This is the accepted version of the following article: Calabria B, Doran CM, Vos T, Shakeshaft AP, Hall W. Epidemiology of alcohol-related burden of disease among Indigenous Australians. Australian and New Zealand Journal of Public Health2010;34(S1):S47-S51., which has been published in final form at http://onlinelibrary.wiley.com/doi/10.1111/j.1753-6405.2010.00553.x/full
Epidemiology of alcohol related burden of disease among Indigenous Australians

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Abstract

Objective: To compare the burden of alcohol related harm and underlying factors of this harm, by age and sex, for Indigenous and general population Australians.

Methods: Population attributable fractions are used to estimate the disability adjusted life years (DALYs) for alcohol-related disease and injury. The DALYs were converted to rates per 1,000 by age and sex for the Indigenous and general populations.

Results: Homicide and violence rates were much higher for Indigenous males: greatest population difference was for 30-44 years, Indigenous rate 8.9 times higher. Rates of suicide were also greater: the largest population difference was for 15-29 years, Indigenous rate 3.9 times higher. Similarly for Indigenous females, homicide and violence rates were much higher: greatest population difference was for 30-44 years, Indigenous rate 18.1 times higher. Rates of suicide were also greater: the largest population difference was for 15-29 years, Indigenous rate 5.0 times higher.

Conclusions: Alcohol consumption and associated harms are of great concern for Indigenous Australians across all ages. Violent alcohol related harms have been highlighted as a major concern.

Implications: To reduce the disproportionate burden of alcohol related harm experienced by Indigenous Australians targeted interventions should include the impact on families and communities and not just the individual.

Key words: Indigenous, Disability Adjusted Life Year, Alcohol, Harms
Introduction

Although the deleterious impact of alcohol on Indigenous Australians and their communities has been extensively documented (1-6), obtaining accurate estimates of the extent of harm across a range of health indicators (including death, hospitalisations, quality of life and social costs) has been challenging. One approach to this task has been to use Disability Adjusted Life Years (DALYs), a summary measure of health that combines years of life lost (YLL) and years lived with disability (YLD) as a consequence of a disease or injury.

Two reports using DALYs to describe the drug and alcohol related burden of disease and injury in Australia have recently been published: one for Australia generally (7); and one specific to Indigenous Australians (8). In the general Australian population, alcohol is responsible for 3.3%, and prevents 1% of the total disease burden, a net effect of 2.3%, equivalent to 61,091 DALYS and 0.8% (1,084) of all deaths (7). For Indigenous Australians, alcohol harm causes 6.2%, and prevents 0.8% of the total burden, a net effect of 5.4% (5,171) of DALYs and 6.7% (192) of all deaths (8). The disproportionate burden of alcohol related harm experienced by Indigenous people results in an estimated life expectancy of fifteen years less, on average, than in the general population (8).

Using DALY estimates as the basis for developing, implementing and evaluating policies and interventions will be critical given the clear lack of Indigenous alcohol intervention research to date (9). Such policies and interventions, however, are likely to be more effective if they are tailored to specific sub-populations and disease types (10, 11), rather than remaining restricted to broad-based, population-level comparisons between general population and Indigenous Australians. This paper
aims to compare alcohol consumption DALYs for Indigenous and general population Australians by age and sex and by disease or injury related to use.

Method

The methodology has been described in detail elsewhere (7, 8, 12); a summary follows. The population attributable fraction (PAF), representing the expected proportional reduction in mortality if alcohol exposure were reduced to an alternative (counterfactual) distribution, was calculated before determining the number of attributed deaths. The PAF uses the exposure level, actual population distribution of the exposure; counterfactual (alternative) population distribution of the exposure, relative risk of mortality at exposure level and maximum exposure level (see equations 1A for continuous exposures and 1B for categorical exposures).

\[
PAF = \frac{\int_{x=0}^{m} RR(x)P(x) \, dx - \int_{x=0}^{m} RR(x)P'(x) \, dx}{\int_{x=0}^{m} RR(x)P(x) \, dx} (1A)
\]

\[
P(x): \text{actual population distribution of exposure} \\
P'(x): \text{counterfactual (alternative) population distribution of exposure} \\
RR(x): \text{relative risk of mortality at exposure level } x \\
m: \text{maximum exposure level}
\]

\[
PAF = \frac{\sum_{i=1}^{n} P_i \cdot RR_i - \sum_{i=1}^{n} P'_i \cdot RR_i}{\sum_{i=1}^{n} P_i \cdot RR_i} (1B)
\]

\[
n: \text{number of exposure categories} \\
P_i: \text{proportion of population currently in the } i^{th} \text{ exposure category} \\
P'_i: \text{proportion of population in the } i^{th} \text{ exposure category in the counterfactual (alternative) scenario} \\
RR_i: \text{relative risk of disease-specific mortality for the } i^{th} \text{ exposure category}
In order to estimate the number of alcohol-attributable person deaths in the population, in part (e.g. accidents) or whole (e.g. alcoholic liver cirrhosis), the population distributions of alcohol exposure were based on individual-level consumption data (7, 13, 14). Alcohol consumption data, for the general Australian population, were taken from the National Health Survey (NHS 2001) (15). For the Indigenous population the prevalence of alcohol consumption was derived from the Australian Bureau of Statistics National Torres Strait Islander Health Survey (NTSIHS) 2004-05 (16). Prevalence of alcohol consumption was categorised into the four levels used in English and colleagues’ analysis of the risks of alcohol consumption (14), in accordance with the NHMRC’s recommendations on alcohol consumption (17). The population distributions of alcohol exposure for each level of alcohol intake were estimated by age and sex for both Indigenous and general population Australians.

Relative risks and PAFs from Ridolfo and Stevenson (18) were used for conditions for which there is evidence of causation by alcohol consumption. Included in these estimates are harms, i.e., injury or diseases, that are causally related and completely attributed to alcohol exposure as well as related harms that are causally but not solely attributed to alcohol exposure (contributing factors) (19).

The following diseases and injuries were included: ischemic heart disease; other cardiovascular disease (CVD) (including stroke, hypertensive heart disease, and inflammatory heart disease); cancer; road traffic accidents; homicide and violence; suicide (including self-inflicted injuries); alcohol use disorders (including dependence, harmful use, alcoholic cirrhosis); and other (including fire, burns and scalds, gallbladder and bile duct disease, surgical and medical misadventure, striking and crushing accidents, poisoning, cutting and piercing accidents, sports injuries, other transport accidents, natural
and environmental factors, machinery accidents, suffocation and foreign bodies, drowning, pancreatitis, and falls).

Age standardisation was applied to DALYs to account for the variation in age structure between Indigenous and the general population, resulting in comparable age specific estimates. The DALYs for alcohol related harm and contributing factors were converted to rates per 1,000 by age and sex for the Indigenous and general populations.

Results

Alcohol related burden of harm

Rates of alcohol related harm among Indigenous males are three times higher than in the general Australian population: rates were more than twice as high for Indigenous males aged 0-29 years and more than three times higher thereafter. Rates for Indigenous females were seven times higher than general population females, consistently more than five times higher from age 15 to 59 years (see Table 1).
Table 1. Rates (DALYs per 1,000) of alcohol-related disease and injury, Australia

|                  | Age (years) |   |   |   |   | Age (years) |   |   |   |   |
|------------------|-------------|---------------|---------------|---------------|---------------|-------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                  | 0-14        | 15-29         | 30-44         | 45-59         | 60+           | Total        | 0-14          | 15-29         | 30-44         | 45-59         | 60+           | Total         |
|                  |             |               |               |               |               | Indigenous population | General population |             |               |               |               |               |               |               |               |               |               |
| Males            |             |               |               |               |               |               |               |               |               |               |               |               |
| Ischemic heart disease | 0.00 | -0.33 | -4.05 | -8.57 | -12.24 | -2.26 | 0.00 | -0.05 | -0.49 | -2.14 | -6.13 | -1.52 |
| Other CVD        | 0.00 | 0.38 | 1.42 | 2.84 | 7.64 | 0.98 | 0.00 | 0.19 | 0.20 | 0.42 | 1.29 | 0.37 |
| Cancer           | 0.00 | 0.03 | 1.41 | 6.79 | 12.11 | 1.48 | 0.00 | 0.04 | 0.33 | 1.77 | 3.02 | 0.91 |
| Road traffic accidents | 0.71 | 4.98 | 4.87 | 2.22 | 0.43 | 2.81 | 0.31 | 2.41 | 1.42 | 0.45 | 0.13 | 1.00 |
| Homicide and violence | 0.00 | 3.70 | 4.28 | 1.42 | 0.30 | 1.98 | 0.00 | 0.61 | 0.48 | 0.19 | 0.06 | 0.29 |
| Suicide          | 0.00 | 5.51 | 6.68 | 1.56 | 1.17 | 2.98 | 0.00 | 1.42 | 1.90 | 1.17 | 0.46 | 1.03 |
| Alcohol use disorders | 0.00 | 3.99 | 12.11 | 24.86 | 15.09 | 6.59 | 0.00 | 3.36 | 3.10 | 4.32 | 3.13 | 2.76 |
| Other            | 0.16 | 1.16 | 1.81 | 1.61 | 1.51 | 0.95 | 0.05 | 0.53 | 0.50 | 0.44 | 0.69 | 0.43 |
| Total males      | 0.88 | 19.41 | 28.53 | 32.74 | 26.01 | 15.52 | 0.36 | 8.54 | 7.44 | 6.63 | 2.65 | 5.29 |
| Females          |             |               |               |               |               |               |               |               |               |               |               |               |
| Ischemic heart disease | 0.00 | -0.14 | -1.09 | -2.82 | -5.26 | -0.83 | 0.00 | -0.01 | -0.09 | -0.42 | -2.52 | -0.57 |
| Other CVD        | 0.00 | 0.18 | 0.05 | -0.85 | -2.44 | -0.16 | 0.02 | -0.06 | -0.12 | -0.55 | -2.13 | -0.53 |
| Cancer           | 0.00 | 0.06 | 0.64 | 1.97 | 4.95 | 0.61 | 0.00 | 0.02 | 0.39 | 1.30 | 1.59 | 0.63 |
| Road traffic accidents | 0.17 | 0.84 | 1.40 | 0.39 | 0.00 | 0.62 | 0.07 | 0.27 | 0.18 | 0.06 | 0.00 | 0.12 |
| Homicide and violence | 0.00 | 3.20 | 3.07 | 0.36 | 0.62 | 1.56 | 0.00 | 0.23 | 0.17 | 0.06 | 0.03 | 0.10 |
| Suicide          | 0.00 | 0.99 | 1.30 | 0.29 | 0.00 | 0.57 | 0.00 | 0.20 | 0.40 | 0.29 | 0.09 | 0.20 |
| Alcohol use disorders | 0.00 | 2.00 | 8.04 | 10.04 | 6.16 | 3.60 | 0.00 | 0.70 | 1.13 | 0.92 | 0.62 | 0.69 |
| Other            | 0.09 | 0.19 | 0.52 | 0.66 | 1.40 | 0.33 | 0.03 | 0.11 | 0.14 | 0.14 | 0.86 | 0.24 |
| Total females    | 0.25 | 7.32 | 13.92 | 10.03 | 5.43 | 6.31 | 0.12 | 1.46 | 2.20 | 1.79 | -1.49 | 0.89 |

NB: Other CVD = stroke, hypertensive heart disease, inflammatory heart disease; suicide = including self-inflicted injuries; alcohol use disorders = including dependence, harmful use, alcoholic cirrhosis; other = fire, burns and scalds, gallbladder and bile duct disease, surgical and medical misadventure, striking and crushing accidents, poisoning, cutting and piercing accidents, sports injuries, other transport accidents, natural and environmental factors, machinery accidents, suffocation and foreign bodies, drowning, pancreatitis, falls.
Contributing factors to alcohol injury and disease

Males

In terms of underlying alcohol related disease and injury, rates of DALYs for Indigenous males were higher than general population males across all age groups (see Figure 1, Table 1). Road traffic accidents were the main contributing factor for alcohol related harm in Indigenous males aged 0-14 years (2.3 times higher). Homicide and violence rates were much higher for Indigenous males: 6.1 times higher for 15-29 year olds; 8.9 times higher for 30-44 year olds; 7.5 times higher for 45-59 year olds; and 5.0 times higher for 60 years or more. Rates of suicide were also greater for Indigenous males: the largest difference between populations was for 15-29 year olds with the Indigenous rate 3.9 times higher. Alcohol use disorders made a larger contribution in later years of life with rates 5.8 times higher for 45-59 year olds and 4.8 times higher for Indigenous males aged 60 years or more. On the positive side, the protective effects of ischemic heart disease were higher in Indigenous males compared to the general population: 6.6 times higher for 15-29 year olds; 8.3 times higher for 30-44 year olds; 4.0 times higher for 45-59 year olds; and 2.0 times higher for 60 years or more (see Table 1).
Figure 1: Alcohol-related disease and injury by sex: males

Females

Among Indigenous females, rates of DALYs were higher than general population females (with the exception of similar rates for both groups for cancer) across all age groups (see Figure 2, Table 1). Similarly to Indigenous males, road traffic accidents were the main contributor to alcohol related harm for Indigenous females aged 0-14 years (2.4 times higher). Homicide and violence rates were much higher for Indigenous females: 13.9 times higher for 15-29 year olds; 18.1 times higher for 30-44 year olds; 6.0 times higher for 45-59 year olds; and 20.7 times higher for 60 years of more. Rates of suicide were also greater for Indigenous females: the largest difference between populations was for
15-29 year olds with the Indigenous rate 5.0 times higher. Alcohol use disorders made a larger contribution later in life with rates 10.9 times higher for 45-59 year olds and 9.9 times higher for Indigenous females aged 60 years or more.

Figure 2: Alcohol-related disease and injury by sex: females
Discussion

Previous analyses have shown alcohol DALYs are much higher in Indigenous, compared to general population Australians (7, 8). This study shows that rates of alcohol disease burden are consistently higher for Indigenous people across all age groups. It also shows the specific disease or conditions that cause the most alcohol harm, common to both males and females, are homicide and violence, suicide, alcohol use disorders, and road traffic accidents.

The elevated contribution of alcohol to male and female homicide and violence confirms findings from a recent Australian Government report that highlights alcohol as an important factor for violence in Indigenous communities (20). Homicide and violence affect not only drinkers but may cause harm to people who do not drink alcohol and since these cases are not easily identified by data systems, our results are likely to be underestimates. The extent of underestimation is likely to be greater for females, relative to males, given females are more often victims of violence and homicide (21).

Other alcohol related harms were also consistently higher for Indigenous than general population Australians: rates of suicide were especially elevated among Indigenous males and females under the age of 44 years. The most commonly reported method of suicide for Indigenous males was hanging, followed by death by firearms (22). Violent methods of suicide used by Indigenous males are similar to those reported by males in the Australian general population (23). Indigenous female methods of suicide are also notably violent, with hanging most commonly reported (22), rather than drug overdose in general population females (23).
Limitations

There is a urgent need to improve the evidence base for alcohol policy in Australia (24). Although this research is based on epidemiological studies that apply an accepted methodology, the underlying data used to calculate alcohol related harm are drawn from a range of sources from varying quality including: specific Indigenous and general population alcohol prevalence data; relative risks from international literature for chronic diseases; Australian general population data on alcohol related injuries; and variety of other sources that were predominantly Australian. Self-reported consumption data used are prone to biases (25): however, this method of estimating alcohol-attributed deaths has been commonly used (13, 14). Although estimates of alcohol disease and injury include a wide range of conditions, they are likely to be an underestimate of the true proportion of alcohol-related harm because: 1) they exclude alcohol-related injuries experienced by individuals who have not consumed alcohol, primarily because there are no valid and reliable estimates of the extent of alcohol harm experienced by non-drinking victims; and 2) it is likely that not all perpetrators who have consumed alcohol are identified. Few direct data sources for Indigenous estimates were found so relativities found in proxy measurements were largely used (7, 8). Further, the data from the Australia Burden of Disease and Injury study (7) did not explicitly separate Indigenous from non-Indigenous populations. The substantial alcohol related harm reported in these studies reinforces the need for improved data collection.

Policy implications

Information is available on potential strategies to reduce alcohol harm, although most of the recent studies tend to focus on strategies to curb alcohol-misuse in the general population, such as changes
to the taxation of alcoholic beverages (26, 27). The cost-effective population-wide approaches to reducing alcohol harm would be improved by implementing complementary interventions tailored specifically to high-risk sub-populations or diseases and conditions (28). The analyses in this paper suggest interventions that focus on reducing homicide and violence in Indigenous males and females, and with specific attention to lowering rates of suicide for Indigenous males and decreasing the number of Indigenous females who have an alcohol use disorder, are most likely to have the biggest impact in reducing alcohol related harm for Indigenous Australians and their communities (20).

Indigenous Australians have a unique pattern of alcohol related disease and harm that justifies implementation of specific interventions for this population. Implementing more than one intervention strategy would increase the likelihood of significantly reducing alcohol related problems (26, 29). Given the disproportionately high rates of alcohol use disorders, homicide and violence, and suicide, it may be that interventions specific to factors critical to the functioning of Indigenous communities and individuals would be highly cost-effective. Positive interaction with family, for example, has been identified by Indigenous Australians as the most important characteristic to facilitate behaviour change generally (30) and the major reason for reducing or ceasing alcohol use specifically (30, 31). This highlights the potential importance of developing intervention strategies that include families, as well as communities and individuals. It is critical, however, that any intervention is developed and implemented in consultation with Indigenous community members, families and individuals, to ensure they are culturally acceptable, reflecting the knowledge base and world view of Indigenous Australians (8, 32).
In addition to social harms, there is clearly a need for more effective interventions to reduce deaths and injuries associated with traffic accidents, especially among young people. Despite the effectiveness of random breath testing (26) road traffic accidents are a substantial problem for Indigenous and general population Australians, except females 60 years or more. A recent analysis relevant to the Australian population generally, indicated that the most cost-effective strategies for reducing alcohol related road deaths among young Australians are likely to be a zero-tolerance policy for alcohol and driving until the age of 22 years (33).

Conclusions

Indigenous males had a higher alcohol related burden of disease than general population males attributable to all contributing factors. Indigenous males also had a higher protective effect of ischemic heart disease. Key problem areas for alcohol related harm among Indigenous Australian males were: homicide and violence, suicide and road traffic accidents. Indigenous females had a higher alcohol related burden of disease than general population females with the exception of similar rates for cancer across groups. Although Indigenous females had a higher protective effect of ischemic heart disease, general population females had a higher protective effect for other CVD. Key problem areas for alcohol related harm among Indigenous females were: homicide and violence, alcohol use disorders and road traffic accidents.

An informed policy response first requires a detailed characterisation of the contributions that alcohol use makes to disease burden by age, sex and Indigenous status as we present in this paper. It also requires methodologically rigorous evaluation of culturally sensitive interventions to reduce Indigenous alcohol related harm and should, in the Indigenous context, include the impact on families
and communities and not just the individual.
Acknowledgements

Wayne Hall is supported by an NHMRC Australia Fellowship.
References


