**Disease burden: A detailed analysis by modifiable risk factor**

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**Introduction** A breakdown of disability-adjusted life years (DALYs) into specific diseases, age groups and genders allows an estimation of the level of disease burden that can be attributed to modifiable risk factors. This is important as this proportion of the total disease burden is avoidable and demonstrates the potential gain in health through public health interventions that aim to reduce risk factor prevalence. It is of course important to recognise that current methods limit this study to ten major risk factors. The impact of other risk factors such as dietary and psychosocial that are currently unable to be quantified in totality should not be underestimated when interpreting this information.

**Tobacco**

Tobacco smoking was attributed 19,133 DALYs, the greatest of the quantifiable risk factors studied, accounting for 8.6% of the overall burden (Figure 1). Mortality was the main contributor to the burden associated with tobacco, as most diseases caused by smoking have high mortality. Lung and other cancers (mouth, oesophagus, larynx, stomach, pancreas, bladder, kidney and uterus) caused 48% of the total burden attributed to tobacco, while chronic obstructive pulmonary disease (COPD) caused a further 25%. Although the burden attributed to passive smoking was only 0.2%, the greatest effects were on children through childhood asthma and low birth weight (Figure 1).

The burden from passive smoking among children was similar for both boys and girls. For ages over 35 years, the burden due to tobacco for males was more than twice that of females. The difference between genders is explained by a lag in the development of cancers and respiratory conditions caused by smoking and the higher prevalence of smoking among males in the past resulting in higher incidence of these conditions among males in 2000. Other conditions contributing to the tobacco burden were peripheral vascular disease, lower respiratory tract infections, inflammatory bowel disease, fire injuries, SIDS and otitis media (Figure 2).

**Physical inactivity**

Insufficient physical activity (no vigorous activity in a week) was responsible for the second greatest quantifiable disease burden of the ten risk factors studied, accounting for 4.9% of the total burden. Cardiovascular conditions (ischaemic heart disease, stroke and hypertension) account for 57% of the physical inactivity burden (Figure 3).
The burden due to physical inactivity increases with age and was similar for both genders. Mortality contributes to the burden to a greater extent than disability for those aged over 55 years. Prior to that, a high proportion of the total burden is due to disability (Figure 4).

**Figure 4: Disease burden attributed to physical inactivity by age and gender**

**Figure 5: Disease burden attributed to hypertension by condition**

Hypertension

High blood pressure (systolic > 160/diastolic > 95) is associated with other risk factors such as obesity and high blood cholesterol and is itself an important risk factor for cardiovascular disease. High blood pressure ranks third among the ten risk factors studied and accounted for 4.1% of the total disease burden. Ischaemic heart disease and stroke account for 85% of the hypertension burden (Figure 5).

**Figure 6: Disease burden attributed to hypertension by age and gender**

The majority of the hypertension burden was due to mortality and occurred among the older age groups. The burden for age groups over 55 years was higher among males than females (Figure 6).
Overweight and obesity
Overweight (Body Mass Index (BMI) from 25 to 29) and obesity (BMI greater than 30) was attributed 3.9% of the total burden and ranked fourth in terms of the proportion of overall burden of the ten risk factors studied. Non–insulin-dependent diabetes (Type 2), ischaemic heart disease and osteoarthritis accounted for 77% of the burden attributed to overweight and obesity (Figure 7).

The disease burden was similar for males and females and increased with age. Disability accounts for the majority of the burden under the age of 55 years, while mortality contributes a greater proportion of the burden after age 55 years. For the ages 35 to 64 years, the burden was higher among males than females, mainly due to the higher mortality of ischaemic heart disease and cancer among males (Figure 8).

Alcohol
The consumption of alcohol at moderate levels (no more than two standard drinks daily for females and four for males) has been demonstrated to have a protective effect against cardiovascular disease. Harmful and hazardous levels of alcohol consumption (more than two standard drinks daily for females and four for males) lead to diseases such as cirrhosis, stroke, breast and other cancers (mouth, oesophagus, larynx and liver) as well as suicide, road traffic accidents and other injuries (falls, fires, drowning, occupational and violence). Alcohol dependence accounts for the greatest proportion of harm caused by alcohol, with the majority of the burden due to disability. Other leading causes of burden attributed to alcohol were road traffic accidents, cirrhosis and stroke, all contributing a large mortality component. (Figure 9).

Although alcohol had a benefit of 4,999 DALYs, the harm due to alcohol was 12,222 DALYs, resulting in a net burden of 7,223 DALYs attributed to alcohol. The net burden among males (5.3%) was greater than in females (1.0%). The harmful effects of alcohol were greatest among males aged 15 to 24. The benefits from alcohol were greatest in the older age groups (Figure 10).
Determining the burden of alcohol by levels of drinking indicates that low-risk drinking (at moderate levels) has minimal harm or benefit for ages younger than 45, but substantial benefit for ages 45 years and over with little harm. However, high-risk drinking causes substantial burden across all age groups, with little benefit (Figure 11).

**Other Drugs**

Besides the direct burden from abuse and dependency of drugs other than alcohol and tobacco, the abuse of these drugs also increased the risk of poisoning, hepatitis, suicide and self-harm, HIV/AIDS, inflammatory heart disease and low birth weight. The burden attributed to other drug abuse accounts for 2.5% of the overall burden (Figure 12). The greatest contribution to burden was from ‘other drug dependence and abuse’, which was 0.9% of total burden or 37% of other drug abuse. This category includes all drug-dependent mental health conditions, as well as accidental poisoning in people 15 years and older, due to the use of a range of licit and illicit drugs other than those specified. The burden attributed to ‘other drug dependence and abuse’ among males was twice that of females.

The majority of the burden from other drug abuse occurs among young people. The proportion of burden was highest among the 15 to 24 year age-group, which has a large disability contribution to the burden (Figure 13). A relatively large disability burden among young people was due to a high incidence of drug abuse at this age and the protracted level of disability that results.

**Inadequate fruit and vegetables**

Dietary behaviour has been linked to the protection from, or reduced risk of, developing many diseases. Unfortunately, due to the complexity and interaction of dietary components such as fat, salt, sugar, fruit, vegetables, cereal foods, iron and calcium, there is a lack of data linking diet as a whole to disease. There is however strong evidence that consumption of fruit and vegetables offers protection against many cancers, ischaemic heart disease and stroke. An inadequate intake of fruit and vegetables (less than five servings daily) accounts for 2.4% of the total disease burden. Cancer contributed 80% of the burden attributable to inadequate intake of fruit and vegetables (Figure 14).
The majority of the burden attributable to inadequate intake of fruit and vegetables was due to mortality. Male burden was higher than female burden for all age groups, with the highest burden among the 64 to 75 year age-group in both genders (Figure 15).

High blood cholesterol

High blood cholesterol (greater than 5.5 mg/dl) was attributed 1.9% of the overall disease burden. Ischaemic heart disease and peripheral vascular disease are currently the only two conditions considered partially attributable to high blood cholesterol. The greatest contribution of the disease burden for high blood cholesterol was due to mortality, with 97% accounted for by ischaemic heart disease (Figure 16).

The high blood cholesterol burden increased with age, but the burden for each age group was consistently higher in males compared to females (Figure 17).

Occupational exposures and hazards

The burden attributable to occupational exposures and hazards accounted for 1.8% of the total burden. The male burden was more than twice that of the female burden, with mortality contributing to a greater proportion of the burden among males than females. Cancer accounted for 41% of the total occupational exposures and hazards burden, followed by injuries with 28% (Figure 18). The burden attributable to occupational exposures and hazards may be an underestimation as the exposures to asbestos through mining in WA was probably higher than that used to estimate the national aetiological fractions. Mesothelioma rates in WA are among the highest in the world, reflecting the high exposure to asbestos in the State.
Figure 19: Disease burden attributed to unsafe sex by condition

- 0.8% Total burden
- 0.5% Cervical cancer
- 0.1% HIV/AIDS
- 0.1% Sexually transmitted infections
- 0.1% Maternal conditions

Method
The population attributable fraction method was used to calculate the proportion of total burden attributable to risk factors as in the attribution of the mortality burden to risk factors. For details of the calculation and application of the aetiological fractions refer to the supplementary technical report and the bulletin in this series which overviews the attribution of burden to risk factors. In the future, as evidence emerges of relationships between specific risk factors and more diseases, a greater proportion of the disease burden can be attributed to these risk factors.

Unsafe sex
The burden attributable to unsafe sex was 0.8% of the total burden, with the burden among females almost seven times higher than that among males. Cervical cancer accounted for 62% of the unsafe sex burden explaining the relatively high female burden (Figure 19).

Conclusion
The findings of this study clearly demonstrate the impact of a large number of risk factors on the disease burden of the Western Australian population. While the report provides information about specific risk factors, policies and health promotion programs need to reflect the fact that many of these risk factors commonly coexist and interact.

For the purposes of this study, the burden was attributed to each risk factor independently and measures the potential reduction in burden if the harmful effect of each risk factor was eliminated from the population. As the likely interactive effects of two or more of these risk factors were not considered, the sum of the burden attributed to each risk factor was unlikely to equal the actual burden attributable to all risk factors.

Finally, it should be recognised that many diseases and conditions have other underlying risk factors that are yet to be incorporated into the Burden of Disease methodology. Like biomedical and physical risk factors listed in this report, psychosocial risk factors will also have a major effect on disease burden.

Key findings
- Tobacco contributed to the greatest quantifiable disease burden, especially among those older than 45 years. Passive smoking has greatest effect among children.
- Physical inactivity and obesity contribute a significant burden although the latter risk factor impacts on a wider age range.
- Harmful effects of hazardous alcohol consumption were apparent at all ages, but highest amongst the youngest.

References

Implications
- The large disease burden attributed to tobacco still makes tobacco-control strategies a priority.
- Policies directed at risk factor modification should recognise that the health impact of these risk factors are manifested mainly as “disabilities” in the younger age groups and “mortality” in the older.
- Strategies addressing overweight and obesity should recognise the increasing prevalence of this risk factor in our community and young children.
- Findings of this report support policies and programs that target smoking, drinking and drug abuse in teenagers and young adults. It is important to recognise the time lag between behaviour and disease manifestation.
- It should be recognised that while this study has reported on the disease burden of individual risk factors, these behaviours often occur simultaneously.