illustrated in Figure 16, which contrasts the distribution of YLL resulting from the harmful and beneficial effects of alcohol, by age and sex. The opposite was true of the YLL resulting from the beneficial effects of alcohol, particularly for women, where the beneficial effect was substantial at ages over 75 years.

In Western Australian males, the burden of disease averted by alcohol consumption was lower than that caused by alcohol consumption. However, the opposite was true for females. For both men and women, the mortality burden was experienced mostly at younger ages while the beneficial effects were most evident in older ages.

Figure 16: The burden of disease and injury attributable to the harmful and beneficial effects of alcohol, by age and sex, Western Australia, 2000

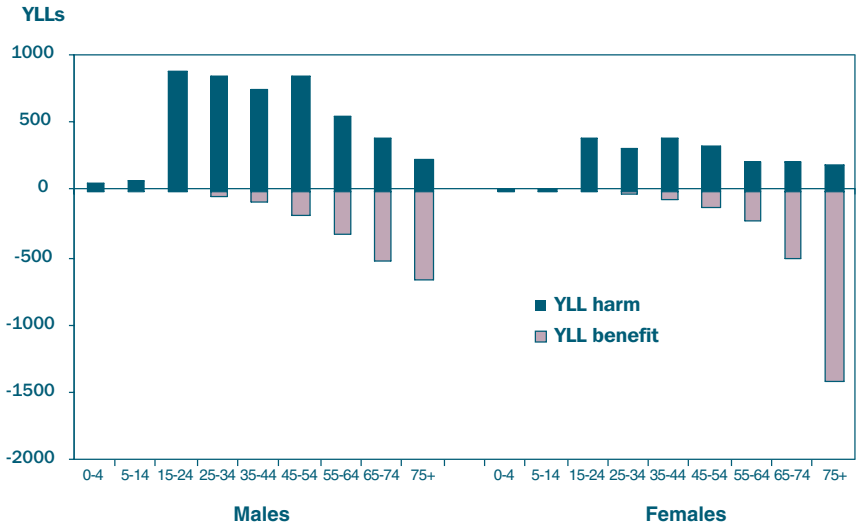
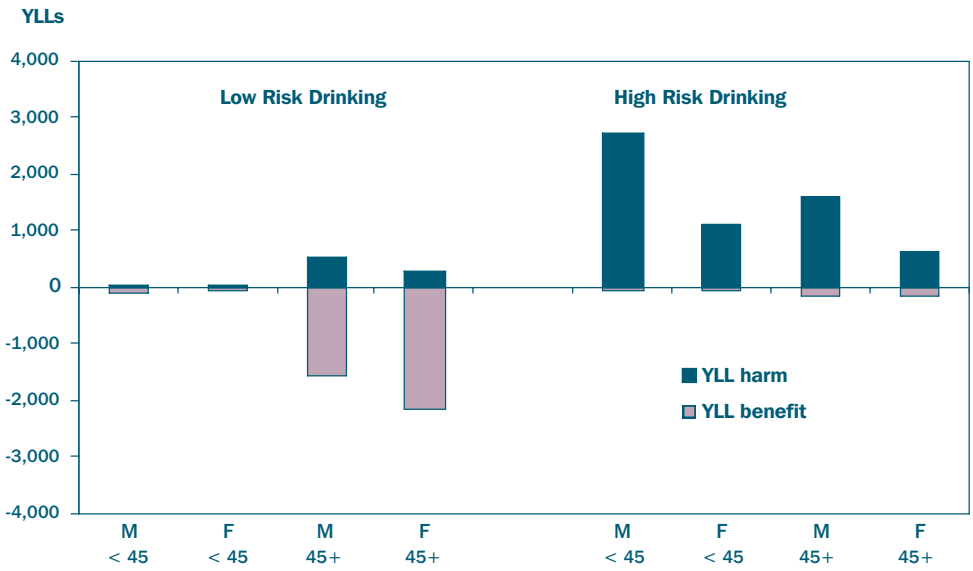


Figure 17 illustrates the effects of low risk drinking on the one hand and high risk (hazardous and harmful) drinking on the other. In the under 45 year age group, low risk drinking has minimal harm or benefit. However, high risk drinking imparts substantial burden in this age group and minimal benefit. In the older age group, low risk drinking has a substantial benefit, offset by a relatively small burden. High risk drinking, on the other hand, has minimal benefit and a relatively high burden.

Figure 17: The burden of disease and injury attributable to the harmful and beneficial effects of low–risk and high–risk alcoholic drinking, by age and sex, Western Australia, 2000.



3.3.4 Other drug use

The burden of mortality attributable to drug use other than alcohol and tobacco accounted for 3.0% of the total YLL. The proportion of total burden was almost twice as high for men (3.7%) compared to women (2.1%).

An accurate estimate of the prevalence of other drug use is difficult to obtain due to the low prevalence and the fact that many of the drugs are illegal. Whatever information is available is for Australia as a whole, and the evidence shows usage peaks in the 20–29 year age group with a substantial reduction in use thereafter.[11] Male rates were higher than those for women.

The WA burden of mortality due to other drug use was calculated using PAFs obtained from a recent publication.[21] The conditions that were considered as being related to other drug use included those for which drugs were the direct cause of death, as well as some conditions for which drug use is a risk factor.

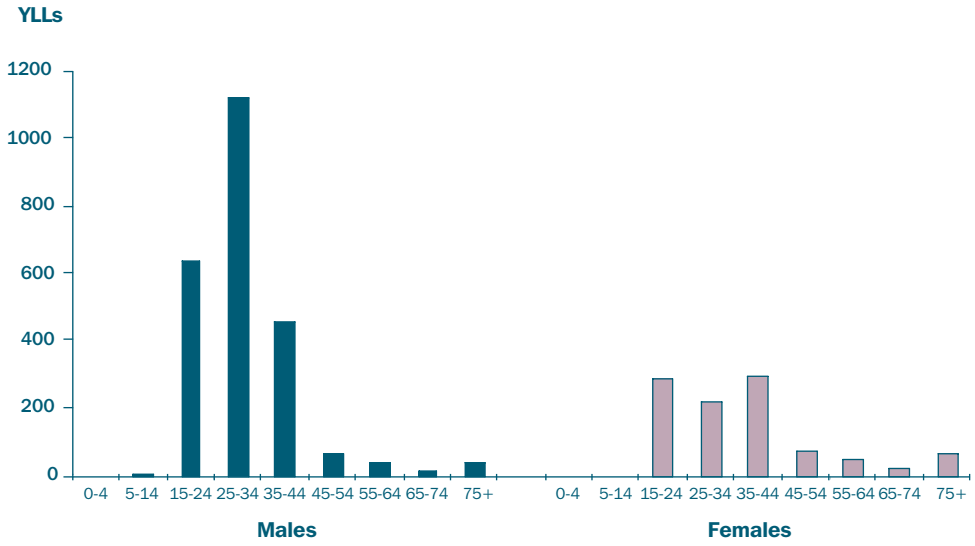
Table 8 lists the conditions and attributable YLL from each group of conditions. The biggest burden of drug use other than alcohol and tobacco in WA was as a result of 'other drug dependence and use', which was 2.0% of all male and 1.3% of all female mortality burden. This category includes drug-dependence mental health codes as well as accidental poisoning in the 15 years and over age groups due to the use of a range of licit and illicit drugs (ICD-10 codes X41 and X42) where the drug type was not specifically coded.

Table 8: Burden attributable to drug abuse other than alcohol and tobacco by sex, Western Australia, 2000

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
HIV/AIDS	0	2	0.0	0	5	0.0	0.0
Hepatitis B	0	5	0.0	1	27	0.1	0.0
Hepatitis C	4	43	0.1	3	32	0.1	0.1
Low birth weight	0	1	0.0	0	1	0.0	0.0
Heroin dependence and use	11	254	0.4	4	125	0.3	0.3
Benzodiazepine dependence and use	2	58	0.1	1	19	0.0	0.1
Cannabis dependence and use	1	28	0.0	0	0	0.0	0.0
Other drug dependence and use	53	1276	2.0	32	632	1.3	1.7
Inflammatory heart disease	0	1	0.0	0	0	0.0	0.0
Poisoning	17	436	0.7	3	84	0.2	0.5
Suicide and self-inflicted injuries	11	279	0.4	3	84	0.2	0.3
Total	**99**	**2383**	**3.7**	**48**	**1010**	**2.1**	**3.0**

YLL due to drug use other than alcohol and tobacco occurred mainly in people under the age of 45 years, with males peaking in the 25–34 year age group and females in the 15–24 year age group. The YLL were substantially higher among men compared to women (Figure 18).

Figure 18: Attributable burden (YLL) of other drug use, by age and sex, Western Australia, 2000

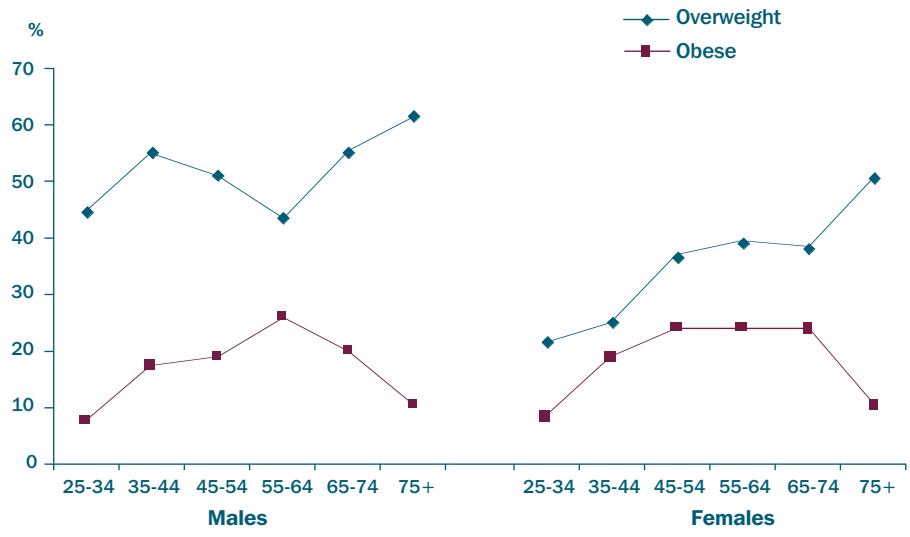


3.3.5 Overweight and obesity

Body mass is measured through the Body Mass Index (BMI) which is the weight of the person over the square of the height. Obesity (BMI>=30) differs from overweight (BMI=25–29.9).[27] There is evidence from a range of surveys that overweight and obesity states are increasing Australia-wide and in WA.[11,22,28] Based on self-reported information, the WA Health and Wellbeing Survey (2000) estimated that the proportion of men overweight or obese in 1995 increased by 9% in 2000 compared with a 5% increase in women over the same period.

Figure 19 illustrates the distribution of overweight with age. Obesity initially increased with age and then decreased after age 55–64 years for men and after age 65–74 years for women (AUSDIAB 2000, WA data). Weight loss is common in older people, including healthy older people and people with wasting disease. Life expectancy among obese people also tends to be lower.

Figure 19: Prevalence of overweight and obesity, by age and sex, Western Australia, 2000



Source: AUSDIAB 2000, International Diabetes Institute

The prevalence of overweight status was higher for males than for females at all ages. Overweight status among WA women increased with age, especially after the age of 35 years and then again after the age of 75 years. Male overweight prevalence had an initial peak at age 35–44 years after which it decreased. It increased steadily again from the age of 55–64 years.

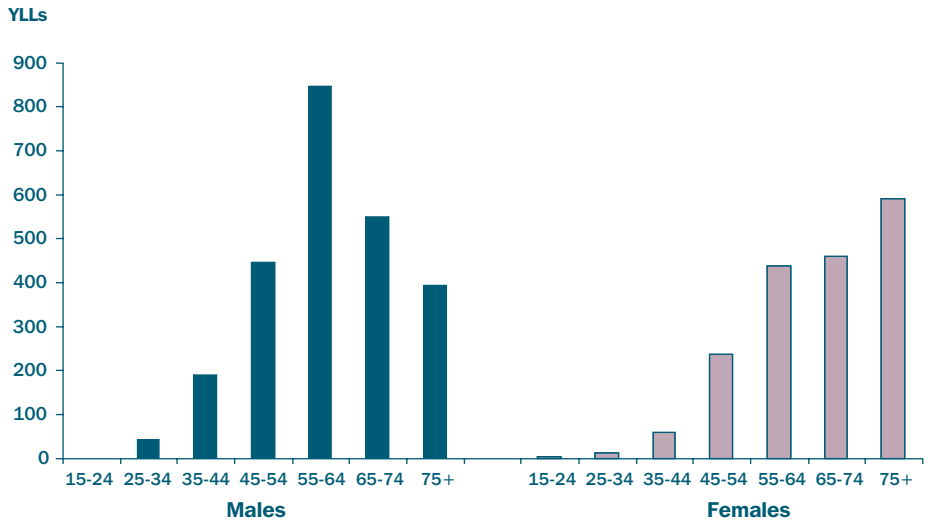
Being overweight or obese is a risk factor for a range of conditions including ischaemic heart disease (IHD), hypertension, some cancers, non-insulin dependent diabetes mellitus (NIDDM) and some orthopaedic problems (Table 9). Overweight and obesity accounted for 3.8% of all mortality burden, with the proportions of male and female totals being similar. IHD, NIDDM and colorectal cancer accounted for over 80% of the mortality burden attributable to being overweight or obese.

Table 9: Mortality burden attributable to overweight and obesity by sex, Western Australia, 2000

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
IHD	77	1097	1.7	43	504	1.0	1.4
Ischaemic stroke	8	91	0.1	13	124	0.3	0.2
Colo-rectal cancer	37	419	0.7	28	329	0.7	0.7
Gall bladder disease	3	22	0.0	2	11	0.0	0.0
Hypertension	19	149	0.2	23	162	0.3	0.3
NIDDM	64	687	1.1	52	520	1.1	1.1
Osteoarthritis	1	5	0.0	1	9	0.0	0.0
Back problems (including slipped disc)	0	0	0.0	0	0	0.0	0.0
Endometrium cancer	0	0	0.0	3	36	0.1	0.0
Kidney cancer	0	0	0.0	2	20	0.0	0.0
Post-menopausal breast cancer	0	0	0.0	7	86	0.2	0.1
Total	**209**	**2470**	**3.9**	**173**	**1801**	**3.7**	**3.8**

The mortality burden started in the 15–24 year age group and increased substantially for men until the 55–64 year age group after which it decreased (Figure 20). The burden for women increased fairly steadily with age, with the highest burden being in the 75-year and older age group. Until the age of 65–74 years the mortality burden from obesity was higher for males than females. Thereafter, the mortality burden from obesity for females was higher.

Figure 20: Mortality burden (YLL) attributable to overweight and obesity, by age and sex, Western Australia, 2000

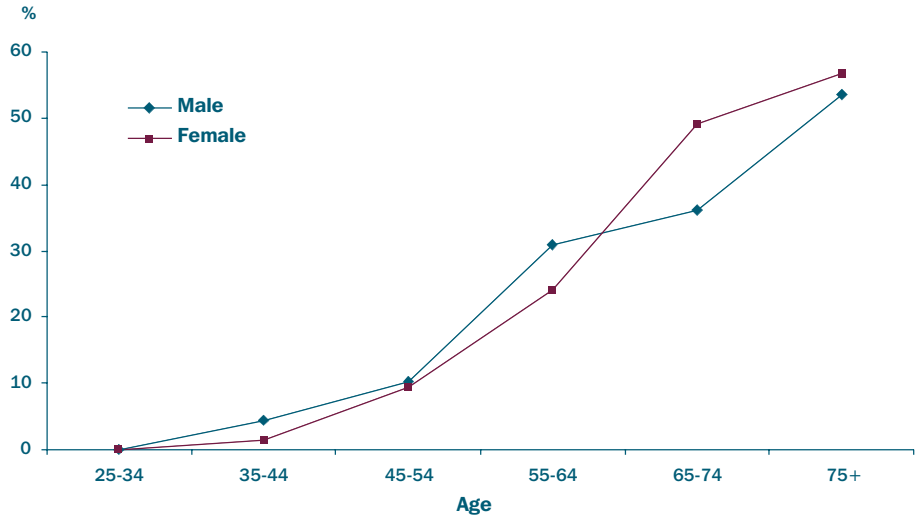


3.3.6 Hypertension

Hypertension is an important physiological risk factor for cardiovascular disease and is associated with other risk factors, including obesity, diabetes and high cholesterol.[11] It accounted for 6.6% of the mortality burden in WA in 2000, the third highest proportion of burden attributable to a risk factor.

In this study hypertension is defined as a blood pressure ≥160 mmHg and/or diastolic blood pressure ≥95 mmHg. There is evidence that the average systolic and diastolic blood pressure of the Australian and West Australian populations decreased significantly in the 1980s across all age groups.[22] In 2000, the prevalence of hypertension in WA was 13.6% for males and 14.6% for females, with less than 60% of those having controlled hypertension.[28] Figure 21 shows the increase of hypertension with age. Female prevalence was below male prevalence until the age of 55–64 years, after which it was higher.

Figure 21: Prevalence of hypertension, by age and sex, Western Australia, 2000



Source: AUSDIAB 2000, International Diabetes Institute

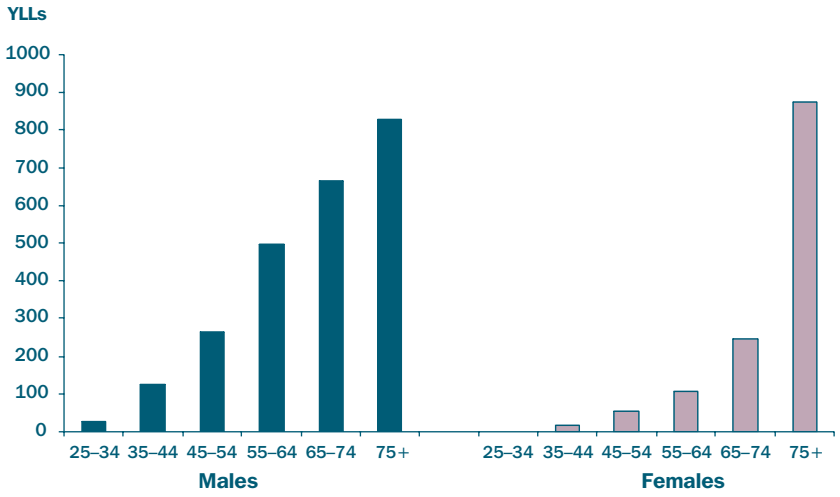
Table 10 shows the YLL contribution of different hypertension-related diseases to the total burden attributable to hypertension. Ischaemic heart disease and stroke accounted for 86% of the hypertension burden. The proportion of total mortality burden due to hypertension was higher among females than males.

Table 10: Mortality burden attributable to high blood pressure by sex, Western Australia, 2000

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
Hypertensive Heart Disease	48	345	0.5	70	468	1.0	0.7
Ischaemic Heart Disease	254	2043	3.2	287	1991	4.1	3.6
Stroke	165	1158	1.8	170	1193	2.4	2.1
Hypertensive Renal Disease	13	114	0.2	8	75	0.2	0.2
Peripheral Arterial Disease	5	30	0.0	9	49	0.1	0.1
Total	**485**	**3690**	**5.8**	**545**	**3776**	**7.7**	**6.6**

The mortality burden attributable to hypertension increased with age and was higher for males below 75 years but higher for females thereafter (Figure 22). The hypertension mortality burden was substantial for women over the age of 75 years.

Figure 22: Mortality burden (YLL) attributable to hypertension, by age and sex, Western Australia, 2000



3.3.7 High blood cholesterol

High blood cholesterol was associated with 3.3% of the total YLL in WA in 2000.

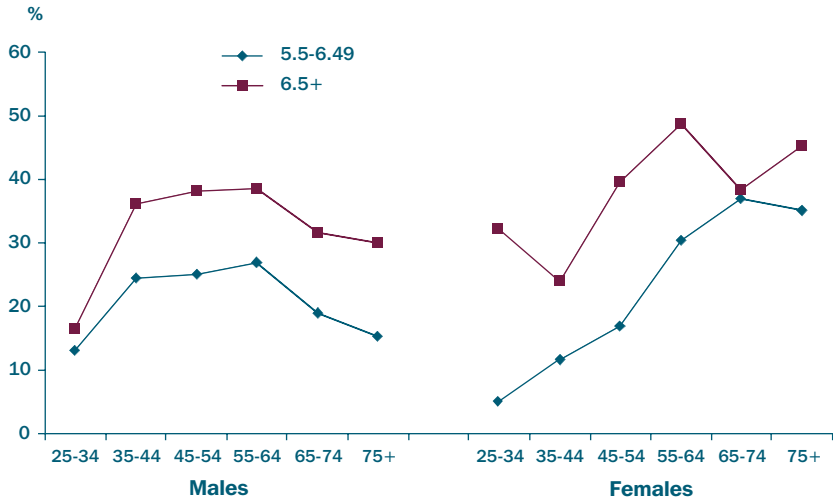
Blood lipid levels reflect genetic background but are modified by diet, obesity and other lifestyle factors. Total cholesterol levels are a crude but consistent measure of cardiovascular disease risk, particularly for coronary heart disease.[28] There is strong evidence that total blood cholesterol levels of above 5.5 mmol/l impart increased risk of developing coronary heart disease and the risk increases at levels above 6.5 mmol/l.[11]

Despite the increasing awareness of the importance of lipid control, there has been no evidence of a reduction in the prevalence of elevated cholesterol levels since the early 1980s.[28]

Figure 23 shows the estimated prevalence of high total cholesterol in the 2000 WA population. Over half the population of WA over the age of 25 years (52% males; 53% females) had elevated total blood cholesterol levels, with men having a greater prevalence of moderately high levels and women having greater prevalence of high risk levels. Men had higher prevalence of high total blood cholesterol in the middle ages (35-54 years). Female prevalences were substantially higher than those for males in the less than 35 years and the 55 years and over age groups.

For both males and females, cholesterol prevalence went up with age until about the age of 64 years, after which prevalence reduced.

Figure 23: Prevalence of high cholesterol, by age and sex, Western Australia, 2000



Source: AUSDIAB 2000, International Diabetes Institute

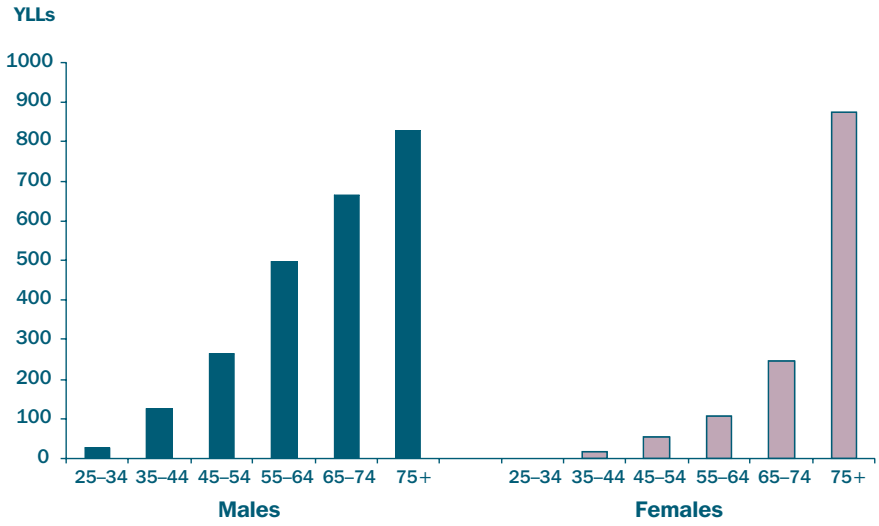
Ischaemic heart disease (IHD) and peripheral arterial disease (PAD) are the two conditions that were included as being partly attributable to high total blood cholesterol. Almost all the YLLs attributable to high cholesterol were due to IHD (Table 11). The proportion of total burden attributable to blood cholesterol was greater for males than for females.

Table 11: Mortality burden attributable to high total blood cholesterol by sex, Western Australia, 2000

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
IHD	261	2374	3.7	180	1276	2.6	3.2
PAD	5	29	0.05	3	17	0.03	0.04
Total	**266**	**2403**	**3.8**	**183**	**1293**	**2.6**	**3.3**

The increase in YLL by age was linear for males but exponential for females, so that the majority of the mortality burden for males occurred below the age of 75 years while the opposite was true for females (Figure 24).

Figure 24: Mortality burden (YLL) attributable to high total blood cholesterol, by age and sex, Western Australia, 2000

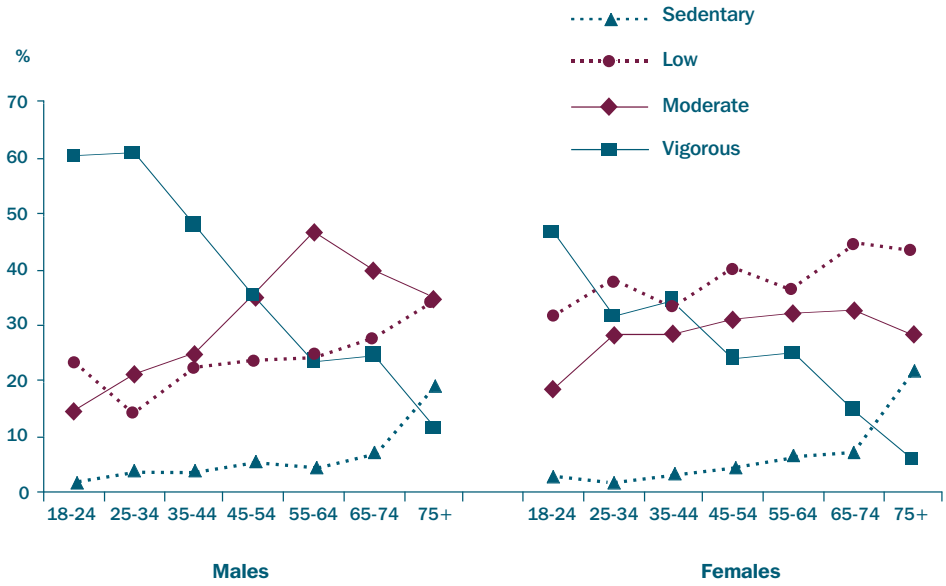


3.3.8 Physical inactivity

Insufficient physical activity was associated with the second greatest mortality burden in WA in 2000, being responsible for 6.9% of the total years of life lost.

There is increasing evidence that a moderate amount of physical activity has a positive impact on health. Physical activity levels have declined in Australia in recent years, and it is probable that the increase in obesity is associated with a reduction in physical activity during this period.[28] Information from the WA Health and Wellbeing Survey (2000) shows that females had a higher prevalence of insufficient (sedentary and low) levels of physical activity compared to males at all ages (Figure 25). Sedentary and low levels increased with age. Vigorous physical activity reduced most dramatically with age, especially for men where prevalence was high in the under-35 age group.

Figure 25: Physical activity levels, by age and sex, Western Australia, 2000



Source: 2000 Collaborative Health and Wellbeing Survey, Health Department of WA

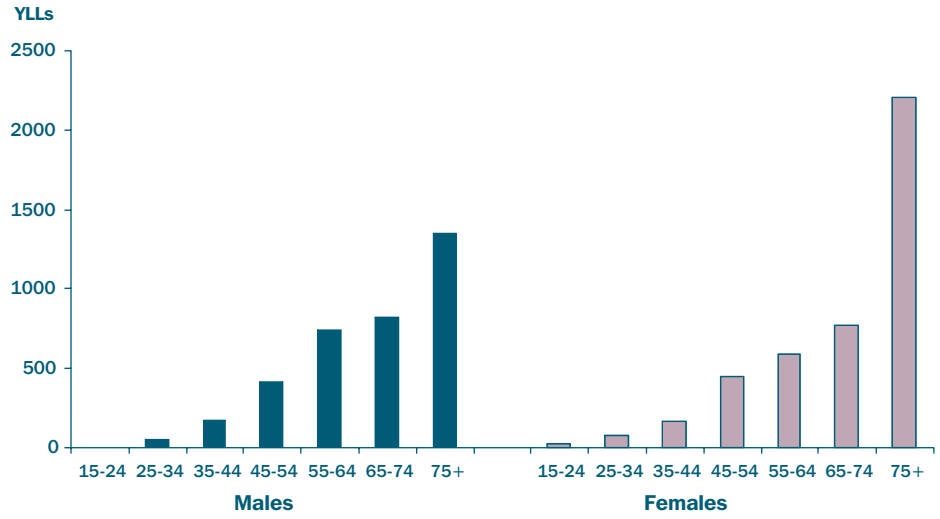
Table 12 lists the conditions that are known to have an association with physical inactivity, as well as the number of YLL associated with physical inactivity for each condition, by sex. Physical inactivity was responsible for a greater proportion of mortality burden for females (8.7%) than for males (5.6%). Ischaemic heart disease and stroke accounted for about two–thirds of the mortality burden attributable to physical inactivity, while colorectal cancer contributed a further 17% to this burden.

Table 12: Mortality burden attributable to insufficient physical activity by sex, Western Australia, 2000

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
Colorectal cancer	65	677	1.1	64	713	1.4	1.2
Breast cancer	0	3	0.0	50	652	1.3	0.6
Hypertension	7	54	0.1	12	84	0.2	0.1
IHD	223	2001	3.1	209	1527	3.1	3.1
Stroke	76	567	0.9	135	1041	2.1	1.4
Type 2 diabetes mellitus	10	104	0.2	11	112	0.2	0.2
Falls	16	149	0.2	29	158	0.3	0.3
Depression	0	0	0.0	0	1	0.0	0.0
Total	**398**	**3555**	**5.6**	**510**	**4289**	**8.7**	**6.9**

The burden due to physical inactivity increased with age, and was higher in males than females under 75 years but substantially higher in females 75 years and over (Figure 26).

Figure 26: Mortality burden (YLL) attributable to insufficient physical activity, by age and sex, Western Australia, 2000



3.3.9 Unsafe sex

The mortality burden attributed to unsafe sex was 1.1% of the total mortality burden. The proportion of female burden attributed to unsafe sex was 7 times higher than the male proportion, mainly due to cervical cancer.

The method used in this report follows that used in the Australian and Victorian studies. They adapted the method used by Berkley (1998) to estimate the global burden of disease attributable to unsafe sex.[29] Rather than using the prevalence of unsafe sex, an attributable fractions approach was used for selected causes. All the burden of sexually transmitted diseases was attributed to unsafe sex, as well as 97% of male burden and 71% of female burden for HIV/AIDS (based on the 1996 proportion of incident cases due to sexual transmission). Fractions of hepatitis B and hepatitis C burden that were attributed to sexual transmission were derived from surveillance reports of the National Centre for HIV Epidemiology and Clinical Research and the Australian Hepatitis C Surveillance Strategy. Ninety–three per cent of terminations in Australia were assumed to be for unwanted pregnancies[30] and 90% of cervical cancers were estimated to be attributable to sexual transmission of the human papilloma virus.[29]

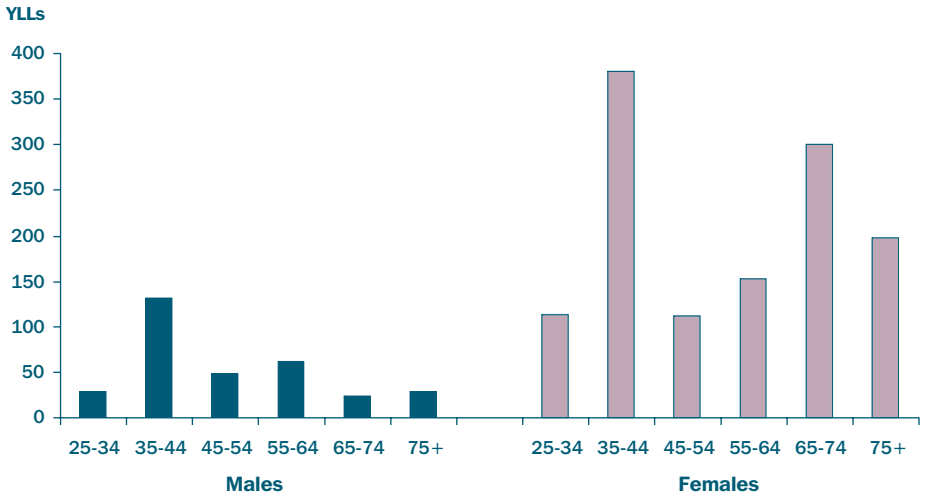
Cervical cancer accounted for 77% of the total YLL due to unsafe sex, while HIV/AIDS accounted for a further 17% of the total (Table 13). The relatively low mortality burden from HIV/AIDS compared to 1996 figures is because the incidence has decreased and life expectancy has increased for people with AIDS due to the introduction of more effective drug therapy.

Male YLL due to unsafe sex was lower than that for females at all ages. Male YLL peaked at 35–44 years while the distribution of female YLL was bipolar, peaking at 35–44 years and again at 65–74 years (Figure 27).

Table 13: Mortality burden attributable to unsafe sex, by sex, Western Australia, 2000

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
STDs (not HIV/AIDS)	0	0	0.0	0	0	0.0	0.0
HIV/AIDS	9	197	0.3	1	18	0.0	0.2
Hepatitis B	1	9	0.0	2	45	0.1	0.0
Hepatitis C	1	8	0.0	1	6	0.0	0.0
Maternal conditions	0	0	0.0	0	0	0.0	0.0
Abortion	0	0	0.0	0	0	0.0	0.0
Cervical cancer	0	0	0.0	31	956	1.9	0.8
Total	**10**	**213**	**0.3**	**34**	**1025**	**2.1**	**1.1**

Figure 27: Mortality burden (YLL) attributable to unsafe sex, by age and sex, Western Australia, 2000



3.3.10 Insufficient fruit and vegetable intake

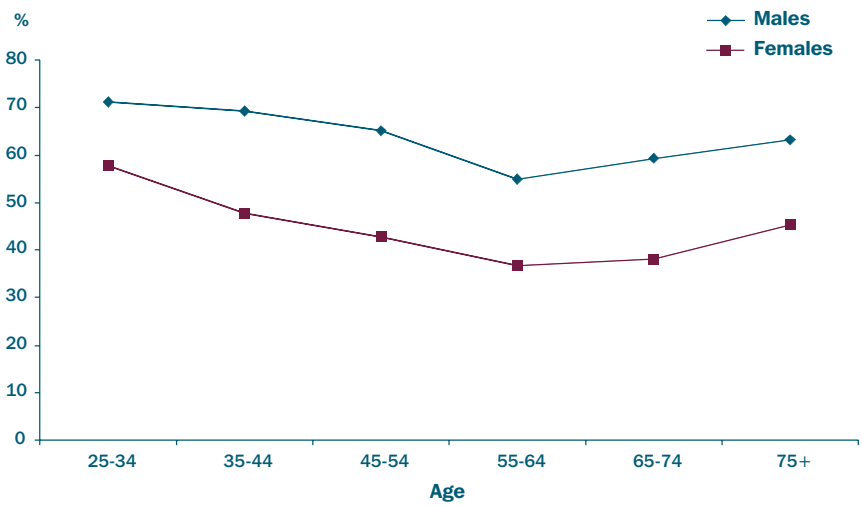
The Australian Dietary Guidelines promote a low fat, low salt, moderate sugar diet that is high in fruit, vegetables and cereal foods for the whole population with high iron and calcium content foods for young people and women.[31] Because of the complexity of dietary intake and the lack of data for all dietary components, it was not possible to do a risk factor analysis for diet as a whole. On the basis of work done in New Zealand,[32] one component, namely fruit and vegetables, was selected for analysis.

There is increasing evidence that fresh fruit and vegetables offer protection against many cancers and coronary heart disease.[11] Based on the definition that consumption is insufficient if less than 5 servings of fruit and/or vegetables is consumed per day, 4% of the mortality burden in WA 2000 was attributable to insufficient fruit and vegetable intake. This can be considered to be a conservative estimate as the number of diseases considered in the analysis (cancers, IHD and stroke) was limited.

Male prevalence of self-reported insufficient fruit and vegetable intake was greater than that for women at all ages over 25 years for WA in 2000 (Figure 28). For both sexes, insufficient intake decreased until the age of 64 years, after which it increased.

Table 14 shows that all cancers combined contributed 80% of the mortality burden due to insufficient fruit and vegetable intake in WA, while the remainder was contributed by IHD and stroke. Insufficient fruit and vegetable intake accounted for a higher proportion of total mortality burden for males than females.

Figure 28: Prevalence of inadequate fruit and vegetable intake, by age and sex, Western Australia, 2000



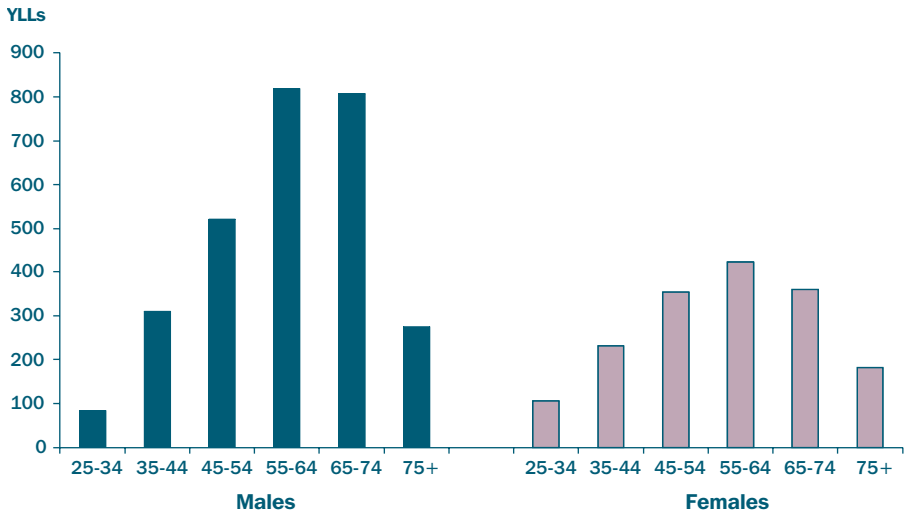
Source: 2000 Collaborative Health and Wellbeing Survey, Health Department of WA

Table 14: Mortality burden attributable to inadequate fruit and vegetable intake, by sex, Western Australia, 2000

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
All cancers	176	2200	3.5	96	1445	2.9	3.2
IHD	35	516	0.8	8	129	0.3	0.6
Stroke	7	100	0.2	5	87	0.2	0.2
Total	**218**	**2815**	**4.4**	**109**	**1661**	**3.4**	**4.0**

Male YLL due to insufficient fruit and vegetable intake was higher than that for females at all ages except 25–34 years. The highest burden was in the 55 to 74 year age groups (Figure 29).

Figure 29: Mortality burden (YLL) attributable to insufficient fruit and vegetable intake, by age and sex, Western Australia, 2000



3.3.11 Occupational exposures and risks

The burden of mortality attributable to occupational exposures and risks accounted for 2.1% of the total YLL for WA in 2000.

As for the 1996 Australian burden of disease study, population attributable fractions were obtained from an Australian coroner's report-based study of occupational injury mortality and a study of occupational exposures causing cancers and other chronic diseases.[11]

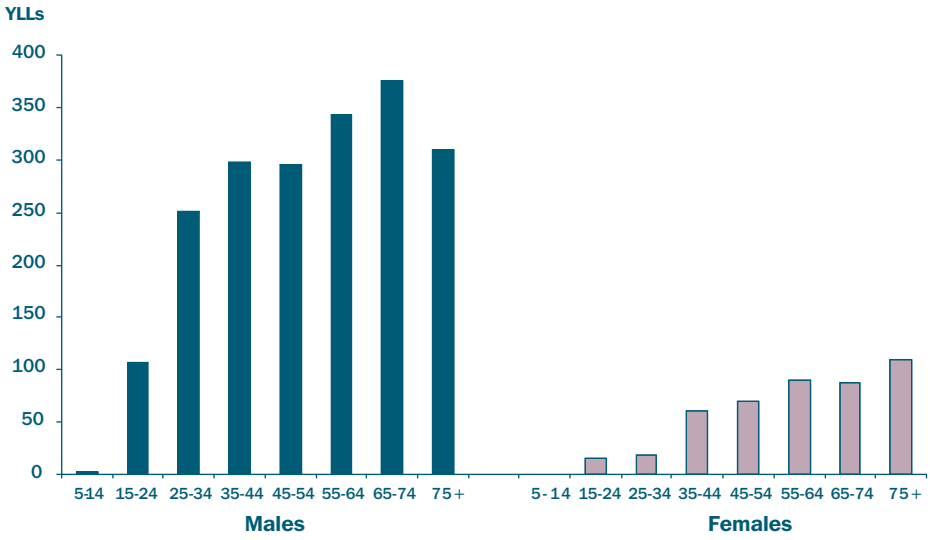
Table 15 shows the conditions that were considered to have an occupational component and the contribution of each to the total burden of mortality in WA 2000. Males had a much higher proportion (3.1%) of mortality burden that was attributable to occupational factors compared to females (0.9%). Cancers accounted for a significant proportion of the burden. Injuries appear significant for males only.

Table 15: Mortality burden attributable to occupational exposures and risks, by sex, Western Australia, 2000

Condition	Males			Females			Combined
	Attributable deaths	Attributable YLL	% Total YLL	Attributable deaths	Attributable YLL	% Total YLL	% Total YLL
Cancers	105	1084	1.7	24	299	0.6	1.2
Nervous system disorders	3	21	0.0	4	10	0.0	0.0
Cardiovascular diseases	3	53	0.1	1	26	0.1	0.1
Chronic respiratory diseases	4	31	0.0	3	26	0.1	0.1
Musculoskeletal disorders	0	0	0.0	0	0	0.0	0.0
Other chronic diseases	1	6	0.0	1	6	0.0	0.0
Road traffic accidents	12	287	0.4	1	26	0.1	0.3
Other transport accidents	6	131	0.2	0	0	0.0	0.1
Falls	2	43	0.1	0	2	0.0	0.0
Machinery accidents	2	41	0.1	1	24	0.0	0.1
Other unintentional injuries	12	268	0.4	0	3	0.0	0.2
Intentional injuries	1	17	0.0	1	13	0.0	0.0
Total	**150**	**1983**	**3.1**	**36**	**435**	**0.9**	**2.1**

Figure 30 shows that the significant burden from occupational risks occurred in men. As expected, for both men and women, the burden occurred predominantly in the ages during which people are employed, although there was a significant contribution to the burden in those aged 75 years and over as well due to the delayed effect of some occupational exposures.

Figure 30: Mortality burden (YLL) attributable to occupational exposures and risks, age and sex, Western Australia, 2000



4. Discussion

Overview of mortality burden

The life expectancy at birth of Australian males and females ranks within the top 5 countries in the world.[12] The life expectancy at birth and at age 65 years among Western Australian males and females was marginally higher than the Australian population in 2000. Western Australian women can be expected to live 4.4 years longer than Western Australian men. In addition, the mortality burden as measured by YLL was greater among males, due mainly to the higher number of deaths occurring at ages younger than 75 years. Due to the method used to calculate life expectancy, female life expectancies were somewhat lower in this report than those published by the ABS. However, comparisons within the report were made using consistent methods.

The increase in life expectancy from 1996 to 2000 among Western Australian males and females of around one year is reflected in the decrease in YLL for both sexes from 1996 to 2000. Whilst cardiovascular diseases and malignant neoplasms account for the majority of the total YLL for both sexes, it was the decrease in the YLL attributed to cardiovascular diseases that contributed greatest to the decline in total YLL. Declines in the rate of cardiovascular diseases (in particular ischaemic heart disease and stroke) in recent years have been associated with reductions in the prevalence of high blood pressure, smoking and saturated fat intake and with improvements in medical interventions.[33]

Although the total YLL declined between 1996 and 2000, there was an increase in the YLL attributed to injury and poisoning. Both Australian and West Australian female age-standardised mortality burden from injury increased during this period, highlighting the need to review injury and poisoning prevention strategies in this group.

Increased female injury mortality burden – fact or artefact?

The apparent increase in age–standardised injury mortality burden for females may be associated with the introduction of ICD–10 coding system where more deaths are coded as being due to external causes than under the ICD–9 system.[33] However, the fact that the Australian and Western Australian age–standardised YLL rates for males decreased slightly and that for females increased substantially since 1996, indicates that the apparent increase in injury-related mortality burden among females is not due to the systematic propensity to code deaths as injury rather than non-injury.

An increase in accidental poisoning due to dependent drug overdose could explain the increase, reflecting a mental health/addiction problem rather than an external cause. However, the increase remained true whether or not selected accidental drug poisoning codes (X41 and X42) were excluded from injuries and included under drug dependence/mental health.

Further investigation of death and YLL rates in different age and injury-type combinations, showed that the substantial increase in WA female injury YLL rates between 1996 and 2000 injuries can be attributed to a high suicide rate among young females (in particular those 15–24 years) in 2000. The high rate for the year was not part of a trend, but reflects annual variation where there are a relatively small number of events. The increase in Australian female YLL injury rates can also be attributed to an increase in injury rates in younger women, mainly due to accidental poisoning (in particular unspecified and 'other' drugs/medications, X44, which constituted 60% of the female poisonings due to drug and medicines) and to a lesser extent suicide. The fact that these deaths occurred in younger ages means that their effect is exacerbated by the higher conversion ratio of deaths to YLLs in the younger age groups. Thus the increase in female Australian injury age–standardised mortality burden is partly an artefact of the method of categorising accidental poisoning in this context. Most of the deaths from other and ill-defined accidental drug poisoning were probably drug-dependence related and should be classified under mental health.

Finer disaggregations of injury YLL at older ages were not always useful due to artefacts resulting from the method of redistribution of ill-defined injuries. The number of deaths due to ill-defined injuries was much larger in the 2000 data due to coding changes in which accidental falls among the elderly were coded as ill-defined injury. This increased the number of deaths that were redistributed among injury codes, with the result that high-frequency injury codes would be somewhat inflated with deaths that were, in fact, deaths from falls. This is reflected, in part, by the apparent decrease in the mortality burden of accidental falls among older people.

From our investigation, it appears that the switch from ICD–9 to ICD–10 has hampered the comparability of BOD estimates from some injury codes, in particular accidental poisoning from drugs and medicines and accidental falls. Because of this, future BOD studies need to further refine how injury-related ill-defined codes are dealt with.

Risk factors

Assessment of burden resulting from risk factors can estimate the potential of prevention and as such is a powerful tool in forming the basis of public health policy.[12] The risk factors studied here are either actual exposures or lifestyle factors, for example, physical inactivity and smoking, or physiological states, for example, obesity, hypertension and hypercholesterolemia. The burden attributable to social states, for example socio-economic disadvantage, has not been estimated although this may be done in future analyses.

Risk factor prevalence obtained from surveys varies depending on the methods used. Estimates based on observed rather than self-reports of high cholesterol, anthropometric information and blood pressure (all obtained from the AUSDIAB study) were favoured in this analysis. Estimates based on self-reported data were used for tobacco use, fruit and vegetable intake, alcohol consumption and physical inactivity. Comparisons between the self-reported prevalence estimates from the WA Health and Wellbeing survey and other surveys showed substantial variation, although the effect on the total YLL attributable to these risk factors was not extensive, showing that the overall attributable burden of disease findings are fairly robust.

The exposure categories used for fruit and vegetable intake, alcohol consumption and physical activity all refer to current exposure and ignore past behaviours as well as lags between exposure and disease. Past tobacco consumption was estimated using an indirect method.[34] Many chronic diseases are associated with exposures over a long period of time, so that a more comprehensive approach to these exposures would improve the estimates of population attributable fractions.

Independent versus combined effect of risk factors

In this report attribution of mortality burden to risk factors associates the mortality burden to the risk factors independently. However, two or more risk factors may interact to affect the same disease resulting in a net effect which may be less or more than the sum of their separate effects. For this reason the proportion of total YLL attributed to the 10 risk factors analysed can only be estimated as the sum of the individual factors. This is not likely to be equal to the actual burden attributable to all risk factors.

Work has begun on developing a method to estimate the total effects of risk factors on disease, using a multiple factor model developed by the WHO.[12] Based on this model that assesses the joint effects of risks on healthy life expectancy, the WHO suggests 47% of global mortality can be attributed to the 20 leading risk factors and around one-third to the 10 leading risk factors.[12] Therefore large health gains can be made from public health interventions. The detail for each risk factor can be best used to indicate target groups for intervention, rather than to review or evaluate existing interventions.

Risk factor burden and public health interventions

The life course approach to risk factors suggests that exposure to risk factors has different impacts on mortality burden at different life stages, and that exposures to disadvantageous experiences and environments accumulate throughout life, increasing the risk of illness.[12,35] This has helped explain the wide socio-economic differences in morbidity and mortality. These findings have important implications for policy and public health intervention in that a range of public health messages should be generated that target different age and sex groups, and that socially disadvantaged groups within these need particular attention.

From the WA 2000 results, tobacco, high cholesterol, hypertension and physical inactivity impact mainly in later life, with the strong impact on males being evident at earlier ages than in females. These factors all rank highly in terms of attributable mortality burden. The impact of alcohol is complicated by its having both substantial beneficial and harmful effects, which manifest at different life stages and at different levels of drinking. The harmful effects are evident mainly in the younger ages, and particularly among men. The beneficial effects are evident mainly in the older ages, and particularly among females. Low risk drinking predominantly imparts benefit at the higher ages, while high risk drinking imparts risk at all ages.

The ranking of the proportions of attributable mortality burden in WA was similar to Australia in 1996,[11] with tobacco being the risk factor associated with the greatest mortality burden. The recent reduction in the decline in smoking prevalence, particularly among males is not likely to be noticed for several decades due to the lag time required for development of smoking–related diseases. Tobacco consumption is controlled in WA by taxation, legislation and enforcement of smoking bans in public places, bans on advertising of tobacco products and information dissemination through warning labels, advertising and consumer information packages. Nationally, structural health sector financing arrangements and insufficient resources for mass media education have hampered progress in tobacco control strategies.[36] A recent report by the VicHealth Centre for Tobacco Control outlines a practical agenda for comprehensive action aimed at markedly reducing the social and economic costs of tobacco use in Australia.[36]

Currently, no estimate is available on the mortality burden of disease attributable to dietary factors overall or for a full range of dietary components. In addition, the estimated mortality burden attributable to inadequate fruit and vegetable intake is conservative. However, high cholesterol and hypertension (arguably partial proxies for dietary saturated fat and salt intake respectively) and obesity (partial proxy for calorie intake) can be considered to be nutrition-related factors. Of these, insufficient fruit and vegetable intake and obesity/overweight impact strongly in adult age groups below 75 years, especially among men. The Department of Health of WA adheres to the Eat Well Australia strategy (Public Health Nutrition Strategy 2000–2010), and implements multiple strategies including short, intensive mass media advertising and community-based consumer education through health facilities, food retailers and food service providers and the promotion and sale of a Department of Health recipe book.

Other drug use, occupational risks and unsafe sex ranked low relative to the other risk factors studied. The impact of occupational risks and injuries is fairly evenly spread from 25 years onwards. However, the method for estimating occupational burden is in a relatively early stage of development, including the fact that aetiological fractions reflect national data. This means that in areas where particular exposures are more common, occupational burden will be underestimated. In WA, where asbestos mining was prevalent until 1966 and the mesothelioma rates are among the highest in the world,[37] the number of cancer deaths attributable to occupational exposures are probably underestimated. The age distribution of these deaths would also be affected.

The mortality burden from unsafe sex, while peaking in the 35–44 year age group, is also spread fairly evenly across all adult age groups. The profile and magnitude of the mortality burden attributable to unsafe sex has changed since 1996, with male burden reducing substantially and the burden falling predominantly on females of all ages, mainly due to cervical cancer. This change is mainly as a result of the decrease in AIDS deaths in WA from 28 in 1996 to 9 in 2000, which can be largely attributed to the use of Highly Active Antiretroviral Therapy [HAART] for the treatment of HIV infection. Public Health interventions introduced in WA do not specifically focus on HIV/AIDS (AIDS is a major focus in many low and middle income countries), but rather on comprehensive programs to reduce sexually transmitted infections generally. Interventions include school-based education from pre-primary to Year 10, peer-based education for high-risk groups including sex workers and men who have sex with men, early detection and treatment of sexually transmitted infections and population-based mass media.

The mortality impact of drug use occurs mainly among youth and young adults. Interventions introduced in WA include school-based education and prevention strategies, counselling, population-based mass media and free distribution of needles and syringes.

Most of the diseases contributing to substantial mortality burden have some genetic component in their causal pathway. While the avoidable burden of genetic disease cannot yet be quantified, especially in the case of chronic diseases influenced by multiple genes, genetic-based interventions can augment other preventative efforts.[12]

Burden of disease as a reflection of the epidemiological profile

The pattern of disease evident in the profile of mortality burden for WA as a whole is typical of that seen in industrialised regions, as is the distribution of burden of disease attributable to the 10 selected risk factors. This is in contrast to developing regions, where the other extreme of the epidemiological transition – the predominance of infectious diseases and malnutrition is still evident in terms of patterns of disease burden and burden attributable to risk factors.[12,38] Developing countries now experience a double burden because non-infectious diseases also contribute substantially to the burden of disease, especially among the poor. Clearly, the risk factors shape the pattern of disease and injury. The pattern of mortality burden seen in some of the remote regions in WA reflects an intermediate epidemiological pattern.

The health system includes all actions whose primary goal is to improve health. BOD analysis holds great potential for conveying public health messages to politicians, planners and the public in terms of how diseases and risk factors affect population mortality and ill-health. A major thrust in risk factor control strategy needs to be cooperation with other sectors whose responsibilities impact significantly on the health of the population. In the WA context, this approach is particularly important in planning interventions for Aboriginal and Torres Strait Islander populations whose mortality burden is substantially higher than the rest of the population.[22] The differential in the mortality burden experienced in the remote and rural regions of WA (where the impact of Aboriginality is most marked) compared to metropolitan areas also calls for innovative interventions.

Data Sources

One incidental benefit of the burden of disease methodology has been the identification of the strengths and weaknesses of existing health information systems.

The feasibility of the WA burden of disease study has been improved by the many data collections available for analysis in WA. For this report, the reliable and complete mortality data set has enhanced access to missing data through the WA linked data system.[39] An area of death coding that could be improved is the allocation of deaths to ill-defined causes so as to minimise the need to reallocate deaths to more specific codes. In the mortality component of the study, the linked data system was used to obtain date of birth or age information on some

individuals. However, this resource will be used more extensively for the disability component. Ongoing health surveillance through regular health and wellbeing survey results also provides up-to-date information on the prevalence of behavioural risk factors in the population. Despite these WA-specific data sources, national data sources still need to be used to supplement local data.

Future developments

The menu of risk factors for which attributable burden of disease can be estimated is expanding. In WA, the nutrition sector has shown interest in improving the estimates of overall nutrition-related burden of disease. While past Australian estimates of diet-related attributable proportions were done by consensus of experts,[40] an update will require significant investment of resources for epidemiological review. One factor that may hamper this process is the fact that research is increasingly being done on ever-narrower nutritional components and their relationship to diseases. The interaction of multiple nutritional components makes an aggregated dietary view difficult to quantify. In addition, some nutrients have negative and positive effects on health and this will need to be taken into account when estimating BOD attributable to diet.

This report has not compared different ethnic or socio-economic groups in WA. Such analyses will be considered in the future. Additionally, future work will provide estimates of the years lost due to disability (YLD) so that the health indicator provides an insight into both quantity and quality of life for the WA population. The methodology used to generate the results published in this report will be updated to include new developments in the Global BOD approach. Additionally, the extensive health databases in WA may assist in the development of further methods to enhance the general BOD approach.

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