Examining the Social and Economic Costs of Alcohol Use in Australia: 2017/18

National Drug Research Institute, Curtin University

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Preventing harmful drug use in Australia

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EXAMINING THE SOCIAL AND ECONOMIC COSTS OF ALCOHOL USE IN AUSTRALIA: 2017/18

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EXECUTIVE SUMMARY

Introduction

The purpose of this study is to provide an updated estimate of the social and economic costs of alcohol use to Australia in recognition of the: length of time since the last substantive national estimate (Collins and Lapsley, 2008); growing evidence for alcohol as a cause of disease and injury; reinterpretation of previous evidence using new methods in relation to the purported 'protective' effects of alcohol on chronic disease risk; new Australian guidelines to reduce health risks from drinking alcohol (National Health and Medical Research Council, 2020); and, changing patterns of alcohol consumption in Australia. The most recent and complete harm and economic data available were applied to quantify costs incurred during the 2017/18 financial year.

There is some evidence that at a population level, alcohol exposure in Australia has declined during the past two decades (Australian Bureau of Statistics, 2019f). It has also been suggested that observed declines in national per capita alcohol consumption has been largely driven by young people aged 30 years or under (Livingston and Dietze, 2016). Despite this, there are concerns about the public health implications of an ageing population, with increasing evidence of alcohol use and related harm. This is partly driven by: the increased number of older people; the maintenance of lifetime patterns of risky drinking by some as they age; the increased risks of drinking combined with some age-associated issues (e.g., general health, physiological changes, medication use); and, current cohorts having a different drinking history to prior cohorts (Armstrong-Moore et al., 2018; Kelly et al., 2018; Wilkinson et al., 2016). Overall, in 2019, about one third of people aged 14 years and older exceeded the current national guideline (National Health and Medical Research Council, 2020) for reducing drinker's risk of alcohol-related harm (Australian Institute of Health and Welfare, 2021b). Notably, for healthy adult men and women, Guideline 1 keeps the risk of alcohol-related harm low (i.e., less than 1 in 100 chance of dying from an alcohol-related condition) but it does not eliminate all risk (National Health and Medical Research Council, 2020).

Over the past decade or so, there has been increasing research focused on a reappraisal of alcohol's role in the development of chronic disease (e.g., National Health and Medical Research Council, 2020). This has included closer consideration of how limitations inherent to traditional observational studies (e.g., cohort and case-control designs), which dominate the literature, may have contributed to an under-estimation of causal relationships (e.g., Juonala et al., 2009; Ko et al., 2021; Liang and Chikritzhs, 2013a, b; Naimi et al., 2005; Naimi et al., 2017; Naimi et al., 2019; Ng Fat and Shelton, 2012; Pletcher et al., 2005; Staff and Maggs, 2017; Stockwell et al., 2016; Wood et al., 2018). A growing number of critical reviews and meta-analyses (e.g., Degenhardt et al., 2018b; Fekjær, 2013; Vos et al., 2020), coupled with new findings from epigenetic studies (e.g., Au Yeung et al., 2012; Chen et al., 2008; Holmes et al., 2014; Lawlor et al., 2013; Millwood et al., 2019; Voight et al., 2012), have highlighted considerable uncertainty around the veracity of purported 'protective effects' indicated by observational studies for some conditions. Particularly in doubt is the extent to which, if at all, low dose alcohol use confers a cardiovascular benefit (e.g., heart disease, stroke) on low level drinkers (e.g., Fillmore et al., 2006; National Health and Medical Research Council, 2020; Sherk et al., 2020; Zhao et al., 2017).

Taking these developments into account, a scenario approach was adopted to estimating alcohol-attributable mortality and morbidity by applying three alternative sets of assumptions with regard to magnitude and causality of apparent protective effects. In general terms, the three sets of assumptions represent ‘unmitigated protective effects’, ‘reduced protective effects’ and ‘no protective effects’ and are respectively depicted by low bound, central and high bound cost estimates (see Section 2.5 for further details).

Adverse health effects due to alcohol consumption result in direct costs to the health system (e.g., hospitalisations, emergency department (ED) attendances, pathology services, pharmaceuticals) and indirect costs through reduced productivity, lost years of life and increased years lived with ill-health. Alcohol-attributable costs are also incurred by the criminal justice system (e.g., police, courts, correctional services), the transport sector (e.g., road traffic crashes), workplaces and several other areas, including costs arising from family violence and child abuse.

Major cost domains

Our central estimate, based on the ‘reduced protective effect’ scenario, was that alcohol caused a net total of 5,219 deaths and around 127,000 hospital separations in the financial year 2017/18. These deaths resulted in net tangible costs of $2.6 billion in 2017/18, with hospital separations contributing a further $0.7 billion (Summary Table 1). In addition to inpatient care, the health impacts of alcohol generated considerable costs to ambulance, ED, outpatient, primary care and other health services. Newly released data (Australian Institute of Health and Welfare, 2019f), enabled estimation of costs across a greater range of services (e.g., dental, imaging) than previously possible, and will allow greater replicability of methods across different substances in the future. Overall, these non-inpatient costs, covering both outpatient and other non-hospital services, totalled $2.1 billion, which included $0.3 billion for care provided by family members and other informal carers.

Alcohol consumption results in costs to employers through lost productivity from both increased levels of absenteeism and injuries while at work. Some estimates have included further costs for reduced productivity while at work (‘presenteeism’) due to either short-term effects (acute intoxication / ‘hang-over’) or alcohol-attributed ill-health (Sullivan et al., 2019), but no suitable Australian data were found to reliably estimate presenteeism. Therefore, although calculated, it was not included in the overall total. Nevertheless, the incorporated workplace costs summed to $4.0 billion, with absenteeism accounting for nearly 90 percent of this total.

The tangible alcohol-attributed costs to the justice system, that is police, courts, detention and some costs to victims of crime, totalled $3.1 billion. The major categories of offences attributed to alcohol were driving under the influence (DUI), disorder, other offences and violence. Assaults and sexual assault were the main categories impacting on the costs borne by victims of crime (also see intangible costs below).

The cost of road traffic crashes was $2.4 billion. This figure excluded costs arising from deaths and hospital separations, which were captured elsewhere and also excluded costs from crashes where other licit or illicit drugs were identified in addition to alcohol.

The inclusion of alcohol purchases within a social cost estimate is subject to some contention. We estimated costs incurred by people dependent on alcohol, as it can be argued that their purchasing decisions are not solely driven by a rational process that maximises their long-term outcomes. Expenditure on alcohol by this group was estimated to be $1.1 billion. Similarly, prevention programs (primary and secondary) are not always included in social cost analyses, given that expenditure does not necessarily vary with the extent of alcohol use. However, under a counter-factual scenario of 'no alcohol use', these programs would not be required, so they were included in the estimate ($0.1 billion).

Drawing on a 2016 analysis (McCarthy et al., 2016), the tangible harms arising from alcohol-attributable child abuse were quantified at $0.7 billion, after excluding costs that may already be accounted for elsewhere in the report (e.g., health service costs). A report by KPMG quantified harms to women and children from domestic, family and intimate partner violence (2016). Drawing on international data (Rossow and Bye, 2012; The Lewin Group, 2013), low and high bounds for alcohol-attributed violence were constructed. From the total cost of alcohol-attributable violence, items that potentially overlapped with other sections of the report (e.g., premature mortality, justice system) were excluded. This left an estimate of $0.9 billion for alcohol-attributed domestic violence. Finally, there were costs due to child protection services and child death reviews ($0.5 billion) attributed to alcohol. The overall total for tangible costs was $18.2 billion.

Summary Table 1: Summary of alcohol-attributable costs (2017/18)

Domain	Central estimate ($)	Low bound ($)	High bound ($)
Tangible costs			
Premature mortality (Chapter 3) – net cost	2,608,950,363	2,497,313,449	2,676,413,408
Hospital morbidity (Chapter 3)	716,743,492	489,846,757	972,514,246
Other health costs (Chapter 4)	2,060,950,395	1,635,565,936	2,803,795,732
Workplace (Chapter 5)[a]	3,992,032,371	1,407,327,253	6,576,737,488
Crime (Chapter 6)	3,059,356,511	2,369,232,186	4,410,201,205
Road traffic crashes (Chapter 7)[a]	2,395,890,700	1,550,965,576	3,240,815,824
Alcohol purchases (Chapter 9)[b]	1,137,305,661	[c]	[c]
Other tangible costs (Chapter 10)	2,193,789,926	1,485,815,133	4,295,624,559
Total tangible costs	**18,165,019,419**	**12,573,371,951**	**26,113,408,123**
Intangible costs			
Premature mortality (VoSL) (Chapter 3)	25,891,775,743	17,046,019,369	108,705,701,428
Victim of crime (DALYs) (Chapter 6)	694,508,216	573,180,387	836,023,182
Morbidity (DALYs) (Chapter 9)	20,730,614,727	2,349,262,278	77,047,670,533
Child abuse (DALYs) (Chapter 10)	1,334,600,014	769,946,294	1,899,220,687
Total Intangible	**48,651,498,700**	**20,738,408,328**	**188,488,615,830**
TOTAL COST	**66,816,518,119**	**33,311,780,279**	**214,602,023,953**

[a] Excludes costs likely captured elsewhere.
[b] For those with alcohol dependence.
[c] Central estimate used in calculating totals.
DALYs = disability adjusted life year: VoSL = value of a statistical life. Totals may not sum due to rounding.
Further costs, including harms to others (Chapter 8) were estimated, but not included in the total – see summary Table 2.

Intangible costs substantially exceeded tangible costs, representing 72.8 percent of the total cost. Intangible costs of premature mortality were the most significant domain of costs, with the 5,219 instances of premature mortality resulting in an intangible cost of $25.9 billion (Summary Figure 1), and an estimated 116,735 lost years of life. In addition, lost quality of life in terms of disability adjusted life years (DALYs), for those fulfilling the criteria for alcohol dependence, was estimated to have cost $20.7 billion. In evaluating the impact of alcohol on crime, a component for the lost quality of life for victims of crime was included. These DALYs were valued at $0.7 billion. Finally, drawing on an analysis by McCarthy et al.(2016), harms of alcohol-attributable child abuse, again operationalised as DALYs, incurred a cost of $1.3 billion. The total intangible costs of alcohol were thus estimated to be $48.6 billion, making the **overall total estimated social and economic cost of alcohol in 2017/18 to Australia $66.8 billion.**

Costs tentatively identified, but excluded from the overall total

There were three domains where likely costs attributable to alcohol were estimated, but not included in overall costs (Summary Table 2). Of all illicit and licit drugs, it has been argued that alcohol is the only substance where, at a population level, the magnitude of alcohol-attributable harms experienced by others is larger than that which accrues to users, with alcohol rated above crystal methamphetamine, tobacco and heroin (Bonomo et al., 2019; Nutt et al., 2010). However, we were unable to identify a method that ensured 'double counting' would not occur in estimating a total cost that incorporated harms experienced by others. For example, DALYs were used to estimate lost quality of life from being a resident partner or child of an alcohol dependent person, but it is likely that this estimate overlapped, to an unknown extent, with intangible costs estimated for victims of crime. It was estimated that there were about 319,000 partners and 356,000 children living with an alcohol dependent person, and the resultant lost DALYs were valued at $21.8 billion, but this estimate was not included in our total cost of alcohol. Similarly, lack of reliable Australian data on the prevalence of fetal alcohol spectrum disorder (FASD) meant that we could not confidently include this in the final total. Finally, while a cost was assigned to alcohol-attributable injury and absenteeism in the workplace, there were insufficient Australian data to reliably estimate the impact of alcohol-caused presenteeism, whereby productivity was reduced due to the effects of alcohol intoxication, hangover effects or ill-health. It has been reported that the cost of presenteeism may be four times that of absenteeism (Sullivan et al., 2019), so the value in Summary Table 2 could be a significant under-estimate. Combined, these three domains could potentially add a further $42.7 billion to the overall cost of harms attributable to alcohol.

Summary Table 2: Summary of tentative cost estimate not included in 2017/18 overall total

Domain	Central estimate ($)	Low bound ($)	High bound ($)
Presenteeism (Chapter 5)	4,924,427,406	2,473,507,201	4,924,427,406
Harms to others – intangible costs to partners & children (Chapter 8)	21,800,171,769	2,302,962,116	83,797,996,341
Fetal alcohol spectrum disorder (Chapter 10)	16,000,000,000	14,400,000,000	23,300,000,000
TOTAL COSTS	**42,724,599,175**	**21,627,389,522**	**112,022,423,747**

Totals may not sum due to rounding.

Limitations

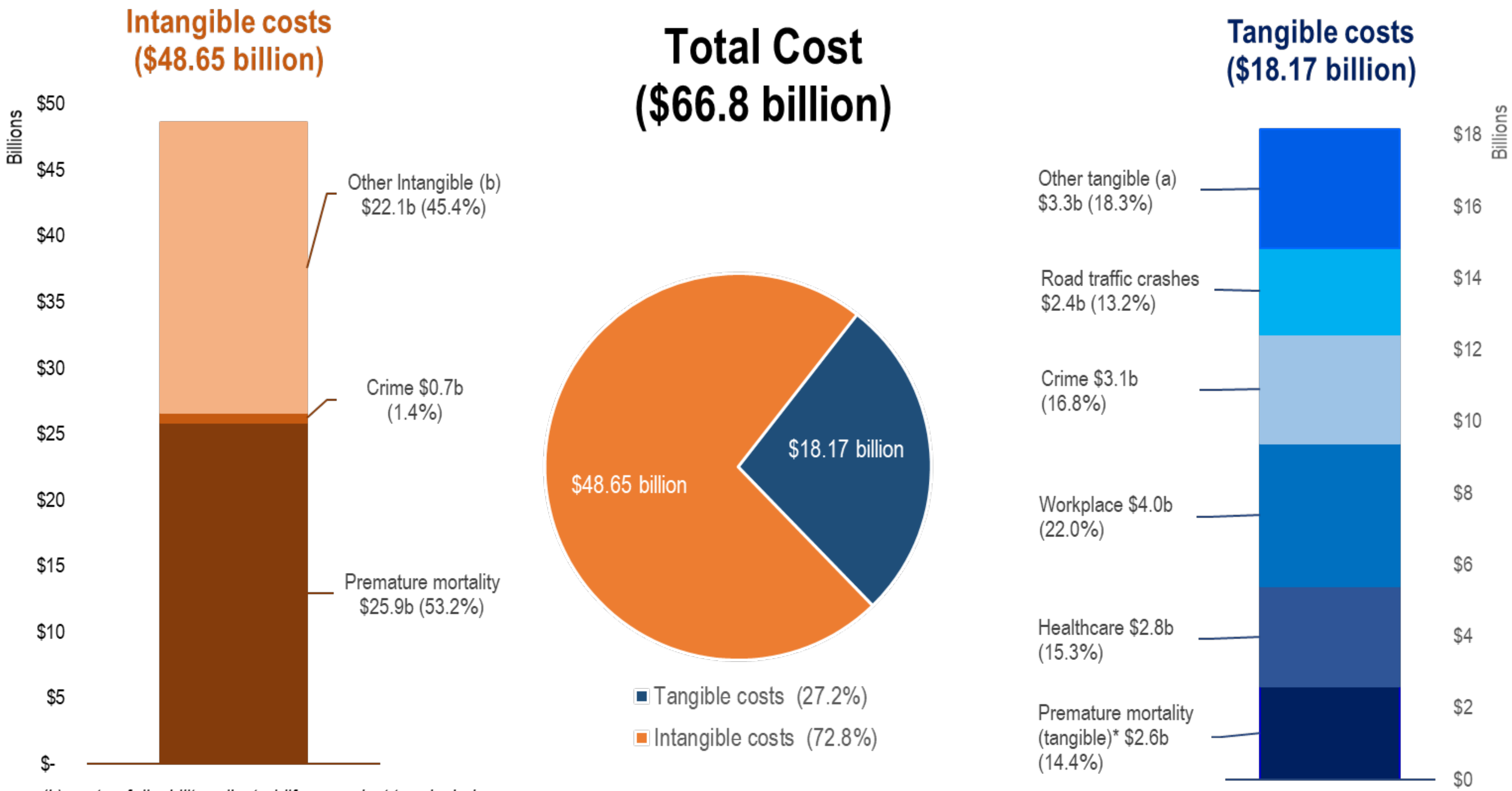
There were a number of limitations identified in attempting to estimate the overall cost of alcohol to Australia. It is clear that alcohol consumption can have serious impacts on people who either do not consume alcohol or who are lower risk consumers, however it was not possible to separate cost components in a manner that allowed overall harm to be quantified without risk of double-counting some elements. In some instances, due to insufficient Australian data upon which to base reliable estimates, we were also unable to quantify costs arising from harms identified as critical areas of action for the Australian Government. This included the wholly alcohol-attributable condition of FASD and its lifelong impacts, for which international studies have indicated that costs are likely to be substantial (Greenmyer et al., 2018; Greenmyer et al., 2020; Popova et al., 2016).

As with earlier reports in this series, it was not possible to identify the proportion of key federal agency budgets (e.g., Australian Federal Police, Australian Border Force, Federal Court) allocated to alcohol-related crime and interdiction activities. Although these costs may be less extensive than for illicit drugs, there are still costs, for example in relation to fraud and smuggling (Australian Border Force, 2019), that would involve Federal agency resources.

Conclusions

The use of alcohol has extensive social, health and economic costs to Australia, which were conservatively estimated at $66.8 billion in 2017/18, despite the exclusion of significant costs where it was not possible to either produce reliable estimates or avoid double counting across domains. The extent to which these harms extend beyond the individual alcohol consumer provides a clear rationale for interventions and policies to minimise these harms.

Summary Figure 1: Distribution of intangible and tangible costs in 2017/18



(b) costs of disability adjusted life years lost to: alcohol dependence; and, child abuse (Chapters 9 and 10).

(a) includes expenditure on alcohol (Chapter 9) domestic violence & miscellaneous costs (Chapter 10)

Infographic

WHAT DOES ALCOHOL USE COST AUSTRALIA?

33% Australians **EXCEED guidelines for low-risk consumption**
481,548 Australians are **DEPENDENT** on alcohol
5,219 **DEATHS** are alcohol-attributable

The tangible costs of alcohol use amount to $18.2 BILLION

$2.6 billion
Premature death

$3.1 billion
Crime

$2.4 billion
Road traffic crashes

$2.8 billion
Healthcare

- **$422.8 million** Ambulance/ED
- Age 65+ years 6,000 cancer hospital separations
- Age 15-34 years 13,000 mental health hospital separations

$4.0 billion
Workplace

- **$3.6 billion** Absenteeism
- **$0.4 billion** Workplace injury

$3.3 billion
Other e.g. family violence

- **$0.9 billion** Domestic violence
- **$1.1 billion** Child abuse/ protection
- **$1.1 billion** Alcohol purchases by dependent drinkers

The intangible cost of alcohol use was $48.6 BILLION

(including $25.9 billion premature death and $20.7 billion lost quality of life)

THE TOTAL COST OF ALCOHOL USE WAS $66.8 BILLION

Data from 12-month period July 2017 to June 2018

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Abbreviations

ABDS	Australian burden of disease study
ABS	Australian Bureau of Statistics
AAC	alcohol-attributable conditions
AAF	alcohol-attributable fraction
ACR	Australian Coordinating Registry
ACT	Australian Capital Territory
AF	attributable fraction
AIC	Australian Institute of Criminology
AIHW	Australian Institute of Health and Welfare
ANCOVA	analysis of covariance
ANOVA	analysis of variance
ANZSOC	Australian and New Zealand Standard Offence Classification
AODTS	alcohol and other drug treatment services
AR-DRG	Australian refined diagnosis related groups
ASSIST	alcohol, smoking and substance involvement screening test
ASSIST-lite	alcohol, smoking and substance involvement screening test short form
AUD	Australian dollar
BAC	blood/breath alcohol concentration
BEACH	bettering the evaluation and care of health
BITRE	Bureau of Infrastructure, Transport and Region Economics
CAD	Canadian dollar
CI	confidence intervals
COD URF	cause of death unit record file
CPI	consumer price index
DALYs	disability adjusted life years
DES	disease expenditure study
DPP	Department of Public Prosecution
DUI	driving under the influence
DUMA	drug use monitoring Australia
ED	emergency department
EUR	European currency unit
FASD	fetal alcohol spectrum disorder
GBD	global burden of disease
GDP	gross domestic product
GOM	Guardianship of the Minister
GP	general practice/practitioner
GSP	gross state product
GST	goods and services tax
HIV	human immunodeficiency virus
ICD	international classification of disease
IHD	ischaemic heart disease
IHPA	independent hospital pricing authority
InterMAHP	international model of alcohol harms and policies
MBS	Medicare benefit scheme
MSO	most serious offence
MVC	motor vehicle crash
NAIP	national alcohol indicators project
NCETA	National Centre for Education and Training on Addiction
NDRI	National Drug Research Institute
NDSHS	national drug strategy household survey
NEC	not elsewhere classified:
NHCDC	national hospital cost data collection
NHMD	national hospital morbidity database
NHMRC	National Health and Medical Research Council
NPV	net present value
NSW	New South Wales
NT	Northern Territory
OR	odds ratio
PAAF	population alcohol-attributable fractions
PBS	pharmaceutical benefits scheme
PICOS	participants, interventions and comparators, outcomes & study design
QALYs	quality adjust life years
QLD	Queensland
RBT	random breath test
RoGS	Report on Government Services
RR	relative risk
RTA	road traffic accidents
SA	South Australia/Australian
SEIFA	socio-economic indexes for areas
TAFE	technical and further education
URG	urgency related group
USD	United States dollar
US Dot	United States Department of Transportation
VIC	Victoria/Victorian
VoSL	value of a statistical life
VoSLY	value of a statistical life year
WA	Western Australia/Australian
WHO	World Health Organization
YLL	years of life lost

CHAPTER 1: INTRODUCTION

Steve Whetton, Robert J. Tait, Tania Dey, William Gilmore, Alice McEntee, Aqif Mukhtar, Suraya Abdul Halim, Ann Roche, Steve Allsop & Tanya Chikritzhs

1.1 Rationale

The National Drug Research Institute (NDRI) at Curtin University was engaged by the Australian Government Department of Health to undertake this research into the costs of alcohol to Australia, in collaboration with a multi-disciplinary team of Australian researchers from: the South Australian Centre for Economic Studies, University of Adelaide; and, the National Centre for Education and Training on Addiction (NCETA), Flinders University.

The aim of the study was to produce a comprehensive national estimate of the social and economic costs of alcohol use to Australia in 2017/18. The estimate included costs arising from consumption of both 'home-made' and commercially produced alcohol as it was not feasible to separate these classes – although in Australia, home-made or unrecorded alcohol is thought to make a negligible contribution to overall consumption (Huckle et al., 2020). While all cost domains were eligible for inclusion, we recognised that in some areas there were insufficient data or established methods to enable costs to be calculated. In these instances, where possible, estimates were made but not included in the overall estimate, or where no estimate was possible, this was noted. This report is the fifth in a series of social cost studies that have assessed costs due to both illicit (i.e., methamphetamine, cannabis, extra-medical opioids (Whetton et al., 2016; Whetton et al., 2020a, b)) and licit drugs (i.e., tobacco (Whetton et al., 2019)). The reports are based on similar underlying methods, but with variations reflecting available data: in this instance the approach was most closely aligned with that used in the determination of the social cost of tobacco use (Whetton et al., 2019). Nevertheless, where available, more comprehensive data or refined methods for modelling alcohol were preferred over "replication" of methods used in the earlier reports.

The remainder of this chapter provides a brief context of alcohol use in Australia, with a particular focus on social costs studies since the seminal national analysis by Collins and Lapsley (2008). In addition, Appendix 1.1 contains results of a rapid review of the international literature since 2015. Comparing social costs between countries is problematic due to differences in the social context of alcohol use and in costs structures, for example in health costs or in the criminal justice system. Nevertheless, these studies provided information on the range of domains where costs are likely to be incurred.

Chapter 2 provides an overview of the approach taken to economic analysis and the underpinning rationale. Chapter 3 describes epidemiological and economic methods applied in the quantification of alcohol-attributable[1] deaths and hospital separations (inpatient) and their resultant social costs. This component was undertaken in parallel with NDRI's long-running alcohol use and surveillance project, the National Alcohol Indicators Project (NAIP) (Chikritzhs, 2009; Gilmore et al., 2021; National Drug Research Institute, 2021) (also funded by the Australian Government Department of Health). For net deaths, years of life lost (YLL) were estimated from national averages by age and sex, before estimating tangible and intangible costs. Costs of net inpatient hospital separations were based on Independent Hospital Pricing Authority (IHPA) estimates of average cost per separation (Independent Hospital Pricing

[1] We use the term "alcohol-attributable" to denote alcohol caused. "Alcohol-related" is used to denote conditions where alcohol is a potential cause (e.g., bowel cancer) before applying the relevant attributable fraction (Sherk et al., 2019).

Authority, 2020). Chapter 4 addresses health costs incurred beyond inpatient care including emergency department (ED), outpatient, ambulance, primary care, and alcohol treatment services, and outlines methods used.

Workplace costs in terms of accidents, injuries and absenteeism are set out in Chapter 5. Note, workplace deaths and work-related road traffic crashes are dealt with in other chapters. In Chapter 6, attribution of costs to the criminal justice system were based on the Drug Use Monitoring Australia (DUMA) survey (Australian Institute of Criminology, 2020) and included costs to: police; courts; prisons; community corrections; and, victims of crime. Chapter 7 focuses specifically on costs arising from alcohol-attributable road-traffic accidents. To avoid 'double counting', deaths and health system costs were excluded from this chapter.

Estimated costs arising from harms to those living with a person with alcohol dependence, particularly costs from lost quality of life for partners and children, are presented in Chapter 8. The approach used in this chapter mirrors methods used in previous reports and these harms were not included in the overall total due to ongoing debate about how best to estimate them, and how to avoid double counting with other cost items. Chapter 9 provides a tentative estimate of the costs to those defined as 'dependent' on alcohol both in terms of their lost quality of life from dependence, lost quality of life from alcohol-attributable illness and injury, and for the purchase of alcohol.

Chapter 10 reports on a selection of other cost areas including child protection system costs, alcohol misuse prevention programs and injuries arising from family violence. Chapter 11 summarises the revenue impacts of alcohol use and examines which groups (households, businesses or governments) face the tangible costs of alcohol consumption. The final chapter discusses the findings and implications arising from the analysis.

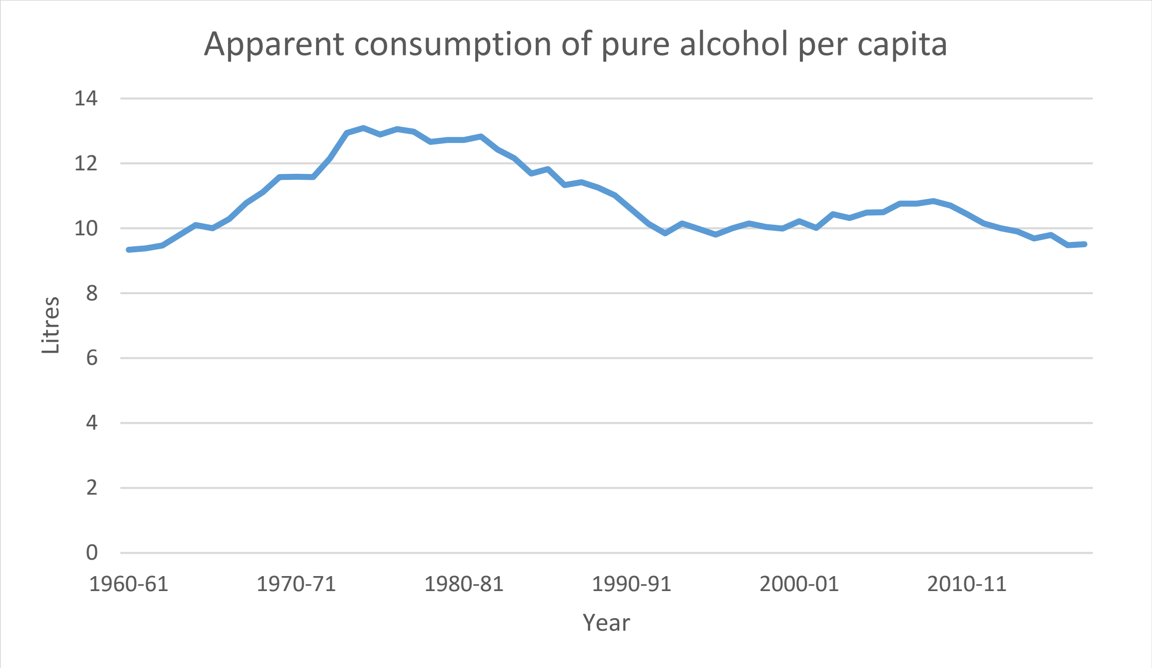
1.2 Background

The 2019 National Drug Strategy Household Survey (NDSHS) (Australian Institute of Health and Welfare, 2020d) reported on the proportion of Australian residents exceeding the then national guidelines for reducing alcohol-related harm (National Health and Medical Research Council, 2009). According to the NDSHS, 24.8 percent of people exceeded four standard drinks on a single occasion at least once a month, and 16.8 percent exceeded two drinks-per-day[2]. However, these estimates are part of a downward trend, with the percentage exceeding single occasion guidelines having declined from about 30 percent in 2001 and lifetime risk falling from about 21 percent (Australian Institute of Health and Welfare, 2020d).

This trend is also supported by excise and sales data that show that over the past 60 years the amount of alcohol consumed-per-person has varied from 9.34 litres in 1960/61 to 13.09 litres in 1974/75, with a steady decline over the past decade to 9.5 litres in 2017/18 (see Figure 1.1) (Australian Bureau of Statistics, 2019f). However, the overall decline in alcohol use may conceal some important differences by specific groups. In particular, about two-thirds of the decline in alcohol use between 2007 and 2013 occurred in those aged under 30, with some older age groups increasing their consumption (Livingston and Dietze, 2016).

[2] These levels relate to NHMRC Australian Guidelines to Reduce Health Risks from Drinking Alcohol published in 2009. The current guidelines now recommend no more than 10 standard drinks per week and no more than four drinks on a single occasion (National Health and Medical Research Council, 2020).

Figure 1.1: Apparent alcohol consumed per year, age 15 and older 1960/61 to 2017/18



Note: A number of changes in methodology occurred from 2008-09 to 2017-18, therefore, comparisons between these years should be interpreted with caution. See source for details (Australian Bureau of Statistics, 2019f).

It is also notable that the new national guidelines to reduce harms from alcohol-related disease or injury, released in December 2020, lowered the weekly recommended maximum for low-risk consumption from 14 standard drinks or less (National Health and Medical Research Council, 2009) to no more than 10 standard drinks (National Health and Medical Research Council, 2020). This change reflected the National Health and Medical Research Council's (NHMRC's) review of the latest body of scientific research evidence concerning alcohol's effects on human health. As such, compared to the previous guidelines, a larger proportion of the Australian population is considered to be drinking in excess of recommended maximum consumption levels (Australian Institute of Health and Welfare, 2021b).

While the total amount of alcohol consumed is one factor underpinning the harms arising from its use, it is not the only determinant. The drinker's age, gender, genetics, socioeconomic status and setting are also important considerations. Further, alcohol use may also harm and incur costs for other people, for example, through road traffic crashes, violence and reduced quality of life for those exposed to negative behaviours related to intoxication (Laslett et al., 2019).The most recent Australian burden of disease study (ABDS) estimated that alcohol use accounted for 4.5 percent of the total disease burden (Australian Institute of Health and Welfare, 2019h). Alcohol-attributable injuries (14.1%), mental health conditions (12.0%) and gastro-intestinal disorders (10.5%) made the largest contributions to disease burden, with males (6.0%) incurring a higher alcohol-caused burden than females (2.8%) (Australian Institute of Health and Welfare, 2019h).

1.3 Australian alcohol social cost studies

The most recent national estimate of alcohol's social costs was derived from 2004/05 data and estimated that the cost of alcohol consumption to Australia was $15.3 billion. This total comprised $10.8 billion in tangible costs with an additional $4.5 billion incurred through intangible costs (Collins and Lapsley, 2008). Notably, the analysis adjusted for 2,437 deaths that were "prevented" by moderate consumption of alcohol, with more than 114,000 hospital bed-days "saved" by this consumption. Since that time, and as reflected in the updated Australian guidelines for low-risk alcohol consumption (National Health and Medical Research Council, 2020), there is recognition that the epidemiological evidence has changed for causal effects of alcohol on a range of health conditions. In particular, it is noted in the guidelines that the evidence for apparent protective effects of low-level alcohol use on cardiovascular diseases has been increasingly challenged by new studies with improved design and methods. Overall, it is suggested that apparent cardio-protective effects derived from observational studies may be an artefact of design weakness and methodological error (Chikritzhs et al., 2015; Sherk et al., 2019). Conversely, the evidence for causal effects of alcohol on cancer, even at low levels of use, has strengthened and the range of cancer types in which alcohol has a partially causal role has increased in the past 15 years or so, such that low levels of consumption, from about one standard drink-per-day, are associated with an increased risk of some cancers (National Health and Medical Research Council, 2020; University of Sydney, 2018). Major changes in the underlying epidemiological evidence for causal relationships such as these can have substantial impacts on the magnitude of social cost estimates.

Table 1.1 shows Australian social cost studies conducted since the last in a series of national reports on alcohol and other drug use by Collins and Lapsley (1991, 1996, 2002, 2008). Six of the nine more recent cost studies focused on: New South Wales (NSW) (New South Wales Auditor General, 2013); the Northern Territory (NT) (Smith et al., 2019); alcohol caused absenteeism (Roche et al., 2016); harms to co-workers (Dale and Livingston, 2010); harms to others more broadly (Laslett et al., 2010); and, potential gains from reducing high-risk alcohol consumption (Cadilhac et al., 2009). Two studies provided comprehensive national estimates: the report by Collins and Lapsley (2008) based on 2004/05 data, and the summary paper drawing on 2010 data by Manning and colleagues (2013). The latter provided a concise summary of costs and an overview of their approach, but further details on methods used and data accessed were not available (personal communication, Manning, September 2020). The last paper was a systematic review of preventable disease risk factors which included most of these reports (Crosland et al., 2019).

Table 1.1: Australian social cost of alcohol studies published between 2008 and 2020

Report	Target year	Conditions included	Total ($billion)	2017/18 values ($billion)[b]
Collins & Lapsley (2008)	2004/05	Tangible (e.g., crime, health productivity, RTC); Intangible (deaths; RTC morbidity)	15.318	21.069
Cadihac (2009)	2008	(Reducing high-risk use) Productivity & health	3.499	4.282
Dale (2010)	2008	Costs to co-worker	0.453	0.554
Laslett (2010)	2008	Harms to others (tangible & intangible)	20.60	25.750
Manning (2013)	2010	Justice, health, workplace, RTC	14.352	16.794
NSW AG (2013)	2010	Cost to NSW government & NSW society (police, heath, justice, workplace, RTC)	3.867	4.525
Roche (2016)	2013	Absenteeism	2.022	2.205
Smith[a] (2019)	2015/16	Tangible & intangible costs in NT	1.387	1.434
Crosland (2019)	2016/17	Systematic review (health & other expenditure)[c]	1.119-16.217	1.141-16.740

[a] Update of 2009 report: 2004/05 cost $642 million.
[b] Costs were updated to December 2017 from the mid-point of the study period.
[c] Costs vary widely reflecting the areas eligible for inclusion in each study.

1.4 Conclusions

Past ABDS (Australian Institute of Health and Welfare, 2016, 2019h; Begg et al., 2007; Sherk et al., 2019) have identified the substantial net harm arising from alcohol consumption, and social cost studies (Table 1.1) have demonstrated the diversity of domains alcohol use impacts. However, few studies reflect current understanding and interpretation of observational studies (Chikritzhs et al., 2015; Sherk et al., 2019) and encompass a compressive assessment including harms due to drinking by other people.

1.5 Human research ethics approval

This study was approved by Curtin University Human Research Ethics Committee (ID 2020-0675). The NAIP was approved by the same committee (ID 138/2013).

CHAPTER 2: OVERVIEW OF APPROACH TO ECONOMIC ANALYSIS

Steve Whetton & Tanya Chikritzhs

2.1 Background: Approach to economic analysis

Social cost studies are conducted to estimate the total costs of a disease, condition, or behaviour across society. They are usually undertaken to: inform policy; identify gaps in knowledge; support advocacy; and, potentially, provide a baseline against which interventions can be assessed (Larg and Moss, 2011; Rice, 1994; Single et al., 2003). However, the approach of monetarising outcomes and harms from different areas has been criticised, with the suggestion that the underlying raw data are more informative, and less subjective than calculated values (Makela, 2012). Despite these concerns, social cost studies continue to be conducted for a diverse range of conditions and behaviours (Makate et al., 2019; Mihalopoulos et al., 2020; Oliveira et al., 2019; Pezzullo et al., 2019).

In conducting a social cost analysis, it is first necessary to define which costs are eligible for inclusion and the timeframe in which those costs occur. Next, the prevalence of use needs to be estimated, preferably by the level of potential harm due to differing levels of consumption. In considering the harms caused by consumption, there are some harms that are wholly caused by the substance in question and other harms where consumption is only one of several potential causes of an adverse outcome: for these conditions attributable fractions (AF)[3] need to be calculated. Finally, data needs to be obtained to estimate the costs that arise from each type of harm.

2.2 Social versus private costs

Typically, in assessing social costs, any net costs to the individual consumer themselves are excluded from the estimate on the assumption that purchasing decisions will include an evaluation of all of the benefits and costs that the individual will derive from that product, including future health risks. More formally, engaging in unhealthy or risky behaviours involves consideration of the marginal costs (e.g., purchase of a product, reduced life expectancy or ill-health) *versus* marginal benefits (e.g., pleasure of consumption, social acceptance) and choices regarding consumption will be based on maximisation of the present discounted value of lifetime utility (Cawley and Ruhm, 2011). However, it can be argued that in the case of drugs of dependence, consumers may not be making fully informed or rational decisions.

Nevertheless, some have argued that it is reasonable to exclude costs to the individual consumer even in case of drugs of dependence. For example, the influential Theory of Rational Addiction (Becker and Murphy, 1988) posits that consumption of drugs of dependence are part of a self-controlled, rational process that involves individuals maximising their utility across the current consumption of the drug, the stock of the drug previously consumed and anticipated future temporary or permanent price changes (Becker and Murphy, 1988). However, research data conflict with some of the core assumptions of the Theory of Rational Addiction, with empirical studies suggesting that most consumers:

- underestimate how likely they are to become dependent on the drug (Gruber and Köszegi, 2001; Kenkel, 1991);
- typically have incomplete information on the potential health impacts and especially underestimate the impacts on themselves (Gruber and Köszegi, 2001; Kenkel, 1991;

[3] In the case of this report, alcohol-attributable fractions (AAF).

Khwaja et al., 2007; Smith et al., 2008; US Department of Health and Human Services, 1994);
- rely on 'rules of thumb' and incomplete information in making decisions (Akerlof, 1991; Suranovic et al., 1999);
- have changing preferences for the drug (e.g., positive views about smoking when first consuming tobacco, but subsequently wishing they had never started (Angeletos et al., 2001; Gruber and Köszegi, 2001; Laibson, 2001)); and,
- from a theoretical perspective, Rogeberg also notes that the model abstracts too much from the information available to substance users and the choice sets that they face to be applicable to real world situations, and that the broad brush nature of the core assumptions of the extended utility model mean that any apparent empirical support for the theory cannot be relied upon (Rogeberg, 2020).

To the extent that the consumption of drugs of dependence might or might not be undertaken in a fully informed manner or with a wholly rational decision-making process, then any costs arising can be considered from a policy perspective. Thus, policies could be implemented such that people who use drugs fully internalised all the costs, for example by increasing information on harms or reducing availability (U.S. National Cancer Institute and World Health Organization, 2016). Building on the strengths of the Rational Addiction Model but addressing some of its shortcomings, Gruber and Köszegi (2001) proposed Internality Theory. A major implication of their model was that governments are justified in tackling the internal costs of drugs, for example by having controls on availability. Following from this position is the question of how, if at all, such costs should be incorporated within a social cost framework.

One of three approaches to dealing with costs to the consumer themselves are generally adopted:
- Some social cost studies continue to exclude costs borne by the substance users themselves either because the authors consider the 'rational addiction' hypothesis to still be a useful framework, or due to the difficulty in identifying what net costs borne by the user should be included as a social cost.
- Some studies include only those costs to consumers regarded as most closely related to dependent use (potentially including their expenditure induced by dependence), or where imperfect information is regarded as particularly significant (e.g., costs related to premature mortality) but to disregard internal costs incurred by non-dependent users. For example, Collins and Lapsley (2008) included the intangible costs of premature mortality of all substance users, and the expenditure by dependent users on the drug of dependence. The rationale for this approach is that few of the key assumptions underpinning the 'rational addiction' hypothesis are likely to be fulfilled for persons dependent on a substance, with continued consumption amongst individuals who are dependent likely to be mainly driven by the dependence rather than fully informed and rational decisions.
- Finally, some studies consider *any* indirect costs arising from consumption of a substance as a social cost as well as costs directly arising from dependence. The rationale for this approach is that the condition of fully informed rational consumers maximising welfare across their lifetime is fulfilled by relatively few consumers of intoxicating substances given gaps in knowledge around risk and the extent to which intoxication can impair judgement. Expenditure on the drug incurred by those who are not dependent is still generally considered as ineligible.

Consistent with the approach used in previous reports (Whetton et al., 2016; Whetton et al., 2019; Whetton et al., 2020a, b), the current study adopted the second approach and included internal costs incurred by those classified as dependent on alcohol, as this group constitutes those least likely to make consumption decisions that are fully informed, rational and self-controlled (in other words, we have used the internality model rather than the rational addiction model as our analytical framework). Internal costs borne by drinkers who were not dependent were excluded where possible, except in those cases where information imperfections were considered to be most significant (most notably in the case of premature mortality).

2.3 Timeframe

The target year for the study was the financial year 2017/18: this was chosen as a compromise between recency and the availability of data. In particular, mortality data (2017 calendar year used in this case) are subject to delay, for example, the requirement to finalise coronial proceedings in determining the cause of death.

2.4 Approaches to estimating social costs

The two main approaches used in social cost studies are those based on prevalent cases and those using incident cases. The former evaluates the costs from all existing cases regardless of when harms occurred. This approach is typically used to determine the burden of a disease and aids in the identification of social and healthcare policies to tackle the results of drug use. The incident approach assesses new cases of harm that occur in the target year and their lifetime costs (Vella et al., 2019). Of the two, the prevalence approach is far more widely used (Vella et al., 2019).

The current study adopted the prevalence approach to provide an estimate of the resources required to address the harms identified during the study year. Furthermore, for most conditions, the lifetime (or until the condition resolves) stream of costs is uncertain. Nevertheless, we deviated from this approach in two areas. First, in estimating the costs of premature mortality there are established methods in evaluating the value of the years of life lost (YLL) and we included the present value of all future costs of alcohol-attributable deaths that occurred in the study year. Second, long-term costs of imprisonment for alcohol-attributed crime that occurred in the study year could be estimated into the future, so again the discounted value of future costs were included.

The study selected the indirect method of calculating population alcohol-attributable fractions (PAAF) in preference to the direct method of calculating these fractions. The latter approach is based on a study making a direct attribution on a case-by-case basis of the contribution of substance use to the condition or injury (e.g., a study could analyse incident report data to identify the proportion of house fire injuries where the cause of ignition was inattention due to intoxication). Direct attribution has important limitations, such as variability in the criteria used to determine attribution, observer variation, and a failure to reflect the exposure patterns of the population to which it is being applied. It also reflects the consumption patterns at the time and place of the original study (although established methods exist to adjust AF estimated by direct methods for differences in consumption behaviour). Direct methods are generally only used when there are no estimates of the relative risk of the condition of interest.

2.5 Identifying the scale of harms arising from alcohol use in Australia for 2017/18

The current study aimed to estimate the net social costs of alcohol use for the financial year 2017/18. In relation to the major cost domains, we first sought information on conditions that were wholly or partially attributable to the use of alcohol. Then we estimated the number of people who died (via the Australian Coordinating Registry (ACR)) and the number of hospital separations (via the Australian Institute of Health and Welfare (AIHW)). This modelling followed the International Model of Alcohol Harms and Policies (InterMAHP) (Sherk et al., 2017a) approach with alcohol exposure estimated from national per capita alcohol sales data for those aged 15 years and older (Australian Bureau of Statistics, 2019f), the prevalence of current drinkers (any use in the past 12 months) and life-time abstainers from the National Drug Strategy Household Survey (NDSHS) (Australian Institute of Health and Welfare, 2020d).

Other health care events were primarily extrapolated from the AIHW 2015/16 report on disease expenditure (Australian Institute of Health and Welfare, 2019g), with attribution calculated on a condition basis using the proportion of hospital separations for that condition caused by alcohol.

Workplace costs were limited to those that arose from absenteeism, injury and illness and were estimated from Safe Work Australia (2015) data and the NDSHS (Australian Institute of Health and Welfare, 2020d). The cost of alcohol caused presenteeism was quantified, however it was not included in the final cost estimate due to a lack of Australian data. Work-related deaths and road traffic crashes (RTC) were respectively included elsewhere with other deaths and RTC more broadly.

In relation to the criminal justice system, the equivalent of PAAF were derived from the Drug Use Monitoring Australia (DUMA) survey: these PAAF were applied to police, courts, prisons and victims of crime data.

Spending on alcohol products by dependent drinkers used estimates of the number of people who could be classified as having alcohol dependence from the GBD compare tool (Institute for Health Metrics and Evaluation, 2019).

Estimation of the intangible costs to dependent alcohol users who in 2017/18 were experiencing disability, pain and other reductions to quality of life due to alcohol-attributable disease drew on the number of people who could be classified as having alcohol dependence from the Global Burden of Disease (GBD) compare tool (Institute for Health Metrics and Evaluation, 2019) and the estimated number of alcohol-attributable cases of the included conditions.

Finally, we estimated the long-term future costs of lost productivity as well as the avoided health care costs associated with the alcohol-attributable deaths estimated to have occurred in 2017/18, as well as the intangible cost of those deaths.

For some measures, such as harms to other people from living with a person with dependence, the number of co-residents had to be derived from the NDSHS data (Australian Institute of Health and Welfare, 2020d). This figure was then adjusted to reflect the age and gender distribution of the GBD cohort relative to those identified via the proxy measure of dependence extracted from NDSHS data. In the 2019 survey, the NDSHS included a modified version of the three-item alcohol, smoking and substance involvement screening test (ASSIST-Lite) (Ali et al., 2013) as an indicator of alcohol dependence. Those scoring three or more on the alcohol module were classified as high-risk, which may indicate substance dependence.

2.6 Epidemiological basis for cost calculations: Which people who use alcohol are included?

The harms arising from alcohol use are likely to vary due to a range of personal, genetic and environmental factors. However, available data were often limited to measures of frequency and quantity consumed. In some cases, the prevalence of interest may be "any use" over the past year, which approximates to all people who currently use alcohol. In other cases, in estimating the extent of harms or costs, the focus of interest may be just on those who are dependent on alcohol. Finally, those harmed by another person's alcohol use may or may not be alcohol consumers themselves.

As noted in Section 2.5, one estimate of the prevalence of alcohol dependence came from the GBD. The GBD reports data by calendar year, so the mean values for 2017 and 2018 were used (Table 2.1)[4]. To estimate the national prevalence of conditions, the GBD systematically reviews the literature on each topic to identify reports on the prevalence, incidence, remission and excess mortality: these reports need to include a measure of clinical "caseness" (e.g., based on International Classification of Diseases (ICD) criteria). Prevalence by age, sex, year and country is estimated using DisMod-MR[5] modelling. Due to the potential for under-reporting of stigmatised behaviours in responding to surveys, the GBD also employs indirect methods including back-projection and capture-recapture with these estimates used to adjust ("crosswalk") prevalence estimation derived from surveys (Vos et al., 2017)[6]. Notably, the GBD study does not estimate the prevalence of alcohol use which does not fulfil clinical criteria.

Table 2.1: Estimated mean prevalence of alcohol dependence for ages 15 years and older, 2017/18

Cohort	Central estimate % (N)	Low bound % (N)	High bound % (N)
Males	3.15 (312,193)	2.19 (216,849)	4.27 (422,489)
Females	1.66 (169,354)	1.10 (112,247)	2.38 (243,386)
Total	**2.39 (481,548)**	**1.64 (329,096)**	**3.31 (665,875)**

Sources: Institute for Health Metrics and Evaluation (2020); Australian Bureau of Statistics (2019h).
Totals may not sum due to rounding.

A second source of data was the NDSHS (Australian Institute of Health and Welfare, 2020d). The NDSHS is a triennial national survey of the use of licit (i.e., alcohol, tobacco) and illicit drugs (cannabis, methamphetamine, cocaine, heroin, etc.). The survey collects demographic information, measures wellbeing, and gathers opinions on alcohol and other drug issues. The NDSHS uses a complex multi-stage probabilistic sampling framework in an attempt to collect data on a representative sample of Australians. The response rate for the 2019 survey was 49.1 percent[7]. In 2019 the NDSHS surveyed 22,274 individuals aged 14[8] years and over in Australia (Australian Institute of Health and Welfare, 2019j). In 2019, more than 70 percent of Australians aged 14 years or older had used alcohol in the past 12 months (Australian Institute of Health and Welfare, 2020c). Notably, there has been a significant decline

[4] Percentage based on 20.13 million aged 15 years and older (Australian Bureau of Statistics, 2019h).
[5] Disease modelling meta-regression software.
[6] Details of the method used by the GBD can be found in Vos et al. (2017, supplementary appendix 1).
[7] Based on contact made with in-scope households.
[8] In previous surveys people aged 12 years and older were eligible.

in the proportion drinking daily from 6.0 percent in 2016 to 5.4 percent in 2019 (Australian Institute of Health and Welfare, 2020c) with the prevalence of daily alcohol use significantly declining for males but not for females over the same timeframe. There was a correspondingly significant increase in the prevalence of both male and female ex-drinkers between 2016 and 2019. Table 2.2 shows the prevalence and estimated number in each consumption category for those aged 15 years and older [9].

The estimate of the number of people who were dependent on alcohol varies markedly between the Institute for Health Metrics and Evaluation (2020) estimate (481,548) and that derived from the ASSIST-lite reported in the 2019 NDSHS (1,505,000) (Australian Institute of Health and Welfare, 2020d). The former estimate was used given the clinical data that underpin it, whereas the ASSIST-lite is a screening instrument that indicated risk of dependence.

Table 2.2: Estimated prevalence of alcohol use for ages 15 years or older by frequency of use in the past year, 2017/18[a]

Alcohol use category	Female % (N)	Male % (N)	Persons % (N)
Daily	4.0 (412,000)	7.0 (703,000)	5.5 (1,115,000)
Weekly	29.8 (3,072,000)	41.3 (4,133,000)	35.5 (7,205,000)
Monthly	23.0 (2,375,000)	19.7 (1,969,000)	21.4 (4,344,000)
Less than monthly	18.5 (1,902,000)	12.3 (1,230,000)	15.4 (3,132,000)
Ex-drinker [b]	9.9 (1,016,000)	8.1 (815,000)	9.0 (1,831,000)
Never a full-glass of alcohol	14.8 (1,526,000)	10.5 (1,155,000)	13.2 (2,681,000)
ASSIST-Lite ‘dependent’[c]	4.5 (476,000)	10.3 (1,029,000)	7.3 (1,505,000)

Sources: NDSHS (Australian Institute of Health and Welfare, 2020c); [10] ABS (2019h).

[a] N calculated by authors: rounded to 1000.

[b] Consumed at least a full serve alcohol, but has not had an alcoholic drink in the previous 12 months.

[c] ASSIST-Lite = Alcohol, Smoking and Substance Involvement Screening Test (Ali et al., 2013): high risk scores indicate likely alcohol dependence.

2.7 Excluded items

Following the approach of Collins and Lapsley (2008), we did not include in the overall cost any government revenue from excise and customs duty (formally, these are transfer payments). Nevertheless, these are documented separately in Chapter 11. When estimating the costs of tobacco to Australia, we followed the convention of excluding costs arising from Quit campaigns, prevention programs and education initiatives (Whetton et al., 2019). However, in this report, as with our earlier analyses of illicit drugs (Whetton et al., 2016; Whetton et al., 2020a, b), these alcohol-related programs are included and reported in Chapter 10.

2.8 Limitations

There are a number of limitations which are general to social cost studies or that apply to several chapters: these are discussed here. There are also some specific limitations which may only apply to a single data source or interpretation that are addressed in the relevant chapters. Typically, social cost

[9] Age 15 years and older to align with the alcohol sales data and GBD prevalence data.

[10] To ensure confidentiality, some data are removed from the NDSHS confidential unit record file (Australian Institute of Health and Welfare, 2020b), so figures may not exactly match public reports (e.g., (Australian Institute of Health and Welfare, 2020c)): therefore, where available, we use publicly available data.

analyses need to extract information on costs and resource allocations from administrative datasets, which are not necessarily designed with this purpose in mind. The hospital morbidity data provides a rare example of where events and the associated costs incurred are closely related. Hospital separation costs are available via Australian Refined Diagnosis Related Groups (AR-DRG) codes (Independent Hospital Pricing Authority, 2020) with each AR-DRG code assigned a costweight that enables the average cost of that treatment to be calculated. In other domains, for example police and other criminal justice systems, a series of assumptions are required in estimating the proportion of the pertinent budget to be allocated to each type of event. These assumptions are made explicit within the relevant chapters. Nevertheless, there remained areas where a sound rationale was unable to be provided for the allocation of a proportion of the budget. Thus, for the Australian Federal Police, Australian Border Force and Federal Court there will be alcohol-related crime and interdiction activities. Although these costs are likely to be less extensive than for illicit drugs, there are still costs, for example in relation to fraud and smuggling (Australian Border Force, 2019), that would involve the resources of Federal agencies but for which no cost could be assigned.

There are also domains where harms and costs clearly arise, but where there are insufficient data to allow either their calculation or to ensure that their inclusion does not result in ‘double counting’. Alcohol consumption can have serious impacts on other people who may not consume alcohol or who are lower risk consumers. In Chapter 8, DALYs were used to estimate the lost quality of life from being a resident partner or financially dependent child of a person with alcohol dependence, but to avoid potential double counting, these costs were not included in the overall total.

In estimating the intangible costs via the DALYs lost, it was assumed that children and partners would suffer the same level of lost quality of life, and given the formative stage of the field, further adjustment for potential differences seemed unwarranted. Also given the formative stage of research, an initial estimate of harms to other resident adults and children has been provided, but again, not included in the total. It was noted that no studies were identified that directly estimated the DALYs lost as a result of living with a person dependent on alcohol; instead, the analysis drew on studies that estimated the quality of life impact relative to the DALYs lost for the substance user themselves. It is also possible that some of the DALYs lost through residing with a person dependent on alcohol are captured in other costs reported in this study, such as the intangible costs to victims of crime.

There were also harms, such as fetal alcohol spectrum disorder (FASD) where there were insufficient Australian data to allow any reliable estimate to be made, even though cases would be entirely attributable to alcohol use. In addition to FASD, there is limited understanding of the dose response relationship between maternal consumption, gestational stage and conditions such as stillbirth, low birthweight and sudden infant death syndrome. As such, these conditions related to the impacts of maternal consumption on the foetus have been excluded from this analysis due to limitations in the data on consumption of alcohol during pregnancy.

Owing to the delay between the time of death and the closure of a coronial case, there is the potential that not all alcohol-attributable deaths will be captured in this study, in particular deaths from assault/homicide are likely to be (at least slightly) underestimated in the available deaths data for 2017/18.

In estimating the costs due to premature mortality, national data by age and sex on life expectancy were used (Australian Bureau of Statistics, 2019e), with no adjustment for Aboriginal and/or Torres Strait Islander (Indigenous) status. Given the shorter life expectancy for Indigenous Australians (Australian Institute of Health and Welfare, 2021a), this will result in an over-estimation of YLL. The advantage of not reporting data subdivided by age, sex and Indigenous status is that fewer cells in the cause of death (and hospital separations) tables (Tables 3.3 and 3.6) will be suppressed[11], allowing greater precision in the interpretation of specific causes.

2.9 Conclusions

Analysis of harms caused by alcohol is more complex than for harms caused by tobacco or illicit drugs due to the potential for low amounts of alcohol use to confer some health benefits, although the actual extent of these benefits is contested. Therefore, we provided a range of values in relation to cardiovascular disease and type 2 diabetes mellitus, including 'no protective' effect. In addition, increased evidence of alcohol-attributable deaths and morbidity from cancer, is likely to greatly impact the social and economic costs due to alcohol.

It is also important to acknowledge the evolving science underpinning the estimation of alcohol-attributable harm. An analysis of cohort studies, which are fundamental to calculating RR, noted that the average age of those in the relevant studies was more than 50 years, but that more than 38 percent of alcohol-attributable deaths occur before the age of 50 (Naimi et al., 2019). Thus, an analysis of alcohol-attributable deaths among those who have 'survived' to enter cohort studies is likely to incur substantial selection biases. Overall, methods used in these estimates continue to be refined and interpretations improved (Rehm and Imtiaz, 2016).

Given the uncertainly of some elements of the data, where possible, plausible high and low bound estimates have also been provided. For example, where there are alternative methods or sources of data that could be used to estimate costs: these approaches are described in the relevant chapters.

[11] As required to preserve confidentiality (see Section 3.2.1).

CHAPTER 3: DEATHS AND HOSPITAL SEPARATIONS

William Gilmore, Steve Whetton & Tanya Chikritzhs

3.1 Introduction

The consumption of alcohol results in significant adverse health effects and globally has been estimated to cause about three million deaths per year, resulting in 107.7 million years of life lost (YLL) (Griswold et al., 2018; World Health Organization, 2018). Collins and Lapsley (2008) estimated that in 2004/05, alcohol caused 3,494 deaths in Australia, however, this estimate was 'offset' by 2,437 deaths prevented by apparent protective effects of low-level consumption. In addition to the role that alcohol plays in premature death, the burden of morbidity arising from the many forms of illness and injury attributable to alcohol use is considerable. This chapter describes the impact of alcohol use on premature death and inpatient hospital separations in Australia in 2017.

Underlying assumptions about protective effects of alcohol on some conditions can have major impacts on burden of disease and social cost estimates, due in large part to the relatively high prevalence of cardiovascular and related metabolic conditions. As noted in Section 1.3, apparent protective effects of low dose alcohol consumption on overall cardiovascular disease risk, ischaemic heart disease in particular (IHD), and type 2 diabetes mellitus, have been contested and there is growing evidence that methodological problems common to observational studies have led to widespread overestimation of protection in epidemiological studies (Chikritzhs et al., 2015; Sherk et al., 2019).

The Australian Guidelines to Reduce Health Risks from Drinking Alcohol (the Guidelines) (National Health and Medical Research Council, 2020) note the shift in scientific evidence towards greater uncertainty about the veracity of protective effects but nonetheless include them in risk modelling. For comparative purposes, the Guidelines also report results for an alternative scenario where it was assumed that alcohol conferred no protection from premature death for any condition (National Health and Medical Research Council, 2020). In keeping with this approach, central, low and high bound estimates of total alcohol-attributable deaths and hospital separations were calculated by taking three different approaches to quantifying the contribution of protective effects to cardiovascular disease and type 2 diabetes mellitus. This chapter describes the results of our approach to quantifying alcohol-attributable deaths and hospital separations and their associated social costs as well as a detailed account of the underlying epidemiological and economic procedures applied.

3.2 Burden of alcohol on death and hospital separations

This section describes epidemiological methods applied to estimate the burden of deaths and hospitalisations attributable to alcohol use in Australia.

3.2.1 Data sources and procedures

Aggregated data on alcohol-attributable deaths reported for 2017 (representing 2017/18) and hospital separations for 2017/18 were obtained from the National Alcohol Indicators Project (NAIP) (National Drug Research Institute, 2021). The NAIP is an ongoing surveillance project funded by the Australian Government Commonwealth Department of Health that processes and reports on alcohol-attributable mortality and morbidity at national, state and local levels. NAIP data were sourced from the Australian Coordinating Registry (ACR) and the Australian Institute of Health and Welfare (AIHW). The ACR coordinates the cause of death unit record file (COD URF) compiled and coded by the Australian Bureau of Statistics (ABS). The AIHW compiles and manages hospital separation data supplied by state and territory health authorities as the National Hospital Morbidity Database (NHMD).

Key variables used for identification of alcohol-related events included underlying cause of death and, for hospital separation data, primary diagnosis and external cause; all coded according to ICD-10-AM (9th edition) (Independent Hospital Pricing Authority, 2015). Age-group, gender, and inpatient diagnosis related group (DRG for hospital separations) were also used. For hospital admissions, when a separation indicated a principal diagnosis (e.g., mandibular fracture, myocardial infarction), with alcohol involvement as well as an external cause code indicating alcohol involvement (e.g., road injury, fall), the external cause code was designated the underlying cause (i.e., given precedence over the principal diagnosis) (Australian Institute of Health and Welfare, 2018).

To protect confidentiality, processing procedures for death and hospital separation data suppress reporting of cells (e.g., condition, sex and age-group combination) with five or fewer cases. In line with NAIP, suppression was based on five or fewer cases in the original death and hospital separation data i.e., before AF have been applied (see Section 3.3 below). In this report, results have been presented by condition groups organised according to the major body system affected and for injuries according to intention, as follows: cancers, cardiovascular diseases, communicable diseases, digestive system diseases, endocrine disorders, neuropsychiatric diseases, intentional injuries, unintentional injuries (see Appendix 3.1, Table A3.1, for individual conditions included in each condition group and ICD-10 codes).

3.2.2 Conditions and relative risks

Alcohol is a component cause for a wide range of diseases and injuries. Conditions included in analyses underlying social cost estimates provided in this report reflect current scientific consensus regarding alcohol's causal role in disease and injury. In 2017, Sherk and colleagues compiled evidence for alcohol effects on specific conditions including RR estimates by age and gender in their International model of alcohol harms and policies (InterMAHP) guide and tool (Sherk et al., 2017a; Sherk et al., 2017b). Conditions monitored by NAIP, and thereby included in this report, are largely in accordance with InterMAHP v2.1 (Sherk et al., 2017b). Some minor adjustments were made to reflect more recent research developments and Australian approaches to coding: (i) Motor vehicle collisions separated into 'pedestrian' and 'non-pedestrian' motor vehicle collisions; (ii) Intentional self-poisoning changed to 'intentional self-harm'; and, (iii) Inclusion of stomach cancer (Bagnardi et al., 2015) (currently absent from InterMAHP v2.1).

The InterMAHP tool is designed to estimate the proportion of a specific disease or injury that would no longer exist if exposure to alcohol in a given population was zero (i.e., the PAAF, see Section 3.3 below). InterMAHP has several important features. It: (i) incorporates recent advances in statistical methods for estimating PAAF; (ii) allows the user to apply population-specific estimates of alcohol use; and, (iii) provides alternative RR options for ischemic heart disease (IHD), i.e., Zhao et al.(2017) or Roerecke and Rehm (2012).

In line with InterMAHP, the current analyses excluded cholelithiasis and fetal alcohol spectrum disorder (FASD). Cholelithiasis (ICD-10 K80) was excluded on the basis that no clear causal pathway has been proposed to support causal inference (Rehm et al., 2018). InterMAHP excludes FASD due to the poor data generally available for identifying such outcomes. Australian data were sought to estimate FASD harms but no suitable local data were found. Chapters 8 and 10 address the broader issue of 'harms to others' not captured in other parts of the report.

3.3 Attributable fractions

The magnitude of alcohol's contribution to specific conditions varies considerably. For some conditions, alcohol is the sole cause (e.g., alcoholic liver cirrhosis, alcohol dependence). For others, alcohol is a partial cause (e.g., cancers, injuries). Conditions wholly attributable to alcohol are readily identified (i.e., alcohol is included in the condition name) and quantified. For all other conditions, the fraction attributable to alcohol must be estimated. PAAF are best estimated by an approach commonly referred to as the 'indirect method'. The indirect method combines information on condition-specific RR derived from meta-analyses with population-specific estimates of alcohol use (i.e., exposure) to estimate gender, age and condition-specific PAAF.

Facilitated by InterMAHP, NAIP applies a contemporary formula for estimating PAAF as described by Kehoe (2012) and applied in GBD studies (Griswold et al., 2018). This approach assumes an underlying (continuous) gamma distribution for population alcohol consumption and applies condition-specific alcohol RR functions to estimate PAAF. To apply this approach, InterMAHP requires: (i) an estimate of current drinkers (past 12 months), former drinkers and life-time abstainers prevalence by gender and age group for the population of interest; and, (ii) an estimate of per capita pure alcohol consumption for the population of interest (Sherk et al., 2017a; Sherk et al., 2017b). To address this: (i) national prevalence estimates were applied from the 2016 NDSHS (Australian Institute of Health and Welfare, 2017d) (see Table 3.1); and, (ii) the ABS estimate of 9.7L[12] for 2015/16 was used (Australian Bureau of Statistics, 2017d) (Maximum daily exposure was set to 150 grams.)[13]

Table 3.1 shows estimated national prevalence of current drinkers, former drinkers and life-time abstainers by gender and age-group in 2016 (Australian Institute of Health and Welfare, 2017d).

Table 3.1: Prevalence of current drinkers, ex-drinkers and life-time abstainers age 15 years and older

Gender	Age group (years)	Current drinkers (%)	Ex-drinkers (%)	Life-time abstainers (%)
Male	15-34	75.7	3.3	21.0
	35-64	85.1	7.9	7.0
	65+	79.9	12.8	7.3
Female	15-34	74.8	4.8	20.4
	35-64	80.6	8.9	10.5
	65+	66.9	15.6	17.6

Source: AIHW (2017b): calculations by authors.
Totals may not sum due to rounding.

3.3.1 Central, low and high bound estimates

As noted in Section 1.3, apparent protective effects of alcohol for cardiovascular disease and type 2 diabetes mellitus may be due to methodological error (Chikritzhs et al., 2015; Sherk et al., 2019). These conditions, particularly cardiovascular disease, account for a significant share of premature mortality in

[12] The value has been revised in later publications to 9.8L (Australian Bureau of Statistics, 2019f).
[13]. NAIP reports trends in alcohol-attributable deaths and hospital separations. It is NAIP's practice to use consumption estimates from the previous NDSHS in estimating harms in interim year (i.e. 2016 consumption for 2016, 2017, 2018 harm)

Australia, and so any changes in attribution of potential protective effects could have a significant impact on the overall burden of disease of alcohol. In 2017, IHD was the leading cause of death in Australia with 18,590 or 11.6 percent of all deaths attributed to IHD (Australian Bureau of Statistics, 2018a). In terms of alcohol's 'protective effect', IHD and ischaemic stroke (females only) accounted for about 86 percent of deaths averted. Almost all of the remaining 14 percent were attributed to averted type 2 diabetes mellitus deaths (Lensvelt et al., 2018).

To generate central, low and high bound estimates of total alcohol-attributable deaths and hospital separations, risk functions underpinning IHD, stroke (haemorrhagic, ischaemic and unspecified), acute pancreatitis (females only) and type 2 diabetes mellitus were varied to create three possible scenarios as follows:

Central estimate: This scenario used male IHD RR functions reported by Zhao and colleagues (2017) and female IHD RR functions reported by Roerecke and Rehm (2010, 2011, 2012) which result in estimates of no protective effect for male IHD at any level of alcohol use and a significant low-dose protective effect for women, respectively. InterMAHP default risk functions were applied for all other conditions (including protective effects at certain levels of consumption for type 2 diabetes mellitus, acute pancreatitis (females only) and stroke).

Low bound: This scenario applied male and female IHD RR functions reported by Roerecke and Rehm (2010, 2011, 2012) which result in significant estimated low-dose protective effects for both women and men. InterMAHP default risk functions were applied for all other conditions (including protective effects at certain levels of consumption for type 2 diabetes mellitus, acute pancreatitis (females only) and stroke).

High bound (no protective effects): This scenario applied male and female IHD relative risk functions reported by Roerecke and Rehm (2010, 2011, 2012), and the default InterMAHP relative risk functions for all other conditions. However, for any case where the calculated attributable fraction identified a potential protective effect (i.e., was less than zero) the attributable fraction was set to one (i.e., no effect). This variously affected mortality and morbidity attributable fractions for IHD, ischaemic stroke, haemorrhagic stroke, unspecified stroke, acute pancreatitis (females only) and type 2 diabetes mellitus.

Appendix 3.1 lists deaths (Table A3.2) and hospital separations (Table A3.3) condition-specific PAAF underlying the central estimates and low and high bounds.

3.4 Alcohol-attributable deaths

Table 3.2 shows by gender central estimates of net alcohol-attributable deaths caused and averted. Overall, there were 5,219 net deaths attributable to alcohol consumption in 2017. The large majority of the deaths caused occurred in males (82%), particularly those aged 65 years and older. There were 1,491 deaths averted, with 86 percent of these among older women.

Table 3.2: Central estimate of alcohol-attributable deaths averted, caused, and net by age group and gender, 2017

.	0-14 years	15-34 years	35-64 years	65+ years	All ages
Males					
Deaths averted, males	0.0	0.0	- 46.6	- 454.9	- 501.6
Deaths caused, males	1.1	235.3	1,717.8	2,834.5	4,788.7
Net deaths, males	1.1	235.3	1,671.2	2,379.6	4,287.2
Females					
Deaths averted, females	0.0	- 1.3	- 75.3	- 1,598.5	- 1,675.0
Deaths caused, females	1.1	65.0	635.2	1,905.9	2,607.2
Net deaths, females	1.1	63.7	560.0	307.3	932.2
Persons					
Deaths averted, persons	0.0	- 1.3	- 121.9	- 2,053.5	- 2,176.6
Deaths caused, persons	2.2	300.3	2,353.0	4,740.4	7,395.9
Net deaths, persons	2.2	299.0	2,231.1	2,686.9	5,219.3

Totals may not sum due to rounding.

Table 3.3 shows the distribution of net alcohol-attributable deaths by condition group, age group and gender for central estimates. Overall, cancers accounted for the largest proportion of net premature deaths (40%) followed by digestive system diseases (25%). The two top causes of alcohol-attributable death for both males and females were cancers (33% and 69%) and digestive system diseases (21% and 42%). For males aged 15 to 34 years, intentional (46%) and unintentional (41%) injuries combined accounted for 87 percent of deaths in that age group. Among females aged 15 to 34 years, intentional injuries (44%), unintentional injuries (25%) and digestive system diseases (19%) accounted for 87 percent of alcohol-attributable deaths (taking rounding into account).

Table 3.3: Central estimate of net alcohol-attributable deaths by condition, age group and gender, 2017

Condition group	0-14 years	15-34 years	35-64 years	65+ years	All ages
Males					
Cancers		5.2	450.2	970.1	1,425.5
Cardiovascular diseases		4.4	206.5	601.1	812.0
Communicable diseases		n.p.	n.p.	128.8	148.3
Digestive system diseases		13.4	564.7	357.6	935.7
Endocrine disorders		n.p.	n.p.	31.2	35.1
Neuropsychiatric diseases		7.1	135.5	130.5	273.0
Intentional injuries	1.1	107.3	152.4	17.3	278.2
Unintentional injures		97.1	139.2	143.1	379.4
Total alcohol-attributable deaths	**1.1**	**235.3**	**1,671.2**	**2,379.6**	**4,287.2**
Females					
Cancers		4.1	197.2	439.1	640.4
Cardiovascular diseases		0.5	40.3	-337.5	-296.7
Communicable diseases		n.p.	n.p.	87.6	94.4
Digestive system diseases		11.8	220.9	155.0	387.7
Endocrine disorders		n.p.	n.p.	-149.4	-173.3
Neuropsychiatric diseases		3.0	45.3	36.8	85.1
Intentional injuries	1.1	28.0	40.7	6.4	76.2
Unintentional injures		15.8	33.2	69.4	118.3
Total alcohol-attributable deaths	**1.1**	**63.7**	**560.0**	**307.3**	**932.2**
Persons					
Cancers		9.3	647.3	1,409.2	2,065.9
Cardiovascular diseases		4.9	246.8	263.6	515.3
Communicable diseases		n.p.	n.p.	216.4	242.7
Digestive system diseases		25.2	785.6	512.5	1,323.4
Endocrine disorders		n.p.	n.p.	-118.2	-138.3
Neuropsychiatric diseases		10.1	180.8	167.2	358.2
Intentional injuries	2.2	135.3	193.1	23.8	354.4
Unintentional injures		113.0	172.3	212.4	497.7
Total alcohol-attributable deaths	**2.2**	**299.0**	**2,231.1**	**2,686.9**	**5,219.3**

n.p. = not publishable. Cells suppressed where original count ≤5 (i.e., before PAAF applied). Secondary suppression (i.e., next smallest cell suppressed) is applied where small cell count can be calculated using totals.
Totals may not sum due to rounding.

Central, low and high bound estimates of total net alcohol-attributable deaths by age group and gender are shown in Table 3.4. Estimates indicated 5,219 deaths within a range of 4,248 to 7,396 deaths. Notably, most of the variation between the three estimates arises in the 65+ years age group where the majority of purported protective effects from alcohol use are indicated.

Table 3.4: Central, low and high bound estimates of net total alcohol-attributable deaths by age group and gender, 2017

Estimate	0-14 years	15-34 years	35-64 years	65+ years	All ages
Low bound estimate					
Total male deaths	1.1	233.4	1,552.7	1,558.5	3,345.7
Total female deaths	1.1	63.7	560.0	307.3	932.2
Total deaths	2.2	297.1	2,112.7	1,865.8	4,277.9
Central estimate					
Total male deaths	1.1	235.3	1,671.2	2,379.6	4,287.2
Total female deaths	1.1	63.7	560.0	307.3	932.2
Total deaths	2.2	299.0	2,231.1	2,686.9	5,219.3
High bound estimate					
Total male deaths	1.1	235.2	1,717.8	2,834.5	4,788.7
Total female deaths	1.1	65.0	635.2	1,905.9	2,607.2
Total deaths	2.2	300.2	2,353.0	4,740.4	7,395.9

Totals may not sum due to rounding.

3.5 Alcohol-attributable hospital separations

Table 3.5 shows central estimates by gender of net alcohol-attributable hospital separations caused and averted. Overall, almost 127,000 net hospital separations were attributable to alcohol consumption in 2017/18. About 73 percent of overall (net) alcohol-attributable hospital separations were for males. People aged 35 to 64 years accounted for almost 60 percent of total (net) hospital separations, the majority of which were for males (68%).

Table 3.5 Central estimate of alcohol-attributable hospital separations averted, caused, and net by age group and gender, 2017/18

.	0-14 years	15-34 years	35-64 years	65+ years	All ages
Males					
Hospital separations averted, males	0.0	- 33.2	- 861.9	- 2,816.2	- 3,711.3
Hospital separations caused, males	66.6	18,199.9	52,078.4	25,756.5	96,101.3
Net hospital separations, males	66.6	18,166.7	51,216.5	22,940.3	92,390.0
Females					
Hospital separations averted, females	0.0	- 378.0	- 7,263.4	- 15,081.1	- 22,722.5
Hospital separations caused, females	43.5	10,665.9	30,929.6	15,686.7	57,325.8
Net hospital separations, females	43.5	10,288.0	23,666.2	605.7	34,603.3
Persons					
Hospital separations averted, persons	0.0	- 411.2	- 8,125.3	- 17,897.3	- 26,433.8
Hospital separations caused, persons	110.1	28,865.8	83,008.0	41,443.2	153,427.1
Net hospital separations, persons	110.1	28,454.7	74,882.7	23,545.9	126,993.3

Totals may not sum due to rounding.

Table 3.6 shows the distribution of alcohol-attributable hospital separations by condition group, age group and gender for central estimates. Overall, neuropsychiatric diseases accounted for the largest proportion of hospital separations (49%) followed by unintentional injuries (28%). Across all condition groups, hospitalisations occurred much more frequently among males. Some 15,800 female hospital separations for cardiovascular disease were averted, mostly for women aged 65 years and older.

Table 3.6: Central estimate of alcohol-attributable hospital separations by condition, age group and gender, 2017/18

Condition group	0-14 years	15-34 years	35-64 years	65+ years	All ages
Males					
Cancers		47.5	3,127.8	4,208.4	7,383.7
Cardiovascular diseases		203.1	4,294.1	2,122.2	6,619.3
Communicable diseases		316.5	1,758.1	2,987.7	5,062.4
Digestive system diseases		1,007.7	6,452.5	2,169.9	9,630.1
Endocrine disorders		5.5	209.3	371.6	586.3
Neuropsychiatric diseases		7,146.2	24,062.8	4,170.4	35,379.4
Intentional injuries	66.6	2,193.1	1,912.9	92.7	4,265.2
Unintentional injures		7,247.1	9,399.2	6,817.4	23,463.6
Total alcohol-attributable hospital separations	**66.6**	**18,166.7**	**51,216.5**	**22,940.3**	**92,390.0**
Females					
Cancers		76.9	2,309.9	1,785.2	4,172.0
Cardiovascular diseases		-50.4	-4,552.2	-11,208.5	-15,811.2
Communicable diseases		253.7	950.7	1,591.4	2,795.8
Digestive system diseases		478.2	2,647.0	963.9	4,089.1
Endocrine disorders		-61.2	-896.1	-1,054.4	-2,011.8
Neuropsychiatric diseases		5,608.3	18,359.2	2,887.0	26,854.4
Intentional injuries	43.5	1,828.7	1,086.0	64.1	3,022.3
Unintentional injures		2,154.0	3,761.7	5,577.1	11,492.8
Total alcohol-attributable hospital separations	**43.5**	**10,288.0**	**23,666.2**	**605.7**	**34,603.3**
Persons					
Cancers	0.0	124.4	5,437.6	5,993.6	11,555.6
Cardiovascular diseases	0.0	152.7	-258.1	-9,086.4	-9,191.9
Communicable diseases	0.0	570.2	2,708.8	4,579.1	7,858.1
Digestive system diseases	0.0	1,485.9	9,099.5	3,133.8	13,719.2
Endocrine disorders	0.0	-55.7	-686.8	-682.9	-1,425.4
Neuropsychiatric diseases	0.0	12,754.5	42,421.9	7,057.4	62,233.8
Intentional injuries	110.1	4,021.7	2,998.9	156.8	7,287.5
Unintentional injures	0.0	9,401.1	13,160.8	12,394.5	34,956.4
Total alcohol-attributable hospital separations	**110.1**	**28,454.7**	**74,882.7**	**23,545.9**	**126,993.3**

Totals may not sum due to rounding.

Table 3.7 shows central, low and high bound estimates of total alcohol-attributable hospital separations by age group and gender in 2017/18. Overall, the low bound (105,615) and high bound (151,111) estimates were respectively 17 percent lower and 19 percent higher than the central estimate (126,993). However, very large variations occurred between the central (606) and high bound (15,687) estimates for females in the 65+ years age group. Notably, the large majority of apparent protective effects for cardiovascular disease accrue to females at older ages.

Table 3.7: Central, low and high bound estimates of net total alcohol-attributable hospital separations by age group and gender, 2017/18

Condition group	0-14 years	15-34 years	35-64 years	65+ years	All ages
Low bound estimate					
Total male net hospital separations	66.6	18,100.8	42,746.1	10,098.3	71,011.7
Total female net hospital separations	43.5	10,288.0	23,666.2	605.7	34,603.3
Total net hospital separations	110.1	28,388.7	66,412.2	10,704.0	105,615.0
Central estimate					
Total male net hospital separations	66.6	18,166.7	51,216.5	22,940.3	92,390.0
Total female net hospital separations	43.5	10,288.0	23,666.2	605.7	34,603.3
Total net hospital separations	110.1	28,454.7	74,882.7	23,545.9	126,993.3
High bound estimate					
Total male net hospital separations	66.6	18,187.3	50,629.9	25,012.5	93,896.2
Total female net hospital separations	43.5	10,665.9	30,929.6	15,686.7	57,325.8
Total net hospital separations	110.1	28,853.3	81,559.5	40,699.2	151,222.0

Totals may not sum due to rounding.

3.6 Calculating the social cost of premature mortality

Two broad forms of social cost arise as a result of premature mortality: tangible and intangible costs. Tangible costs are those costs for which a market price exists as they can effectively be traded in the market economy. Intangible costs are those costs that cannot be traded such as reduced quality of life from ill-health or value placed on the lost years of being alive.

YLL were calculated in both undiscounted and discounted forms, with the latter used in the cost calculations. Confidentiality restrictions on ABS deaths data prevent the release of data that can potentially disclose individual details, precluding the release of data on single years of age at the condition level. Instead, the relevant parameters needed for the cost calculation – years of life lost (discounted and undiscounted), expected years of working life remaining (discounted) and years of work in the household – were calculated by single year of age, and linked to the detailed deaths data, which was then aggregated into broad age categories before being released.

YLL for each premature death were calculated using single year of age and gender specific estimates for years of life remaining from ABS life tables (Australian Bureau of Statistics, 2019e). Age and gender specific probabilities of employment by single year of age calculated from ABS Census (Australian Bureau of Statistics, 2017b) data were used to calculate the expected number of working years lost in the study year and the present value over the analysis period. Discounting was undertaken using a real discount rate of seven percent as recommended in Australian Government guidance (Department of Finance and Administration, 2006; Department of the Prime Minister and Cabinet, 2016). However, as it was assumed that over the long-term, real output per worker would increase by 1.5 percent per annum, the effective discount rate for premature mortality was a real rate of 5.5 percent.

3.7 Tangible costs of premature mortality

Tangible costs of premature mortality include: the present value of lost expected lifetime labour in paid employment (excluding, where possible, the present value of any private income that would have flowed to a non-dependent consumer of alcohol whose own alcohol consumption was responsible for their premature death); costs to employers of workplace disruption; the lifetime value of lost labour in the household; and, a net cost-saving from the present value of avoided lifetime medical expenditure by government.

No costs have been included in the analysis for funerals and associated expenses, as it has been assumed that the cost of these remain constant in real terms and so there is no net cost (or net saving) from them having occurred prematurely.

3.7.1 Reductions in workplace productivity due to premature mortality

The impacts of a premature death on workplace productivity, where the decedent is in paid employment, are the present value of expected future economic output from the deceased individual, together with the cost to employers of filling a job vacancy.

The impact of a smaller labour force on GDP due to alcohol-attributable deaths in 2017/18 was calculated as a present value over an 80-year timeframe (the maximum expected remaining years of life of all in-scope decedents, and discounted using a real discount rate of seven percent (to align with the Department of Finance and Administration guidance (2006)). It is assumed the costs of filling job vacancies occurred in 2017/18, the year in which the premature death occurred.

Lost personal earnings as a result of one's own non-dependent drinking is a private rather than a social cost, and has been excluded. Overall, just under 43 percent of premature alcohol-attributable deaths are estimated to result from either the drinking of another, or from their own drinking for those who are dependent on alcohol. For these deaths, the full lost economic activity resulting from the premature death is included in the cost calculations. For the remaining deaths, only that share of economic activity that flows to business or government was included as a social cost.[13]

The age- and gender-specific probability that an individual will be in employment over their expected remaining years of life was taken from analysis of 2016 Census of Population and Housing data (Australian Bureau of Statistics, 2017b, data extraction by authors). These age- and gender-specific estimates were linked to individual records in the deaths data before being aggregated for the economic analysis to ensure confidentiality.

Over the analysis period, an estimated discounted 19,419 years of working life were lost due to alcohol-attributable premature death (low bound 18,350, high bound 20,348).

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[13] Data from the national accounts (Australian Bureau of Statistics, 2019c) indicates 47.3 percent of GDP in 2017/18 was compensation of employees with the remaining 52.7 percent of GDP flowing to businesses or government. In those cases where the death was assumed to be due to the own non-dependent drinking of the decedent, only this latter 52.7 percent of GDP was included in the social cost. Certain conditions such as alcoholic liver cirrhosis and alcohol dependence were assumed to occur exclusively amongst persons with alcohol dependence. Conditions such as assault/homicide were assumed to be attributable to another's drinking. For the remainder of alcohol-attributable deaths, it was assumed that the proportion of dependent drinkers amongst drinkers consuming levels that risk long-term harm was a reasonable proxy for the proportion of deaths attributable to persons dependent on alcohol. Therefore between 9 and 16 percent of the remaining male deaths (depending on age) and between 12 and 22 percent of the remaining female deaths were assumed to be due to dependence with the full expected lifetime economic output included as a cost. For the remainder, the share of economic output that comes as individual wage income was excluded from the social costs. Data on the number of persons by gender and age group drinking at a level risking short-term harm were sourced from the 2019 NDSHS (Australian Institute of Health and Welfare, 2020b) and the number of persons by gender and age group who were dependent on alcohol in 2017/18 was sourced from the global burden of disease study (Institute for Health Metrics and Evaluation, 2020). The net effect of these adjustments was that just under 73 percent of the lost economic output was included as a social cost.

Data are not available on how economic output attributable to labour varies across the workforce, or how the economic output of those who die prematurely from alcohol-attributable causes differs from the average. It has been assumed that the economic output of those in work would have equalled the population mean. Gross domestic product (GDP) per employee was calculated from current price estimates of GDP for the year to June 2018 from the ABS national accounts and average employment over 2017/18 (Australian Bureau of Statistics, 2019c, d) and was $148,748 in 2017/18.

The total present value cost to GDP of premature alcohol-attributable mortality, which occurred in 2017/18 assessed over expected years of working life, was $2.1 billion in 2017/18 values (low bound $2.0 billion, high bound $2.2 billion).

In addition, employers face one-off costs to recruit new employees to replace deceased workers, and to train those new workers. The estimated cost of this was $6,422 per prematurely deceased employee in 2006 values (Bureau of Infrastructure Transport and Regional Economics, 2009). Converting to 2017/18 values using the change in the CPI (Australian Bureau of Statistics, 2021b), and applying the estimate of 2,066 persons who died from alcohol-attributable causes in 2017/18 and were in employment at the time of their death, gives a total cost of $17.5 million.

3.7.2 Reductions in labour in the household

Collins and Lapsley (2008) based their estimates of the value of lost labour in the household on the ABS publication *Unpaid Work and the Australian Economy* 1997 (Australian Bureau of Statistics, 1997). This remains the best available source of data on unpaid work in the household despite now being dated. Under definitions used in the report, a household activity is considered unpaid work if an economic agent other than the household itself could have supplied an equivalent service. Such services include domestic activities, childcare, purchasing of goods and services, and volunteer and community work. These are all services that are lost by the community in the event of the death or severe illness of the person supplying them, and are therefore counted as a component of social costs (Collins and Lapsley, 2008).

The ABS report (1997) details two broad approaches that can be taken to valuing unpaid household labour: individual function replacement cost (which can be valued either by the cost of outsourcing each of the specific tasks, or by the cost of hiring a full-time housekeeper to provide all of the services lost); and, the opportunity cost of time (typically measured by the market value of the deceased person's time in work). In this analysis, individual function replacement costs were selected, as using opportunity cost applies a zero value to work undertaken by individuals not in the labour force and therefore tends to systematically understate the value of work undertaken by women who have lower employment rates. This was also the approach taken by Collins and Lapsley in their study (2008).

The total value of male unpaid labour in the household was estimated at $82 billion in 2007 values and female unpaid labour was valued at $154 billion. Converting these figures to per adult estimates using the population data used in the ABS estimates of the value of unpaid household labour (Australian Bureau of Statistics, 1997) and to 2017/18 values using the CPI (Australian Bureau of Statistics, 2021b) gives values of unpaid household work of $20,483 per adult male and $36,570 per adult female. We assumed that the value of unpaid labour in the household for those aged less than 18 and those aged over 75 years old was zero, as individuals below 18 years of age are often dependent (at least partially) on service provision from adults in the household, and above the age of 75 a substantial proportion of the population are either in receipt of formal or informal care, or are providing informal care to another member of their household, which is captured as part of 'other medical costs' (see Chapter 4), creating the risk of double counting.

At the same time as the total discounted YLL were estimated, we also estimated the number of YLL within the age ranges used for the household labour calculation to generate age / age-group and gender specific years of household labour lost.

Our central estimate was that there were 38,947 discounted years of life on household chores lost to alcohol-attributable death over the study period (low bound 36,626, high bound 41,168). This gives an estimated present value of **$951.4 million** ($902.9 million to $1,018.8 million).

3.7.3 Avoided health care costs

Alcohol consumption leads to a net increase in the community disease burden and therefore to increased healthcare costs (also see Chapter 4), however the premature deaths of persons from alcohol-attributable causes also produces partially offsetting reductions in lifetime healthcare costs which these individuals would have incurred in future years had they lived to their expected age at death.

As with the costs of lost economic output, age (or age-group) and gender specifically discounted YLL for each premature death were calculated.

Annual average recurrent healthcare costs per person for 2017/18 ($7,485) were taken from AIHW data (Australian Institute of Health and Welfare, 2019d) and it was assumed that healthcare costs would grow in line with per capita GDP (e.g., YLL used in calculating healthcare costs avoided, were discounted at 5.5 percent to allow for an estimated annual real increase in costs of 1.5 percent per annum).

The estimated total net present value (NPV) (over 30 years using a seven percent real discount rate) of healthcare costs avoided due to premature net alcohol-attributable mortality was a **saving of $467.2 million** (low bound $412.7 million, high bound $569.7 million).

3.8 Intangible costs of premature mortality

Much of the cost to society arising from premature mortality relates to intangible costs, e.g., those costs from factors that cannot be traded or transferred. Valuation of the intangible costs of premature mortality is usually undertaken using what is known as the *value of a statistical life* (VoSL).

It is important to note that the concept being assessed is ***not*** the value of one or more of the individual lives lost prematurely due to the health condition or hazard in question. Rather, the concept is based on a society's average willingness to pay to reduce the risk of premature death by one case. Estimates of this value are generally derived from aggregating across individuals' direct market behaviour, such as willingness to pay for products that result in a small reduction of risk, e.g., additional safety features on cars, or the increase in wage demanded to take a job that has a higher risk of premature mortality.

Current guidance for cost benefit analyses undertaken for the Australian Government recommends using a VoSL that was developed by Abelson (2008). Abelson recommended using a VoSL of $3 million to $4 million in 2006/07 values. Abelson's recommended value was not derived from a meta-analysis of valuation studies, which produce much higher estimates. Rather, whilst it took note of a range of published meta-analyses of both wage premium studies, product market, and willingness-to-pay approaches to valuing a statistical life, it was most strongly influenced by the values recommended by the UK government and the European Union member countries.

The Abelson estimate is in 2007 values and needed to be converted to 2017/18 vales for this analysis. The rate at which a value of statistical life should increase over time as national incomes increase is determined by the income elasticity of demand for reductions in the risk of premature death, with the elasticity representing the proportionate increase in the VoSL for a given increase in per capita incomes. For example, an income elasticity of 0.5 implies that for a one percent increase in per capita income, the VoSL would increase by 0.5 percent. These income elasticities have been variously estimated at 0.5 to 0.6 (Viscusi and Aldy, 2003), 1.32 (with a range from 1.16 to 2.06) (Kniesner et al., 2010) and 1.5 to 1.6 (Costa and Kahn, 2004). We followed the US Department of Transportation (US DoT) (US Department of Transportation, 2015) in adopting a relatively conservative assumption of an income elasticity of 1[14], slightly below the average of the three studies which was 1.16.

Therefore, the central estimate was converted from 2007 values to 2017/18 values using the change in the average nominal national per capita income over that period, giving a 2017/18 VoSL of $4.96 million.

Internationally, much higher values are often used reflecting the findings of studies into the VoSL[15]. The US DoT used a VoSL of USD9.1 million in 2013 values (US Department of Transportation, 2015). This was derived by averaging 15 hedonic wage studies (e.g., studies which estimate the wage premium demand by workers for more dangerous occupations and use the difference in annual mortality rates between industries to calculate the implicit value placed on a premature death). The US Environment Protection Authority also adopts a similar approach, using a slightly different value derived from a marginally different set of studies. Converting the US DoT VoSL estimate to Australian dollars (AUD) using Purchasing Power Parity exchange rates (Organisation for Economic Cooperation and Development, 2016), and then to 2017/18 values using the growth in per capita current prices GDP (Australian Bureau of Statistics, 2018c) from 2012/13 to 2017/18 gives a VoSL of $14.7 million. This value is used as our high bound estimates.

There is a debate in the literature as to whether studies should use a consistent value of averting a premature death, regardless of the expected age of person whose death is averted, or whether it would be more appropriate to use a consistent value for each expected YLL with the value of averting a premature death then varying substantially by age.

In general, using a consistent value for an averted death tends to be used in studies of reductions in transport, health and environmental risks (see for example, (Abelson, 2008; HM Treasury (UK), 2018; US Department of Transportation, 2015)). Values based on life years tend to be used in drug or medical device funding approvals (see for example National Institute of Clinical Excellence 2004 for the UK (2004) and the processes adopted for adding pharmaceuticals for PBS subsidies Australia (Community Affairs References Committee, 2015)).

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[14] This is likely to be an underestimate as empirical analysis suggests that on average people are risk averse (and in particular loss averse) which would imply a price elasticity of averting loss of >1 (Kniesner et al., 2010).

[15] Viscusi and Aldy undertook a meta-analysis of studies that used wage differentials and of those which looked at price premia paid for increased safety features in goods purchased and found the mean of the studies was USD6.7 million in 2000 prices (Viscusi and Aldy, 2003).

Adopting a value of a life year approach has the effect of giving greater weight to premature deaths amongst the young and much lower weight to deaths amongst the old. For example, using the value of a statistical life year derived from Abelson (2008) updated to 2017/18 values (see below for the approach to this) would imply that society would be willing to spend \$5.56 million to avert the premature death of a one year old female and \$5.54 million to avert the premature death of a one year old male, but the willingness to spend to avert the premature death of an 80 year old would be \$2.43 million for a female and \$2.16 million for a male. On the other hand, adopting a single value for a VoSL implies higher values per year of life gained for older persons and lower values per year of life gained for younger persons.

This study has adopted a VoSL approach for its central estimate, reflecting the preponderance of usage in policy studies; the pattern of health spending by society over the life, which tends to reflect need and therefore grows with age from the middle years of life (Australian Bureau of Statistics, 2017c) rather than reducing in the last years of life when care could be expected to produce relatively few additional years of healthy life; and evidence on changes in individual willingness to pay for safety improvements, which only appears to fall modestly with age once adjusted for ability to pay and then only after the age of 70 (Pearce, 2000).

However, as a low bound for our estimate of the intangible cost of alcohol-attributable mortality, we have estimated the cost using a *value of a statistical life year* (VoSLY) approach.

VoSLY are derived from the VoSL by treating the VoSL as the equivalent to the present value of an annuity over the expected years of life remaining, using the following formula:

$$VoSLY \quad = VoSL \times \frac{(1-(1+g)/(1+r))}{(1-(\frac{1+g}{1+r})^{years})}$$

Where

VoSL = the VoSL being used, in this case from Abelson (2008) converted to 2017/18 values

g = the annual escalation factor used for the VoSL, in this case the expected long-term per capita growth rate in GDP of 1.5 percent per annum

r = the discount rate used, in this case seven percent real per annum; and

years = the number of years of healthy life remaining assumed to be implicit in the VoSL calculation, in this case following Abelson (2008) we have used 40 years.

This VoSLY is applied to the estimated potential YLL calculated from the mortality data. Unlike the tangible cost estimates, costs are included for each expected year of life remaining even where that occurs more than 30 years in the future. These annual costs are then converted to a present value estimate using a real discount rate of seven percent. Using the Abelson estimate of the VoSL, the VoSLY is \$309,157.

To ensure consistency with other estimates, we used the Abelson values[16] for our main estimates, which gives an expected intangible cost of net alcohol-attributable premature mortality in 2017/18 of **\$25.9**

[16] Value of a Statistical Life = \$4.96 million

billion (with a confidence interval derived from the range of estimates of net alcohol-attributable deaths of $21.2 billion to $36.7 billion).

Alternatively, if the US DoT (2015)[17] VoSL estimate was used, the estimated intangible cost of 2017/18 net alcohol-attributable premature mortality would be $76.7 billion. This estimate was calculated using the central estimate of net alcohol-attributable deaths (with a confidence interval derived from the range of estimates of net alcohol-attributable deaths of $62.9 billion to $108.7 billion).

Finally, if intangible costs of premature mortality were valued based on potential YLL[18], then the intangible cost of net alcohol-attributable premature mortality in 2017/18 would have an expected present value of $19.3 billion based on the central estimate of YLL to net alcohol-attributable deaths (with a confidence interval derived from the range of estimates of alcohol-attributable deaths of $17.0 billion to $23.5 billion).

3.9 Total costs of premature mortality

Drawing together the estimated tangible and intangible costs of 5,219 premature alcohol-attributable deaths, our central estimate of the cost is $28.5 billion ($19.5 billion to $111.4 billion). Tangible costs are $2.6 billion, with intangible cost accounting for $25.9 billion (Table 3.8).

Table 3.8: Costs of net alcohol-attributable premature mortality

Cost	Central estimate: net alcohol-attributable deaths, & Abelson (2008) VoSL ($)	Low bound: low bound net alcohol-attributable YLL & VoSLY Abelson (2008) ($)	High bound: high bound of net alcohol-attributable deaths & US DoT (2015) VoSL ($)
Tangible costs			
NPV of lost economic output: non-employee	2,107,217,652	1,991,214,186	2,207,940,308
Recruitment/training costs to employers	17,454,113	15,946,659	19,399,332
NPV of value of lost unpaid household work	951,431,406	902,853,566	1,018,809,876
NPV of healthcare costs avoided	-467,152,809	-412,700,962	-569,736,108
Total net tangible costs	**2,608,950,363**	**2,497,313,449**	**2,676,413,408**
Intangible costs			
Value of a statistical life	25,891,775,743	17,046,019,369	108,705,701,428
TOTAL COSTS	**28,500,726,106**	**19,543,332,818**	**111,382,114,836**

NPV = net present value: US DoT = United States Department of Transport: YLL = years of life lost: VoSL = value of a statistical life: VoSLY = value of a statistical life year.
Totals may not sum due to rounding.

3.10 Calculating the social cost of hospital separations

For the purpose of government reimbursement of hospitals for costs related to hospital separations, the IHPA sets specific cost categories applicable to each inpatient hospital separation record based on patient diagnoses, primary type of treatment or service provided, case difficulty, and severity of any complications. This system is referred to as the Australian Refined Diagnosis Related Groups (AR-DRG) (Independent Hospital Pricing Authority, 2020). Hospital separations were coded using AR-DRG version

[17] Value of a Statistical Life in Australian terms = $14.7 million.
[18] Value of a Statistical Life Year lost = $309,157.

8.0. Each AR-DRG code is also assigned a costweight which indicates the average cost of administering that form of treatment relative to the average cost of an acuity adjusted hospital separation ($4,885 in 2017/18) (Independent Hospital Pricing Authority, 2020). This allows the cost of specific separations to be estimated by multiplying their costweight by the average cost of a separation as per the below formula:

Total Cost = $4,885 x average cost-weight for condition x number of attributed separations

In the aggregation of individual records to broad age groups that was undertaken to protect confidentiality, cost-weights were first linked to individual separations and then averaged for conditions within broad age/gender groups when data were aggregated for release.

3.11 Total costs of hospital separations

The estimated total cost of alcohol-attributable hospitalisations in 2017/18 was **$716.7 million** (central estimate) within a low bound of $489.8 million and a high bound of $972.5 million (Table 3.9). Totalling $257.3 million, unintentional injuries accounted for 36 percent of total costs, the largest proportion of any condition group. Neuropsychiatric diseases (27%) and cancers (23%) also made substantial contributions to the total net costs.

Males accounted for the large majority of alcohol-attributable hospital separation costs (87%), however, the proportion varied depending on whether or not protective effects from low level consumption were applied, i.e., males contributed to 81 percent of the low bound estimate and 68 percent of the high bound estimate. In net terms, the central estimate included cost-savings due to cardiovascular and type 2 diabetes mellitus separations, averting $120.2 million and $11.1 million respectively.

Table 3.9: Summary of central, low and high bound estimates of alcohol-attributable hospital separations and total costs (net) by condition group and sex, 2017/18 [a]

Condition group	Gender	Cost		
		Central $	Low bound $	High bound $
Cancers	Female	48,741,640	-	-
	Male	118,635,375	-	-
Cardiovascular diseases	Female	-167,442,305	-167,442,305	28,131,881
	Male	47,247,716	-179,649,018	88,686,590
Communicable diseases	Female	21,019,004	-	-
	Male	40,585,213	-	-
Digestive system diseases	Female	40,744,184	-	-
	Male	92,617,231	-	-
Endocrine disorders	Female	-16,773,570	-	1,971,009
	Male	5,659,480	-	5,672,596
Neuropsychiatric diseases	Female	73,854,823	-	-
	Male	117,210,583	-	-
Intentional injuries	Female	12,557,406	-	-
	Male	24,830,138	-	-
Unintentional injures	Female	79,572,984	-	-
	Male	177,683,590	-	-
All alcohol-attributable conditions (net)	**Female**	**92,274,166**	**92,274,165**	**306,592,930**
	Male	**624,469,326**	**397,572,592**	**665,921,316**
	Total	**716,743,492**	**489,846,757**	**972,514,246**

[a] Where low or high bound estimates were not available, central estimates were used to calculate separations and cost totals. Totals may not sum due to rounding.

3.12 Conclusions

Our estimates show the extent of alcohol's role in premature mortality and hospital separations in Australia. We estimated 5,219 deaths (2017) (resulting in 116,735 lost years of life) and 126,993 hospital separations (2017/18) attributable to alcohol at a cost of $28.5 billion and $716.7 million respectively. Cancers, digestive system diseases, cardiovascular diseases and unintentional injuries contributed to the bulk of the costs.

Acknowledgments

Death data were obtained from the Australian Coordinating Registry at the Queensland Registry of Birth, Deaths and Marriages who act on behalf of the custodians of the data, which include staff in the eight jurisdictional Registries of Birth, Deaths and Marriages, eight jurisdictional Coroners and the National Coronial Information System. We also acknowledge the Australian Institute of Health and Welfare and the National Hospital Morbidity Database.

CHAPTER 4: PRIMARY CARE & NON-ADMITTED PATIENT HEALTH CARE COSTS

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4.1 Introduction

Although any alcohol use confers risk, people who drink alcohol in either 'at-risk' quantities or in 'at-risk' settings[19] are at greater risk of a range of health conditions and injuries, and as such use health services at a greater rate than those who consume alcohol within health guidelines. Increasingly, there is concern about alcohol-related harm among the ageing population and related impacts on services. At-risk groups may also incur further costs for rehabilitation for alcohol dependence and the use of pharmaceuticals for the treatment of alcohol-related conditions. The adverse health conditions caused by alcohol can also have significant impacts on family members who act as carers. The costs arising from inpatient hospital admissions are addressed in Chapter 3. This chapter estimates the health care costs incurred due to alcohol use, excluding costs from hospital inpatients.

In 2017/18, **$185.4 billion** was spent on health care in Australia. Of this, $77.2 billion (41.4%) was spent by the Australian Government, $49.9 billion (26.8%) by state, territory and local governments, and the remainder ($59.3 billion, 31.8%) by health insurance providers, individuals and other non-government agencies. Hospitals received $74.0 billion (39.7%), while $64.3 billion (34.5%) and $19.4 billion (10.4%) were spent on primary health care and referred medical services, respectively (Australian Institute of Health and Welfare, 2019d).

Given alcohol's role in wholly or partially causing a range of health conditions, a proportion of non-hospital health expenditures can be attributable to alcohol use or alcohol dependence. In particular, those who drink alcohol heavily are more at risk of developing a range of health problems such as certain types of cancers, liver cirrhosis and neurological problems (Table 4.1). This cohort is also at higher-risk of incurring accidental injuries, self-harm injuries, road traffic crashes, and falls, requiring them to use a variety of non-hospital health services.

The following areas of other health care costs have been included in this analysis:

- Ambulance services;
- Non-admitted hospital care (ED and outpatient services);
- Un-referred primary healthcare, such as allied health and general practitioner (GP) visits;
- Referred primary healthcare, including radiology, pathology and specialist visits;
- Treatment for alcohol dependence, including community mental health and specialist drug treatment services;
- Pharmaceuticals for alcohol-attributable diseases or conditions;
- Dental care;
- Residential and other aged care services; and,
- Costs to family members of providing care.

[19] The National Health and Medical Research Council defines increased risk as occurring from combinations of individual factors (e.g., age, health, pregnancy, family history), situational factors (e.g., operating machinery) and alcohol factors (e.g., quantity and frequency of consumption) (National Health and Medical Research Council, 2020).

Attribution of overall expenditure due to alcohol-attributable conditions was the first step towards estimating alcohol-attributable costs. For most of the above cost items, two separate approaches were taken to calculate high and low bound costs, with the average of the two being the central estimate. One approach calculated costs via a direct method, as applied in earlier research (e.g., Chikritzhs et al., 2011; Whetton et al., 2019; Whetton et al., 2020a) and by the AIHW *Disease Expenditure Study* (Australian Institute of Health and Welfare, 2019f). The other method used the share of alcohol-attributable hospital costs by condition as the base for alcohol-attribution in a specific health sector. Both methods are described in detail below, and the discussion of each cost domain details the method used for that domain.

4.2 Methods

4.2.1 Disease expenditure method

The disease expenditure method calculates cost estimates based on the disease conditions listed by the Australian Burden of Disease Study (ABDS) subdivided across the different formal components of the health care sector (Australian Institute of Health and Welfare, 2019h). In some domains, such as hospital separations, costs can be directly estimated from diagnostic codes and Australian refined diagnosis related group (AR-DRG) codes (as done in Chapter 3). However, in other domains, costs were apportioned on the basis of indirect estimates using the *Bettering the Evaluation and Care of Health* (BEACH) survey (Britt et al., 2016). The BEACH survey of GPs collects information on the presenting conditions and subsequent diagnostic tests, referrals, treatments and pharmaceuticals. The *Disease Expenditure Study* applied this information to allocate costs in other domains. For details see AIHW report (2019g). Appendix 4.1 lists areas of expenditure and costs that have been included as part of disease expenditure along with the costs that were excluded for calculation purposes.

The *Disease Expenditure Study* reports costs by Australian Burden of Disease Study (ABDS) conditions, which were mapped, by ICD-10 code, to the alcohol-caused conditions reported in Appendix 3.1, Table 3.1; broad mapping by condition is shown in Table 4.1. For some alcohol-attributable conditions, it was necessary to combine two or more conditions into a single overall condition to match the *Disease Expenditure Study*/ABOD categories (e.g., acute pancreatitis, chronic pancreatitis and alcohol-induced pancreatitis were combined as 'pancreatitis'). Details of ABDS conditions by ICD-10 code were obtained from the technical report for the *Disease Expenditure Study* (Australian Institute of Health and Welfare, 2019g).

Numbers of alcohol-attributable hospital separations aggregated by age-group, gender and disease condition for 2017/18 formed the numerator (see Chapter 3 for PAAF methods). Since the number of alcohol-attributable hospital separations were a subset of overall hospitalisations and included data for alcohol-attributable conditions only, for the denominator, overall hospitals separations data by ICD codes were obtained from the AIHW principal diagnosis data cube (Australian Institute of Health and Welfare, 2020a). For example, there were 52,350 gastroduodenal disorders separations as the principal diagnosis in AIHW data, of which 2,171 were for alcoholic gastritis. Therefore, an PAAF of 4.2 percent was estimated and applied to the total disease expenditure due to gastroduodenal disorders (Table 4.1).

Table 4.1: Mapping of alcohol-attributed conditions onto the Disease Expenditure Study conditions

Condition Group	Alcohol-attributed Condition	Disease Expenditure Study	% of AAC Seps in DES (Zh_RR)
Cancers	Breast cancer	Breast cancer	9.9
	Colorectal cancer	Bowel cancer	12.1
	Laryngeal cancer	Laryngeal cancer	22.7
	Liver cancer	Liver cancer	15.8
	Oesophageal cancer	Oesophageal cancer	39.4
	Oral cavity and pharynx cancer	Lip and oral cavity cancer, Other lip, oral cavity and pharynx cancers	37.6
	Pancreatic cancer	Pancreatic cancer	5.7
	Stomach cancer	Stomach cancer	1.6
Cardiovascular conditions	Alcoholic cardiomyopathy	Cardiomyopathy	1.9
	Atrial fibrillation and cardiac arrhythmia	Atrial fibrillation and flutter	7.3
	Haemorrhagic stroke	Stroke	-
	Ischaemic stroke	Stroke	-
	Unspecified stroke	Stroke	-
	All Stroke	Stroke[a]	-6.1
	Ischaemic heart disease	Coronary heart disease	-6.6
	Hypertension	Mapping not possible	excluded
	Oesophageal varices	Mapping not possible	excluded
Communicable diseases	HIV	HIV/AIDS	3.4
	Lower respiratory tract infections	Lower respiratory infections, Influenza and Pneumococcal disease	5.5
	Tuberculosis	Tuberculosis	24.9
Digestive disorders	Acute pancreatitis	Pancreatitis	-
	Alcohol-induced pancreatitis	Pancreatitis	-
	Chronic pancreatitis	Pancreatitis	-
	All Pancreatitis	Pancreatitis[a]	22.7
	Alcoholic Liver cirrhosis	Chronic Liver Disease	-
	Liver cirrhosis	Chronic Liver Disease	-
	All Liver cirrhosis	Chronic Liver Disease	41.9
	Alcoholic gastritis	Gastroduodenal disorders	4.2
Endocrine conditions	Diabetes mellitus	Type 2 diabetes mellitus	2.3
	Alcohol-induced pseudo-Cushing's syndrome	Mapping not possible	excluded
Neuro-psychiatric conditions	Alcohol abuse	Alcohol use disorders	-
	Alcohol dependence	Alcohol use disorders	-
	Alcoholic psychoses	Alcohol use disorders	-
	All Alcohol use disorders	Alcohol use disorders [a]	100.0
	Alcoholic myopathy	Other neurological conditions	-
	Alcoholic polyneuropathy	Other neurological conditions	-
	Degeneration of nervous system due to alcohol	Other neurological conditions	-
	All other neurological conditions	Other neurological conditions[a]	0.2
	Epilepsy	Epilepsy	13.6
Injury and Poisoning (intentional or unintentional)	Accidental poisoning by alcohol	Poisoning	
	Intentional self-poisoning by alcohol	Poisoning	
	All Alcohol Poisoning	Poisoning[a]	6.0
	Assault / homicide	Homicide and violence	17.2
	Drowning	Drowning	13.2
	Falls	Falls	8.3
	Fires	Fire, burns and scalds	14.1
	Intentional self-harm	Suicide and self-inflicted injuries	10.6
	Other unintentional injuries	Other unintentional injuries	14.5
	Road traffic injury non-pedestrians	Road traffic injury - motor vehicle occupants: pedal cyclists, motorcyclists	14.9
	Road traffic injury pedestrians	Road traffic injury - pedestrians	22.5

Sources: AIHW Disease Expenditure Study (2019g); Zhao (2017).

[a] Multiple alcohol-attributable conditions are mapped onto an overall matching AIHW Disease Expenditure Study category (2019g).

AAC = alcohol-attributable condition: DES = *Disease Expenditure Study*: Seps = separations: Zh_RR = Zhao relative risk (2017).

As described in Section 3.3, three different sets of PAAF were used to allow for uncertainty in the scientific literature regarding potential protective effects of low dose alcohol use (as discussed in Section 1.3) on some cardiovascular conditions and Type II Diabetes. PAAF based on relative risks for ischaemic heart disease (IHD) were taken from Zhao and colleagues (2017) and Roerecke and Rehm (2010b) to calculate disease expenditure costs. These costs were used as the central estimate in calculating health care costs based on the disease expenditure method.

When estimating potential protective effects, the number of hospital separations was added to the denominator i.e., the total number of separations for a particular condition with a protective effect for alcohol. As an example, for IHD, the total number of actual patient separations during 2017/18 was 161,801. Based on the scale of protective effect calculated by Zhao and colleagues (2017) and Roerecke and Rehm (2010b), Australian alcohol consumption patterns are estimated to have prevented 13,695 separations, with a net protective effect of 11,490 separations. Therefore, the total number of expected separations if no alcohol consumption had occurred would have been 173,291; and the share of prevented separations was calculated from this notional no alcohol consumption total. Disease expenditure costs calculated using RR estimated from Roerecke and Rehm (2010, 2011, 2012) and RR estimates without protective effect are given in Appendix 4.2.

Cost estimates from the *Disease Expenditure Study* were used in costing non-admitted health care e.g., allied health care, imaging, pharmaceuticals, pathology and GP visits. As the costs reported were for 2015/16, they were adjusted for inflation (Australian Bureau of Statistics, 2021b).

4.2.2 Hospital separations cost-share method

In past reports in this series, for some cost items, such as GP services, there was no unambiguous way of attributing costs to substance use, as there was no consistent and reliable equivalent to the ICD-10 coding used for hospital separations (Whetton et al., 2016; Whetton et al., 2019). To address this challenge, the assumption was made that the proportion of other health costs attributable to substance use could be reasonably approximated by the proportion of hospital bed-days attributed to that substance on the basis that they had a similar distribution of underlying causes (Collins and Lapsley, 2008; Whetton et al., 2013). This approach was used as an alternative method in calculating the healthcare costs attributable to alcohol use (e.g., ambulance services, low bound estimate). If a different method of cost calculation is used for a certain cost item, it is highlighted in the respective section.

In 2017/18, total expenditure on hospital separations was $29.4 billion (Independent Hospital Pricing Authority, 2020). Alcohol-attributable hospital separations were estimated to have had a total net cost of **$716.7 million** (see Chapter 3, Table 3.9 for calculation; this calculation includes the prevented hospital separations), giving a cost-share of **2.44 percent.** This then represents a base cost-share for other medical costs, which was adjusted where other evidence suggested that this was required. It should be noted that in addition to alcohol-attributable medical conditions, the above percentage cost-share also includes the cost of alcohol-attributable conditions such as accidental injury, interpersonal violence and intentional self-harm.

4.3 Non-admitted patients and other medical costs

4.3.1 Ambulance

Information was sourced from different states regarding harms related to alcohol and associated ambulance attendances. While all states keep data on ambulance service utilisation, Victoria collects data on substance use that is reliable enough to be used for ambulance cost calculation in our report. The *Ambo Project: Alcohol and Drug-Related Ambulance Attendances System* (Turning Point, 2019) comprehensively reports on alcohol and other drug-related events attended by Victorian ambulance paramedics. From these data, the rate of alcohol-attributable ambulance attendances per person (15 years or older) was calculated for the state of Victoria and extrapolated to the Australian population.

During 2017/18, there were 25,454 alcohol-attributable ambulance attendances in Victoria: a rate of 483 alcohol-attributable attendances per 100,000 persons 15 years and older. Projecting this rate to the Australian population (Australian Bureau of Statistics, 2019h) amounted to 97,913 alcohol-attributable ambulance attendances. It is likely that the collection of attribution information will not include many cases where attribution to alcohol can only be identified statistically such as breast cancer. But conversely it cannot calculate the ambulance attendances averted due to the potential protective effects of alcohol for a small range of conditions.

In 2017/18, there were 2.02 million ED presentations where the arrival mode was recorded as ambulance, air ambulance or helicopter rescue service. In addition, there were 296,296 intra-hospital transfers for acute patients (Australian Institute of Health and Welfare, 2017a). Assuming that all intra-hospital transfers for acute patients used an ambulance service, the total ambulance activity in 2017/18 was estimated to be 2.31 million transfers. The total 'patient transport' expenditure in 2017/18 was $4.2 billion (Australian Institute of Health and Welfare, 2019d). Therefore, the average cost of an ambulance transfer was calculated as $1,834. Multiplying the average cost with 97,913 alcohol-attributable ambulance attendances gives a total cost of **$179.6 million**. This forms the high bound estimate for ambulance costs.

Using a rationale that the population served is similar, the proportion of ambulance costs attributable to specific causal factors could be argued to be broadly similar to that of hospital separations. Thus, the proportion of hospital separation costs attributable to alcohol use are proposed as a reasonable proxy for the proportion of ambulance costs that can be attributed to this cohort of patients. Applying the cost-share of 2.44 percent of hospital separations attributed to alcohol produces a low bound estimate of **$103.4 million** for alcohol-attributable ambulance services costs. The mean of the low and high bound values was used to produce the central estimate of **$141.5 million**.

4.3.2 Emergency departments

Alcohol use remains one of the most significant preventable issue facing hospital ED across Australia. The most common alcohol-attributable presentations include injuries arising from assaults or fights, vehicle crashes, acute intoxication and mental health concerns. Therefore, potential cost-saving to the public health sector by reducing alcohol-attributable presentations in ED throughout the country is likely to be considerable (Chikritzhs et al., 2011).

According to a previous research study, Australia-wide the estimated proportion of ED injuries attributable to any level of drinking in the six hours prior to an injury was 28.5 percent (Chikritzhs et al., 2011). The total number of ED presentations for patients 15 years or older related to injury and poisoning (ICD-10AM code S00-T98) during 2017/18 was approximately 1.44 million (Australian Institute of Health and Welfare, 2017a); applying a PAAF of 0.285 (or 28.5%) produces an estimated 410,800 alcohol-attributable injury and poisoning presentations. In addition, a further 41,385 alcohol-attributable ED presentations for non-injury conditions (i.e., mental health, circulatory and digestive system and FASD) were estimated by applying the estimated proportion of alcohol-attributable hospital separations within each broad diagnostic chapter as a proxy PAAF for ED presentations (Appendix 4.3). Total estimated expenditure on 7.87 million ED presentations (all age groups) during 2017/18 was $5.5 billion (Independent Hospital Pricing Authority, 2020), giving an average cost of $705 per ED presentation. Applying this averaged cost per ED presentation, the high bound total cost of 452,186 alcohol-attributable ED presentations was estimated to be **$318.8 million** in 2017/18.

The *Disease Expenditure Study* assigned costs to each ED presentation based on average costs from the National Hospital Cost Data Collection (NHCDC) for each hospital and the Urgency Related Group (URG) emergency care classification, developed for activity-based funding (Australian Institute of Health and Welfare, 2019g). The total CPI adjusted (Australian Bureau of Statistics, 2021b) public hospital ED cost in 2017/18 was $6.7 billion. Individual costs for each alcohol-attributable condition were calculated using the proportion of alcohol-attributable hospital separations for that condition as a proxy PAAF for ED presentations (Table 4.1). For example, out of 28,765 total hospital separations for bowel cancer, 3,486 (12.1%) were alcohol-attributable and total expenditure by public hospital ED on bowel cancer estimated by the *Disease Expenditure Study* was $540,941; the cost of alcohol-attributable bowel cancer was therefore estimated as $65,556. Combining all disease conditions, the total alcohol-attributable public hospital emergency cost was estimated to be **$243.8 million.** As this does not include ED run by private hospitals, it is likely to be a conservative estimate. The mean of the low and high bound values was calculated to arrive at a central estimate of **$281.3 million.**

A relatively recent study (Egerton-Warburton et al., 2018) which estimated the contribution of alcohol use to ED presentations across several Australian and New Zealand ED was also considered. In that study, around one in 10 (9.5%) ED presentations were identified as alcohol-positive. However, it was noted that the Egerton-Warburton et al. 2018 study had a relatively small sample size (n=8,435), only screened patients for seven days across eight hospitals and may have included ED presentations that arose from an alcohol affected third party. If alcohol-attributable cost were assigned to be 9.5 percent of all ED presentations, rather than the subset of presentations used here, it will result in a much higher cost estimate. Therefore, cost estimate based on Chikritzhs et al. (2011) is preferable due to it being a more conservative one derived from a more rigorous method.

4.3.3 Non-admitted ("Outpatient")

While there has been considerable research on the demands placed on ambulance services and ED resources from the use of alcohol, there is less information on the impacts on outpatient (now termed non-admitted) care and other health services. Two approaches were used to estimate these costs. First, results from the *Disease Expenditure Study* were used to derive cost estimates from National Non-Admitted Patient Aggregate Database (holding non-admitted patient care data for all public hospitals) and the episode level data from the National Non-admitted Patient Database (holding non-admitted patient care data for all activity-based funding hospitals). Since national outpatient clinic data does not contain diagnostic information, the ABDS conditions managed in outpatient clinics were estimated by the *Disease Expenditure Study* using BEACH data (Australian Institute of Health and Welfare, 2019g).

From the *Disease Expenditure Study* (Australian Institute of Health and Welfare, 2019f), after CPI adjustment (Australian Bureau of Statistics, 2021b) the total public hospital non-admitted patient cost in 2017/18 was $9.1 billion. After calculating the costs for each alcohol-attributable health problem, the total alcohol-attributable public hospital outpatient cost was estimated to be **$219.1 million**, the high bound estimate. This estimate does not include the cost incurred at private hospital outpatient clinics and should therefore be considered a conservative estimate.

The second method used is the hospital separations cost-share method, as used in earlier reports from this series, which assumes that 2.44% of total given health care expenditure is due to alcohol use. The total cost of non-admitted patient care in 2017/18 was $6.8 billion or $317 per episode (Independent Hospital Pricing Authority, 2020, Table 3). Applying the fraction of costs, the lower bound cost of alcohol-attributable non-admitted care was estimated at **$166.2 million**. For the central estimate, the average of low and high bound estimates was calculated to be **$192.6 million**.

4.3.4 Primary healthcare

4.3.4.1 Unreferred medical services

Unreferred medical services in the primary health domain covers services provided to a person by, or under the supervision of, a medical practitioner without a referral from another medical practitioner or person with referring rights. Most commonly, these include visits to a General Medical Practitioner i.e., a GP (Australian Institute of Health and Welfare, 2019d).

Due to the absence of a national administrative data source capturing diagnostic information from GP clinics, the *Disease Expenditure Study* used results from the BEACH survey and data from Medicare Benefit Schedule (MBS) to assign diagnoses to GP visits and map them to ABDS groupings (Australian Institute of Health and Welfare, 2019g). In 2017/18, the total CPI adjusted (Australian Bureau of Statistics, 2021b) cost for GP services in Australia was $9.3 billion. After calculating costs for each alcohol-attributable health problem, the total alcohol-attributable cost for unreferred medical services was estimated at **$90.3 million**, the low bound estimate.

It seems likely that reasons for referral to specialist care would be more closely aligned with hospital episodes than the use of GP services as there are a number of reasons for seeing a GP or other primary care physicians which are largely dissimilar to those for which patients are admitted to hospital. Data from the BEACH survey (Britt et al., 2016), suggests that at least 19.4 percent of GP visits are wholly or largely unrelated to conditions that resulted in hospitalisation (e.g., visits for prescriptions, general check-ups and administrative visits) and therefore should be excluded from these calculations. Since the total expenditure on unreferred medical services for 2017/18 was $12.7 billion (Australian Institute of Health and Welfare, 2019d), 19.4 percent of that cost was excluded and $10.2 billion considered as the expenditure on unreferred medical services potentially attributable to factors causing risks to health.

Using the hospital separations cost-share method, assuming that 2.44 percent of total given health care expenditure is due to alcohol use, **$248.8 million** was estimated to be the cost of alcohol-attributable unreferred medical services (high bound estimate). The average of low and high bound, **$169.5 million** was taken as the central estimate[20].

4.3.4.2 Primary healthcare – referred medical services

Referred medical services are those where the person has been referred by a GP or a medical specialist. Typically, a GP refers patients to specialists, allied health professionals, pathology or radiology providers. BEACH data, combined with MBS items in the Diagnostic Imaging Services category, medical specialists and allied health were used in mapping referred medical services to the ABDS groupings (Australian Institute of Health and Welfare, 2019g).

The total 2017/18 CPI adjusted (Australian Bureau of Statistics, 2021b) cost for allied health, medical imaging, pathology and specialist services in Australia was $14.0 billion. After calculating costs for each alcohol-attributable health problem, the total cost of referred medical services due to alcohol was estimated to be **$169.2 million**, the low bound estimate.

The total expenditure on referred medical services for 2017/18 was $19.4 billion (Australian Institute of Health and Welfare, 2019d). After excluding 19.4 percent for visits that were largely unrelated to conditions that result in hospitalisation, $15.6 billion was considered as the actual expenditure on referred medical services. Using the hospital separations cost-share method, assuming that 2.44 percent of total given health care expenditure is due to alcohol use, **$381.0 million** was estimated as the alcohol-attributable cost of referred medical services. This made the high bound estimate. The average of low and high bounds, **$275.1 million**, was taken as the central estimate.

The overall central estimate for alcohol-attributable primary health care was **$444.6 million,** with **$295.6 million** as the low and **$629.7 million** as the high bound estimates.

4.3.5 Community mental health

The number of service contacts and the costs of community mental health expenditure data were sourced from the AIHW report providing statistics for mental health services in Australia (Australian Institute of Health and Welfare, 2021c).

During 2017/18, around 9.5 million community mental health care service contacts were provided to 435,272 patients across Australia. Of these, 58,262 (0.6%) service contacts were for the principal diagnosis 'Mental and behavioural disorders due to use of alcohol (F10)'. The total expenditure on community mental health care services in Australia during the same time period was $2.3 billion, with an average cost of $237.20 per service contact. Therefore, the total cost of alcohol-attributable community mental health service contacts was **$13.8 million**, taken as the central cost estimate.

Using the hospital separations cost-share method, assuming that 2.44 percent of total given health care expenditure is due to alcohol use, the total cost of alcohol-attributable community mental services was estimated to be **$55.0 million**, taken as the high bound estimate.

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[20] It should be noted that in the past reports of social cost of illness series, to calculate the high bound cost, total expenditure was used without excluding 19.4 percent visits that were largely unrelated to conditions that result in hospitalisation. For the low bound, expenditure excluding 19.4 percent was used.

4.3.6 Specialist drug treatment services

Data on the number of treatment episodes with alcohol as the primary drug of concern were obtained from the AIHW dataset *Alcohol and Other Drug Treatment Services* (AODTS) (Australian Institute of Health and Welfare, 2019c). The AODTS data also contain information on individuals who seek treatment or support for themselves as a consequence of another person's drug use.

Alcohol use is a major factor for people seeking treatment for drug related problems and dependence. During 2017/18, AODTS provided 208,935 treatment episodes and, of those, more than one third (35.3%) were for alcohol as the principal drug of concern.

Average treatment costs for different treatment types were sourced from a previous study that drew on public data to estimate costs for 2013/14 (Mental Health Commission, 2015) and a personal communication (personal communication TK, 2015). The 2013/14 figures were adjusted to 2017/18 for CPI (Australian Bureau of Statistics, 2021b). To avoid double counting, pharmacotherapy sessions were costed at the counselling services rate, as there were resource implications for these service events. Overall, the total cost of treatment for a person's own use of alcohol was **$197.6 million** (Table 4.2).

Table 4.2: Costs of treatment episodes, alcohol as primary drug for own use, 2017/18

Treatment type		**Number of episodes**	**Cost per episode (CPI adjusted)[d] ($)**	**Costs ($)**
Withdrawal		**12,507**		
	Non-residential[a]	*5,042*	*5,116*	25,796,788
	Residential[a]	*7,465*	*7,746*	57,825,346
Rehabilitation		**4,559**		
	Non-residential[a, b]	917	2,134	1,956,681
	Residential[a]	3,642	7,746	28,211,642
Counselling[a]		28,084	2,134	59,925,215
Support & case management only[c]		8,705	1,852	16,117,837
Information & education only[c]		3,160	390	1,233,020
Assessment only[c]		11,438	120	1,369,488
Pharmacotherapy and other[a]		2,406	2,134	5,133,886
Total		**70,859**		**197,569,903**

Sources: Australian Institute of Health and Welfare (2019c).
[a] Mental Health Commission (2015).
[b] Personal communication TK (Personal communication TK, 2015).
[c] Ngui and Shanahan (2010).
[d] These data do not include visits to General Practitioners or other health care provided in community mental health which are captured elsewhere.
Totals may not sum due to rounding.

To calculate treatment episodes for clients who were seeking treatment for other's drug use, such as a family member, relative or friend, the individual proportions out of the total by treatment types were applied. Thus, counselling for one's own alcohol use accounted for 28,084 (37.3%) out of 75,383 counselling episodes. Applying the same proportion, 5,728 counselling episodes for another's substance use resulted in 2,134 episodes attributable to alcohol. Therefore, the additional cost of episodes was $5.1 million (Table 4.3). The total costs of other specialist and drug treatment services for alcohol-attributable cases was **$202.6 million** (Table 4.4), taken as the high bound estimate.

Based on the average treatment costs for different treatment types (Table 4.2), the total expenditure on 208,935 AODTS episodes was $483.8 million. Since alcohol as a principal drug was responsible for 35.3 percent of these episodes, the proportional share of expenditure out of the total was **$170.8 million**. This was taken as a low bound estimate, with a central estimate of **$186.7 million**, being the average of the low and high bound estimates.

Estimates based on AODTS treatment episodes should be considered conservative as they do not include people who go to other non-government agencies, pastoral care or to their local GPs.

Table 4.3: Costs for those seeking treatment due to others' use of alcohol

Treatment type	Episodes - 'seeking treatment for other's alcohol or drug use' (n)	Episodes - treatment for own drug use (alcohol as % of total episodes)	Episodes - 'seeking treatment for other's alcohol use' (n)	Costs ($)
Counselling[a]	5,728	37.26	2,134	4,553,436
Support & case management only	741	29.63	220	406,484
Information & education only	984	19.24	189	73,855
Assessment only	629	35.51	223	26,739
Total	**8,082**	**-**	**2,766**	**5,060,514**

Source: Australian Institute of Health and Welfare (2019c).

[a] These data do not include visits to General Practitioners or other health care provided in community mental health services which are captured elsewhere.

Totals may not sum due to rounding.

Table 4.4: Total expenditure on treatment for alcohol use at specialist treatment centres

Client Type	Costs ($)
Treatment for own use	197,569,903
Treatment for alcohol use by another person	5,060,514
Total	**202,294,172**

Totals may not sum due to rounding.

4.4 Prescribed pharmaceuticals

Pharmaceuticals used in treating alcohol-attributable conditions, received while an inpatient, are included within the costs derived from diagnosis-related group codes, and form part of the costs reported in Chapter 3. Also, all averted medical costs, due to premature alcohol-attributable deaths, including pharmaceuticals, are included in the mortality cost estimate (Chapter 3). Therefore, to avoid double counting, these notional future cost-savings are not included here. However, cost for treatment of alcohol-attributable conditions outside the hospital system is part of other health care costs.

The preferred approach for calculating alcohol-attributable pharmaceutical costs was to follow the method described in the *Disease Expenditure Study* where BEACH data were linked with data from the Pharmaceutical Benefits Scheme (PBS), resulting in a dataset containing the number of prescriptions, total patient co-payment, and total Australian Government expenditure for each ABDS condition, by item code, anatomical therapeutic chemical classification and patient demographics (Australian Institute of Health and Welfare, 2019g).

Pharmaceutical costs for each alcohol-attributable medical condition were then calculated out of total CPI adjusted (Australian Bureau of Statistics, 2021b) PBS expenditure of $14.4 billion in 2017/18. The total alcohol-attributable pharmaceutical cost was estimated to be **$104.5 million**, the low bound estimate.

The high bound cost was estimated using the same approach as for outpatient hospital costs, i.e., allocating a share of total PBS listed pharmaceutical costs equal to the share of alcohol-attributable inpatient separations. In 2017/18 the total cost of PBS and the Repatriation PBS medications was $11.6 billion, with a further $1.5 billion in gap payments, totalling $13.1 billion (Pharmaceutical Benefits Scheme, 2020). Assuming the proportion of PBS listed pharmaceutical costs attributable to alcohol matched the share of hospital separation costs in 2017/18 gives a high bound estimate of **$318.3 million**, with a central estimate of **$211.4 million** being the average of the low and high bound estimates.

4.5 Dental services

Kwasnicki et al. (2008) concluded that those dependent on alcohol had a higher prevalence of dental caries, periodontitis and mucosal lesions than those not alcohol dependent. Various factors might influence this association. For instance, alcoholic beverages such as beer, liquor and mixed drinks have a high sugar content and are acidic (Grocock, 2018) which contributes to the breakdown of the protective enamel of teeth, resulting in long-term dental problems. There is also evidence that at least some people with alcohol dependence are less likely to practice good oral hygiene (Hede, 1996) and may have poorer general health. Alcohol is also an important risk factor for oral cancer (Gormley et al., 2020) with more than one third of hospitalisations for oral cavity and pharynx cancer attributable to alcohol (Table 4.1). Alcohol-attributable cancers will also contribute to dental problems as one of the known adverse effects of chemotherapy is oral health complications (Amodio et al., 2014; Taichman et al., 2015).

Most Australian dental services occur through private dental practices i.e., funded outside of government programs, and there is no national data service that collates and analyses all types of dental services. Therefore, to allocate dental expenditure costs across disease groups, the *Disease Expenditure Study* mapped Australian health expenditure estimates by area and funding source (Australian Institute of Health and Welfare, 2017c) to the burden of disease conditions (Australian Institute of Health and Welfare, 2019g). Combining all disease conditions wholly or partially attributable to alcohol, the total alcohol-attributable dental expenditure was **$45.7 million,** taken as the central estimate. Dental expenditure specific data from the disease expenditure survey was preferred as the central estimate as it was regarded as more likely to pick up the specific drivers of dental cost than the broader average of all alcohol specific hospital separations, which includes conditions with no link to dental health.

The total health expenditure on dental services during 2017/18 was $10.5 billion (Australian Institute of Health and Welfare, 2019d). Assuming a cost-share of 2.44 percent (proxy from attributable hospital separations), a high bound cost of **$256.1 million** was estimated.

4.6 High-level residential care and other aged care

Residential care data (excluding expenditure on high-level residential care for younger people with disability) were extracted from the *Community Services* report on aged care (Steering Committee for the Review of Government Service Provision, 2019b). This item accounted for over two thirds of the total aged care expenditure ($12.4 billion of $18.4 billion), with other services such as home care and other support services accounting for the remainder. As only data on government expenditure on aged care services is available, it is likely that these costs are underestimated.

Data from the AIHW suggest that 53 percent of nursing home residents suffer from some form of dementia (Australian Institute of Health and Welfare, 2012). It was assumed that those with dementia would be in nursing home care regardless of other conditions and have been excluded from the alcohol-attributed cost calculation. Discounting expenditure on high level residential care to exclude patients who have dementia gives potentially an in-scope government cost of $6.6 billion.

Other aged care services have total government expenditures of $5.8 billion. Assuming that a similar proportion of other aged care costs are attributable to dementia, this gives in scope government costs of $2.8 billion. Applying the cost-share from hospital separations suggests that alcohol-attributable cost to government of high-level residential care was **$143.0 million** and the attributable cost to government of other aged care services was **$67.3 million** in 2017/18. These costs were taken as the central estimates as no alternative methods were available to calculate the low and high bound estimates.

4.7 Informal carers

The formal health care sector only represents a portion of total health care provided with a considerable proportion of care hours contributed by family members and friends. A re-analysis of the Australian 'Harms to Others' survey (Laslett et al., 2010) estimated that people who cared for a heavy drinker spent, on average, 32 hours per year caring for that person, their children or other dependents (Jiang et al., 2017a). After discounting 90 percent of this time as 'voluntary' contributions by carers, the study estimated the cost of alcohol-attributable informal carer time at $250 million (Jiang et al., 2017a) or $303 million in 2017/18 (CPI adjusted) (Australian Bureau of Statistics, 2021b).

The informal care considered in the above estimate typically concerned care during acute events (caring for children, providing a taxi service, cleaning up). In addition, informal care can be estimated for activities involved in caring for ill-health and disability due to alcohol-attributed conditions. In 2018, about 2.65 million people reported providing informal care with 861,000 being the primary carer for someone (Australian Bureau of Statistics, 2018d). In 2015, the value of informal care was estimated to be $60.3 billion, when valued at replacement cost[21] (Deloitte Access Economics, 2015). This estimate was based on 0.8 million people who described themselves as primary carers and a further 2.0 million persons who acted as non-primary carers. In contrast, a survey of people with disability reported that 0.3 million required assistance with an activity by an informal carer at least once a year, with 0.2 million people reporting the need for assistance on at least one occasion a week (Australian Bureau of Statistics, 2017c). As there are no data to determine which of these two estimates is more accurate, the estimate reported by carers was used as the high bound and the estimate from those requiring care as the low bound.

The data analysis of informal care costs for specific health conditions was limited as the ABS aggregates informal care needs of people with disability with alcohol-relevant and non-alcohol relevant conditions. Data was available for the following primary conditions[22] which were at least partially caused by alcohol (Australian Bureau of Statistics, 2017c):

- Other diseases of the digestive system;
- Head injury/acquired brain injury;
- Arm/hand/shoulder damage from injury/accident;

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[21] "total resources that would need to be diverted each year from the formal economy to replace the services provided by informal carers, were their services no longer available" (Deloitte Access Economics, 2015, p. iii).

[22] A number of conditions caused by alcohol, particularly cancers, were not reported separately in the data but rather aggregated as other malignant neoplasms, and therefore could not be included in the calculation.

- Leg/knee/foot/hip damage from injury/accident;
- Other injury, poisoning and consequences of external causes;
- Diabetes;
- Myocardial infarction (heart attack);
- Hypertension (high blood pressure);
- Stroke.

In each case the number of persons reporting that they received informal assistance for activities was adjusted to reflect the alcohol-attributable cases using the proportion of hospital separation costs for that condition attributable to alcohol.

There were 3,900 persons (low bound 3,700; high bound, 4,900) reporting that they needed informal assistance at least once per week due to an alcohol-attributable condition, or 0.6 percent of the total persons reporting needing informal assistance at this frequency for any condition (low bound, 0.6 percent; high bound, 0.7 percent).

The cost to primary and secondary carers is likely to vary with the severity of the condition of the person being cared for, with increasing hours per week required for more severe conditions. Across severity levels, the average cost in 2015 was estimated at $70,362 per person per year (Deloitte Access Economics, 2015) or $73,962 in 2017/18 values (Australian Bureau of Statistics, 2021b). Applying this average per person care cost estimate to the number requiring assistance for alcohol-attributable conditions gives an estimated total cost of informal care of $290.6 million.

As an alternative approach to estimation, the share of persons needing assistance due to an alcohol-attributable condition (0.6 percent) was applied to Deloitte Access Economics' estimated total cost of informal care of $60.3 billion (Deloitte Access Economics, 2015) or $63.4 billion in 2017/18 values (Australian Bureau of Statistics, 2021b). This gives an estimated total cost of alcohol-attributable informal care of $375.4 million. For the central estimate, the average value from the two approaches was taken, which was **$333.0 million** (low bound $317.6 million, high bound $414.3 million) (see Appendix 4.1 Table A4.5 for details).

4.8 Limitations

In estimating the cost of residential-care, both those with dementia and young persons with disabilities were excluded. The exclusion of those with dementia may result in a substantial under-estimation of the full cost of alcohol-caused harms, as this population will include those with dementia due to alcohol use. Notably, alcohol-attributable dementia may account for between 10 and 24 percent of residential care dementia cases (Carlen et al., 1994; Oslin and Cary, 2003), and hence the cost of alcohol-attributable aged-care will be underestimated. The lack of reliable data on the prevalence of alcohol-attributable dementia (and other neurological conditions) prevented us from estimating their contribution to these costs (Heirene et al., 2020).

In addition, there are further costs in supporting older adults to remain in their own homes and in providing flexible care options, such as short-term restorative care (Steering Committee for the Review of Government Service Provision, 2019b). In 2017/18 about 783,000 people received support under the Commonwealth Home Support Programme with the Home Care Packages Program accessed by nearly 117,000 people (Australian Institute of Health and Welfare, 2019i). Most people (71%) who have dementia remain in the community with the large majority (77%) accessing formal services (Australian

Institute of Health and Welfare, 2012, 2014). Costs due to dementia were excluded from the estimate of alcohol-attributable non-residential aged-care: some of these cases and costs are likely to be alcohol-caused.

Further, in 2017/18 there were more than 6,000 young people (those aged <65 years) in residential aged care (Department of Social Services, 2020). The exclusion of young people with disability will likely result in the omission of some with injuries due to alcohol-attributable road traffic crashes: acquired brain injury is the most frequent cause of disability for those aged under 50 years in residential aged-care (Winkler et al., 2010).

A considerable difference in the costs of health services derived from the *Disease Expenditure Study* and the Independent Hospital Pricing Authority were noted. For example, the *Disease Expenditure Study* reported hospital non-admitted costs as $8.8 billion ($9.1 billion in 2017/18 (Australian Bureau of Statistics, 2021b; Australian Institute of Health and Welfare, 2019f). In comparison, the IHPA reported a cost of $6.8 billion for the same cost domain (Independent Hospital Pricing Authority, 2020, Table 3). The reasons for these differences could not be determined and hence which estimate was most accurate remains unknown.

It should be noted that while the Disease Expenditure Study extensively used data from the BEACH survey of GPs for cost calculations of non-hospital medical services and pharmaceuticals, it acknowledged the limitations of such data as well. Firstly, the data was collected prior to the Disease Expenditure Study 2015/16 reference period. Secondly, only around 100,000 patient encounters were surveyed and recorded each survey year, given that the actual number of service events for GP and specialist services are several million each year. Therefore, extrapolation of results from a relatively small sample may result in biases, particularly for rare medical conditions which are recorded relatively infrequently (Australian Institute of Health and Welfare, 2019g).

There are currently limited data on specific health service populations and assumptions were made, for example, that those in ED and those using ambulance services were similar. Any differences may serve to increase or decrease the cost of these services.

The cost of informal care provided by family and others, based on assistance required in relation to disability or long-term conditions, was estimated. There were also other costs that could be attributed to more acute alcohol-attributable events, which may add a further $303 million (Jiang et al., 2017a; Laslett et al., 2010). While these costs are unlikely to overlap with the other informal care costs reported here, they could substantially overlap with the costs in Chapter 8, from living with a person dependent on alcohol, and for that reason have not been included in the total. Finally, the aggregation of conditions in the disability report (Australian Bureau of Statistics, 2017c) meant that only a subset of alcohol-attributable conditions could be included in the calculation of informal carer costs.

4.9 Conclusions

This chapter presented health costs in primary care and for other health costs for non-admitted treatment. The estimated total health care cost attributable to alcohol was **$2.1 billion** in 2017/18 (Table 4.5). Notably, even excluding informal care, primary healthcare and non-admitted treatment costs were more than double estimated inpatient care costs due to alcohol (i.e., $1.7 billion vs $0.7 billion [Table 3.9]). The continuing emphasis on reducing length of hospital inpatient stays, given the demand for beds and the costs of inpatient care (Australian Institute of Health and Welfare, 2017e) means that the relative cost of out-of-hospital care is likely to increase in the future. Including an additional valuation for care provided by family members substantially increases the cost of alcohol to society.

The hospital cost-share method was primarily included to allow easier comparison with the estimates produced in the earlier reports in this series. In each cost area, the initial basis in allocating costs was to use the same proportion of costs as represented by alcohol-attributed hospital separation costs (i.e., 2.44%, Section 4.2.2). However, it should be noted that this method did not allow some costs to be calculated (e.g., pathology, allied health), so the approach based on the Disease Expenditure Study is recommended for future analyses especially for more accurate estimation of pharmaceutical costs.
In past reports of this series, pharmaceutical costs were estimated by extracting individual PBS item numbers categorised by various diseases and body systems (Pharmaceutical Benefits Scheme, 2018) and then multiplying the number of drugs dispensed by their government and patient contribution costs. While this approach was very detailed, it did not allow adjustment for the fact that quite a few medications are used to treat problems outside of their intended disease or body system classification. For example, some psychotropic or antidepressant medications to treat functional gastrointestinal disorders such as irritable bowel syndrome (Thiwan and Drossman, 2006). Also, it was not possible to assign medications for health problems as a result of intended or unintended injuries from accidents or any form of violence, since the list of medications in such cases could extend to many body systems and disease categories.

The Disease Expenditure Study used data from the BEACH survey where each referral, prescription, imaging or pathology request was related to a specific diagnosis i.e., mapping each medicine prescribed by a medical practitioner to its one or more diagnoses (Australian Institute of Health and Welfare, 2019g). This allowed more accurate estimation of pharmaceutical costs. Considering the above scenario where antidepressants are sometimes used as a component of the treatment of gastrointestinal disorders for instance (Fikree and Byrne, 2021), the mapping file from BEACH dataset would have linked the prescribed psychotropic drug to its intended diagnosis of gastrointestinal disorder. Thus, the release of the Disease Expenditure Study (Australian Institute of Health and Welfare, 2019g) has greatly facilitated the estimation of health costs and will provide a consistent and replicable basis on which to estimate costs for other conditions. Appendix 4.4 provides a comparison of cost methods used in this report and those used to estimate equivalent costs due to tobacco consumption (Whetton et al., 2019).

In Section 4.2.1 the potential for protective effects of alcohol use on IHD was modelled using the risk assumptions calculated by Zhao and colleagues (2017), which were used as the central estimate in Chapter 3. Appendix 4.2 shows the impact of each scenario across each part of the non-inpatient health sector. The difference between the ‘most protective’ scenario using data from Roerecke and Rehm (2010, 2011, 2012) and the ‘least protective’ scenario (no protective effect of alcohol on IHD) was $366.8 million.

Table 4.6 summarises all the health care related costs mentioned in Chapters 3 and 4 and the proportion of cost attributable to alcohol. Overall, the total health care related expenditure during 2017/18 was $113.0 billion. Out of that, $2.8 billion was attributable to alcohol-caused conditions (2.5 percent of the total). Figure 4.1 shows the percentage of costs in each part of the health care system attributable to alcohol-caused illness.

Table 4.5 Summary of primary care & non-admitted patient health care costs

Cost area	Central estimate ($)	Low bound ($)	High bound ($)
Ambulance costs	141,480,192	103,394,780	179,565,604
Emergency Department costs	281,304,860	243,780,006	318,829,714
Non-admitted patient care costs	192,645,039	166,226,721	219,063,356
Primary healthcare	444,620,361	259,507,786	629,732,936
Unreferred medical services	*169,538,671*	*90,300,024*	*248,777,319*
Referred Medical services	*275,081,690*	*169,207,762*	*380,955,618*
Specialist drug treatment services cost	186,696,525	170,762,633	202,630,417
Community mental health[a]	13,818,419		54,973,441
Prescribed pharmaceuticals	211,388,186	104,490,885	318,285,487
Dental services[a]	45,730,613		256,098,291
High-level residential care[a]	143,003,983		
Aged care[a]	67,274,596		
Informal carers	332,987,622	317,575,515	414,337,906
Total	**2,060,950,395**	**1,635,565,936**	**2,803,795,732**

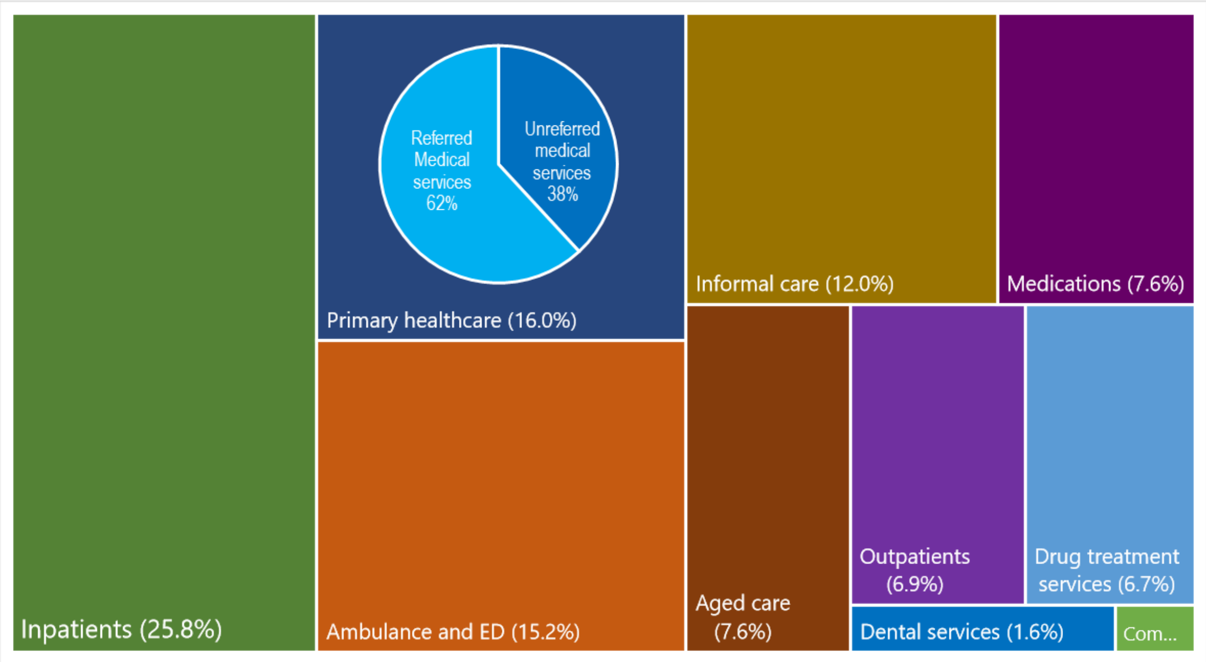
[a] Central estimates have been used to calculate totals where low or high bound costs are not available.
Totals may not sum due to rounding.

Table 4.6: Alcohol-attributable cost-share of total expenditure for health care services in 2017/18.

Item	Alcohol-attributable ($)[a]	Total Health Expenditure ($)	Alcohol-attributable Share
Hospital separations	716,743,492	29,405,990,344	2.4%
Ambulance and ED	422,785,052	9,795,629,122	4.3%
Outpatient care costs	192,645,039	6,819,819,670	2.8%
Primary healthcare	444,620,361	32,054,000,000	1.4%
Drug treatment services	186,696,525	483,793,319	38.6%
Community mental health	13,818,419	2,255,407,252	0.6%
Medications	211,388,186	13,058,367,568	1.6%
Dental services	45,730,613	10,507,000,000	0.4%
Aged care[b]	210,278,579	8,627,144,766	2.4%
Informal care	332,987,622	60,272,000,040	0.6%
Total healthcare related expenditure	**2,777,693,887**	**173,279,152,081**	**1.6%**

[a] Central cost estimates.
[b] Excludes dementia costs.
Totals may not sum due to rounding.

Figure 4.1: Source of alcohol-attributable costs across the health sector including informal carers (% of total alcohol-attributable health sector costs)



Com… = Community mental health: share = 0.5%

CHAPTER 5: WORKPLACE COSTS

Alice McEntee, Ann Roche & Steve Whetton

5.1 Background

As one of the drugs most used in Australia, alcohol impacts the workplace as well as the broad community. One third (33%) of the Australian population drink at levels that put them at risk of alcohol-related disease or injury[23] (Australian Institute of Health and Welfare, 2021b) and alcohol is responsible for 4.5 percent of the burden of disease and injury in Australia (Australian Institute of Health and Welfare, 2019h). Given these findings, it is not surprising that harms are also experienced in the workplace.

More men drink at risky levels (41.3%) than women (23.1%) (National Centre for Education and Training on Addiction, 2021). Employed Australians are also more likely to drink at levels that increase their risk of alcohol-related harm (37.9% vs 17.8-28.1% for other labour force groups[24]) (National Centre for Education and Training on Addiction, 2021). Reported prevalence of risky alcohol use varies by industry and occupational group. For example, workers in electricity, gas, water and waste services (57.1%), construction (52.2%), and agriculture, forestry and fishing (47.8%) industries have much higher prevalence of risky use compared to other industries (National Centre for Education and Training on Addiction, 2021). Among workers, the prevalence of risky alcohol use is higher among males (46.3% vs 28.2% for females), and those aged 18-24 years (48.0% vs 20.3-41.2% for other age groups in the workforce) (National Centre for Education and Training on Addiction, 2021).

Alcohol poses a workplace risk. Use can affect judgement, reasoning skills, problem solving skills, concentration, balance, coordination, and reaction time (Australian Safety and Compensation Council, 2007). These effects can occur after just one drink. As the number of drinks increase, the person may be further impacted by the aforementioned skill deficiencies in addition to other acute health effects such as gut irritation, nausea, confusion, drowsiness, poor muscle control and blurred vision (Australian Safety and Compensation Council, 2007). Consequently, use of alcohol may be associated with risk-taking behaviour, accidents, falls, injury and death. The average rate at which alcohol is metabolised is one standard drink per hour (although various factors such as medical conditions can affect this). Therefore, alcohol use can potentially negatively affect workplace safety, performance and productivity if use has occurred shortly before, or during, work hours. The more standard drinks a person consumes, the longer their body takes to metabolise all alcohol consumed. Among employed Australians who used alcohol in the past year, 5.4 percent reported using alcohol at their workplace (National Centre for Education and Training on Addiction, 2021). Although alcohol use by employees can present a potential danger at work (Australian Safety and Compensation Council, 2007) only a few studies have examined the associated workplace safety and productivity costs related to alcohol.

A study in Iowa, USA (Ramirez et al., 2013) investigating occupational fatalities between 2005 and 2009 reported alcohol was detected in 16 out of 280 (5.7%) deaths (26.2% of all positive toxicology tests). Mandatory testing after railway accidents in the US (following new legislation prohibiting drug and alcohol

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[23] Risk of alcohol-related disease or injury: The Australian Guidelines to Reduce Health Risks from Drinking Alcohol stipulates that healthy adults should consume no more than four standard drinks on any one day and no more than 10 standard drinks a week to reduce the risk of alcohol-related harm (National Health and Medical Research Council, 2020).

[24] Other labour force groups included: student; unemployed/looking for work; solely engaged in home duties; retired or on a pension; volunteer/charity work; unable to work; and, other.

use amongst workers) found alcohol present in 0.6% of cases in the two years after the legislation became effective (Moody et al., 1990).

Research undertaken in Australia also indicates that alcohol use may impact Australian workplaces. Between 1989 and 1992 there were 2,389 people fatally injured while at work or commuting to or from work. Of these deaths, approximately four percent were associated with raised blood alcohol levels (National Occupational Health and Safety Commission, 1998). A later study looking at Victorian work-related fatalities between 2001 and 2006 detected alcohol in 7.3 percent (26 of 355) of deaths. In 5 of the 26 instances, the workers' blood alcohol concentration (BAC) was over 0.05 percent (19%). The coroner reported alcohol as the contributing cause of death in these five instances and thus impairment from alcohol use contributed to 1.4 percent (5 out of 355) of work-related deaths (McNeilly et al., 2010).

In Australia, alcohol use was responsible for 4.5 percent of the total burden of disease, injuries and death in 2015, equivalent to 213,705 disability-adjusted life years. The health impacts of alcohol varied by age and gender. For instance, among males aged 15-24 years, alcohol contributed to 13 percent of the total burden (Australian Institute of Health and Welfare, 2020d).

In addition to the acute risks to health and safety from consumption at work, there are also impacts on workplaces from alcohol-attributable ill-health. To date, estimates of drug-related absenteeism in Australian workplaces have largely been limited to alcohol and illicit drugs (undifferentiated by specific illicit drug type) (Pidd et al., 2006; Roche et al., 2008; Roche et al., 2016). In 2004/05, the cost of lost productivity and absenteeism due to alcohol use was estimated at approximately $3.5 billion (Collins & Lapsley, 2008). In 2013, based on workers' own attribution of absenteeism specifically due to their alcohol use, workers had an estimated 1.7 million days of absenteeism, at an estimated cost of $451.9 million. The alternative measure of absenteeism, based on workers' estimated days off due to injury or illness, resulted in workers who used alcohol reporting 7.6 million extra days off (above days taken by abstainers) at an estimated cost of $2.0 billion (Roche et al., 2016).

Current estimates of alcohol-related costs to Australian workplaces are generally associated with absenteeism. Given that alcohol is amongst the most commonly used drugs in Australia, it is important that all costs specifically attributable to employees' alcohol use and its associated impact on illness, injury and alcohol-related presenteeism and absenteeism are quantified.

5.2 Method

National data were sourced to estimate alcohol-attributable costs to workplace-specific occupational injury (Section 5.2.1), absenteeism (Section 5.2.2) and presenteeism (Section 5.2.3). Additional workplace costs due to alcohol use, where national data were not available, are discussed in Section 5.5.

5.2.1 Occupational injury

To establish the cost of occupational injuries, data were sourced from Safe Work Australia. The best available data[25] come from 2012/13 where injury data were reported for different severity levels and for

[25] National data for serious compensable injuries (≥5 days off work) are collated annually. Published data which also includes lower severity level injuries and non-compensable injuries were last collected in 2012/13. Thus, 2012/13 data are used in the present report.

claims which were compensable and non-compensable and that required absence for at least part of a work-day.

Safe Work Australia (2015) reported the overall extent and cost of occupational injuries in 2012/13. The method used to determine the number of injuries was based on an incidence approach, rather than a prevalence approach (see Appendix 5.1 for further detail of Safe Work Australia's incidence approach). The method used to determine the costs incurred from injuries was based on the concept of the 'human cost' of occupational injury. Only costs associated with actual injuries were included (see Appendix 5.2 for the type of costs included).

Due to an overlap in the reporting of Safe Work occupational injuries with other sections of this report (e.g., Chapter 3 includes workplace costs from premature mortality, and Chapter 7 reports on transport accidents) the number of occupational injuries and associated costs were adjusted to prevent double counting. The adjustments involved i) removing the cost of fatalities from the total costs, and ii) reducing all injury severity type costs by 3.9 percent. The latter adjustment was based on traffic accidents having accounted for 3.9 percent of *serious* compensable occupational injuries (≥5 days off work) in 2012/13 (Safe Work Australia, 2014). It was assumed that a similar proportion of traffic accidents occurred for injuries involving a short absence, long absence, partial incapacity or full incapacity.

The cost of non-fatal and non-transport accident occupational injuries attributed specifically to alcohol use was then identified. To determine this, the RR of an occupational injury being incurred by workers affected by alcohol use and the prevalence of workers affected by alcohol was estimated.

The RR estimate for alcohol was determined using findings from Li et al. (2007) and Grant (2014). In Li et al.'s (2007) case control study of more than half a million random workplace drug tests, an odds ratio of 2.56 for an occupational injury among employees who tested positive for alcohol use was reported. To calculate the population alcohol aetiological fraction (PAAF), this odds ratio (OR) was converted to a RR. Grant (2014) provided the formula for the conversion as follows:

$$RR = \frac{OR}{1 - p_0 + (p_0 * OR)}$$

Where:

RR = relative risk for the risk factor in question
OR = odds ratio for the risk factor in question, and
p_0 = the baseline risk.

Applying this formula to the OR from Li and colleagues (2007) and using a baseline injury risk of 0.032 (based on 374,500 occupational injuries (Safe Work Australia, 2015) among a total workforce of 11,530,000 in 2012/13) gives a RR of 2.437.

McNeilly (2010) reported a workplace alcohol testing positivity rate of 1.4 percent for alcohol detection at an impaired level (BAC>0.05 %).

Applying the RR calculation gives a PAAF of 0.020 for alcohol detected at BAC>0.05 percent. The WHO established a PAAF for acute alcohol-related occupational and machine injuries of 0.07 for both Australian male and female adults (World Health Organization, 2004).

The WHO AF for any alcohol use and the calculated AF for alcohol impairment (BAC>0.05%) were then used to determine the alcohol-attributable cost of non-fatal and non-transport accident occupational injuries.

5.2.2 Workplace absenteeism

To estimate the extent and cost of alcohol-related workplace absenteeism, secondary analyses were conducted on 2019 National Drug Strategy Household Survey (NDSHS) data (Australian Institute of Health and Welfare, 2020b). Only respondents who were employed and aged ≥ 14 years were included in the analyses.

An alcohol use status variable comprising three categories was created. The three categories were: i) alcohol abstainer, ii) alcohol use within guidelines[26], and iii) alcohol use exceeds guidelines.

In relation to absenteeism, two variables were used: absence due to injury and/or illness; and, absence due to their alcohol use. Annual absenteeism due to injury and illness involved summing the total number of days absent from work, school, university or TAFE due to injury or illness in the past three months and then multiplying these days by four to obtain a non-seasonally adjusted annual estimate (with a maximum 240 days absent possible). Annual absenteeism due to alcohol use was also determined by multiplying by four the number of days absent from work, school, university or TAFE due to their own alcohol use in the past three months (with a possible maximum of 240 days absent).

Analysis of Variance (ANOVA) tests were first conducted to establish whether alcohol use resulted in more days absent from work due to illness/injury. However, results required alcohol use status to be dichotomised as abstainer vs consumer. Independent t-test analyses were therefore undertaken to determine whether alcohol consumers were absent due to illness/injury more than abstainers. An independent t-test was also undertaken to determine whether high risk alcohol drinkers took more days off due to their alcohol use than low risk drinkers.

Two Analysis of Covariance (ANCOVA) tests were then conducted to determine the means for illness and injury absenteeism for a) any reason by alcohol use status, and b) due to alcohol use, while controlling for age, gender, marital status, and socio-economic status. These variables were controlled for as they are known to be associated with workplace absence (Bush and Wooden, 1995; Ekpu and Brown, 2015).

Total absenteeism-related costs due to alcohol use were then estimated. To accomplish this, the difference in mean number of annual days absent due to alcohol use was calculated by subtracting the mean days absent among the group who abstained from alcohol from those who consumed alcohol. This figure was then multiplied by $376.25 (one day's wage plus 20% employer on-costs, based on the average weekly ordinary time earnings in 2017[27]) (Australian Bureau of Statistics, 2018b) to obtain a cost estimate of alcohol-related absenteeism (i.e., following a replacement labour cost approach, rather than an economic output per day worked approach).

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[26] Data from this group are not reported in the associated results tables.

[27] Average weekly income data for November 2017 was selected to maintain consistency across other chapters of this report.

5.2.3 Workplace presenteeism

In addition to absenteeism, further alcohol-related costs can be incurred through health-related presenteeism. Productivity costs resulting from presenteeism can occur when employees attend work while unwell or impaired and perform in a sub-optimal manner, resulting in lower quality or quantity of work. To estimate the extent and cost of alcohol-related workplace presenteeism, existing reports on the impact of alcohol use on productivity prevalence were used and applied to national productivity estimates due to any cause.

5.3 Costs due to occupational injury

The results presented below first provide an overview of the number and costs of occupational injuries due to all causes (Section 5.3.1), followed by the costs of non-fatal and non-transport occupational all cause injuries borne by employers, employees, and the community. The 2012/13 estimates of all cause occupational injury costs were adjusted for Consumer Price Index (CPI) increases to mid-2017/18 (Australian Bureau of Statistics, 2021b). The latter results were then used to estimate the cost of occupational injuries (non-fatal and non-transport accidents) attributable to alcohol using the RR and PAAF calculations (Section 5.3.2).

5.3.1 Number and costs of injuries

In 2012/13 there were 374,500 occupational injuries (Safe Work Australia, 2015). A breakdown by injury severity and compensation status is presented in Table 5.1.

Table 5.1: Compensable and non-compensable occupational injuries by severity 2012/13

Injury		**Short absence[a]**	**Long absence[b]**	**Partial incapacity[c]**	**Full incapacity[d]**	**Fatality**	**All**
Compensated	%	59	34	7	<1	<1	100
	N	122,500	71,500	14,200	400	197	208,800
Not compensated	%	65	29	6	<1	<1	100
	N	107,200	48,400	9,600	300	203	165,700
All	**%**	**61**	**32**	**6**	**<1**	**<1**	**100**
	N	**229,700**	**119,900**	**23,800**	**700**	**400**	**374,500**

Source: Safe Work Australia, (2015).
[a] < 5 days off work.
[b] ≥5 days off work and return to work on full duties.
[c] ≥5 days off work and return to work on reduced duties or lower income.
[d] Permanently incapacitated with no return to work.
Totals may not sum due to rounding.

The compensable and non-compensable occupational injuries for 2012/13 (Safe Work Australia, 2015) resulted in a total estimated cost of $28.2 billion (Table 5.2). After excluding fatalities and transport accidents (i.e., costs accounted for in Chapters 3 and 7, respectively), the adjusted cost was $26.3 billion (Table 5.2).

Table 5.2: Costs ($000,000) of occupational injuries by severity 2012/13[a]

Cost	Short absence[b]	Long absence[c]	Partial incapacity[d]	Full incapacity[e]	Fatality	Total ($000,000)
Unadjusted cost ($000,000)	960	4,340	19,250	2,800	880	28,230
Adjusted cost ($000,000)[f g]	923	4,171	18,499	2,691	-	26,284

Sources: Safe Work Australia (2014, 2015).
[a] Costs were rounded to the nearest $1 million in the Safe Work Australia (2014) report.
[b] <5 days off work.
[c] ≥5 days off work and return to work on full duties.
[d] ≥5 days off work and return to work on reduced duties or lower income.
[e] Permanently incapacitated with no return to work.
[f] Fatalities and transport accidents were excluded as they are reported in Chapter 3 and Chapter 7, respectively.
[g] Safe Work Australia (2014) reported that traffic accidents accounted for 3.9% of serious compensable occupational injuries (≥5 days off work) in 2012/13. It was assumed that a similar proportion of traffic accidents occurred for injuries requiring a short absence, long absence, partial incapacity and full incapacity and thus such associated costs were reduced by 3.9%.
Totals may not sum due to rounding.

Safe Work Australia (2015) estimates of the proportions of occupational injury costs borne by employers, employees, and the community were then used to calculate apportioned costs for non-fatal and non-transport occupational injuries (Table 5.3).

5.3.2 Costs of injuries due to alcohol use

Updating the 2012/13 all cause costs to December 2017[28] by applying the CPI (9.7%) (Australian Bureau of Statistics, 2021b) gives a total cost of $28.8 billion. Applying the PAAF for alcohol use with a BAC>0.05 percent (0.02), the total attributable cost of impairment from alcohol use associated with non-fatal and non-transport occupational injuries in 2017/18 was $568.5 million with $34.1 million borne by employers, $142.1 million by the community, and $392.2 million by injured employees (Table 5.3).

When applying the PAAF for any alcohol use (BAC>0.0%) (0.07), the associated non-fatal and non-transport occupational injuries was $2.0 billion with $121.1 million borne by employers, $504.6 million by the community, and $1.4 billion by injured employees. Costs borne by employees are internal costs (assuming the injured worker was the alcohol consumer) and thus not included in the total estimate for workplace costs attributable to alcohol. The total estimate for occupational injury costs attributed to impaired alcohol use is **$176.2 million** and the total costs attributed to any alcohol use is **$625.7 million**. These formed the low and high bound estimates, with the mid-point of these two estimates the central estimate: **$401.0 million** (see Table 5.7)**.**

Given the nature of the available data, it is not possible to identify the extent to which the workplace injuries occurred to the person who used alcohol, or to someone else. As such it is possible that these estimates include some private costs to people who used alcohol[29].

[28] The December 2017 quarterly Consumer Price Index calculator was used to adjust the 2012/13 data to align with timeframes used in other chapters of this report.
[29] Section 5.2.1 details other cost areas that were excluded to avoid double counting e.g., deaths, road traffic crash injuries.

Table 5.3: Costs of non-fatal and non-transport occupational injuries borne by employers, employees, and the wider community 2012/13 and 2017/18

Borne by	Cost (%)	Total Cost ($000,000)			
		All cause 2012/13	All cause 2017/18[a]	Any alcohol 2017/18[b]	Alcohol BAC>0.05% 2017/18[c]
Employers	6	1,577	1,7300.0	121.1	34.1
Employees	69	18,136	19,895.2	1,392.7	392.2
Community	25	6,571	7,208.4	504.6	142.1
Total	100	26,284	28,833.5	2,018.3	568.5

[a] Adjusted using the ABS Consumer Price Index inflation data to December 2017 values (Australian Bureau of Statistics, 2021b).
[b] The adjusted 2017/18 all cause occupational injury cost data were multiplied by the alcohol aetiological fraction (PAAF) for any alcohol use (0.07) to determine costs borne by employers, employees and community.
[c] The adjusted 2017 all cause occupational injury cost data were multiplied by the PAAF for impaired alcohol use (0.01971508) to determine costs borne by employers, employees and community.
Totals may not sum due to rounding.

5.4 Costs due to workplace absenteeism

A total of 11,582 (weighted n = 11,382,444) employed Australians aged 14 years or older provided alcohol use information in the 2019 NDSHS. However, due to methodological issues with how some alcohol data was collected from online participants, only data from 9,860 participants (weighted n = 10,953,083) were included to generate data regarding adherence to the alcohol guidelines (see Australian Institute of Health and Welfare (2021d) for more information). Of these, 15.8 percent abstained from alcohol, 46.3 percent drank at low risk levels, and 37.9 percent drank at levels that increased their risk of alcohol-related harm as per the 2020 alcohol guidelines.[30]

Results of the unweighted ANOVA indicated that there was no statistically significant association between the three alcohol use groups regarding workplace absenteeism due to illness or injury. This is despite a large difference in mean days absent for abstainers compared to the other two alcohol use groups. Alcohol drinking status was therefore dichotomised as abstainer vs consumer. The results of the t-test showed a statistically significant difference in absenteeism due to injury and illness between the two groups ($t(10{,}094) = 2.135$, $p = .008$).

Results of the ANCOVA indicated that, after controlling for age, gender, marital status, and socio-economic status, which are likely to be confounds of alcohol use and absenteeism (Bush and Wooden, 1995), and applying the population weight, there was a significant association between the two alcohol use groups regarding absenteeism due to injury or illness ($F[1, 10{,}072] = 6.387$, $p = .012$). Marital status and SEIFA were also significant covariates. Workers who drank alcohol were absent due to injury and illness an extra 15.8 million days from work per year compared to workers who abstained from alcohol, equating to a cost of approximately $6.0 billion (Table 5.4).

[30] Note: 14-17 year old workers have been included in this assessment of Guideline 1. If only those aged 18+ were included, 15.4 percent abstained from alcohol, 46.5 percent were low risk drinkers, and 38.1 percent drank alcohol at levels that increased their risk of alcohol-related harm. When 14-17 year old workers' alcohol intake is assessed in relation to Guideline 2 (those under the age of 18 should not drink alcohol), 44.7 percent abstained from alcohol and 55.3 percent were at risk of alcohol-related harm.

Table 5.4: The adjusted excess workplace absenteeism due to illness/injury for those who used alcohol, and those who abstained from alcohol (2019 NDSHS data[a]) and associated 2017/18 costs (2019 ABS data[b])[c, d]

Alcohol use status	Estimated Population	Annual Illness or Injury Absence			
		Mean Days Absent[c] (95% CI)	Difference[d] (95% CI)	Excess Days Absent[e] (95% CI)	Cost $[f] (95% CI)
Abstainer	1,725,519	5.955 (4.726-7.184)			
Consumer	9,326,481	7.651 (7.184-8.117)	1.696 (0.933-2.458)	15,816,835 (8,704,824-22,928,855)	5,951,052,568 (3,275,172,774-8,626,935,870)

[a] NDSHS (Australian Institute of Health and Welfare, 2020b).
[b] Australian Bureau of Statistics (2018b).
[c] Calculations based on estimated absenteeism means adjusted for age, gender, marital status, socio-economic status, and occupation.
[d] Mean days absent due to illness/injury for alcohol consumer compared to alcohol abstainers.
[e] Difference in mean absence multiplied by estimated population.
[f] Excess absence multiplied by $376.248 (2017/18 average daily ordinary time earnings plus 20% employer on-costs).
Totals may not sum due to rounding.

Of those who used alcohol, alcohol use above the national guidelines significantly predicted workplace self-reported alcohol-related absenteeism more than for those who used alcohol within the guidelines ($t\ (8{,}050{,}764) = 55.69$, $p = <.001$).

After adjusting for covariates and applying the alcohol population weight, use of alcohol within and above the national guidelines was associated with 1.3 million and 2.0 million excess days off work due to alcohol use per year, respectively. This equated to an annual cost of approximately $1.2 billion (Table 5.5).

Table 5.5: Adjusted excess workplace absenteeism specifically attributable to alcohol (2019 NDSHS data[a]) and associated 2017/18 costs (2019 ABS data[b])[c, d]

Alcohol use status	Estimated Population	Annual Absence due to drug use		
		Mean Days Absent (95% CI)	Excess Days Absent (95% CI)[e]	Cost $ (95% CI)
Low risk	5,075,330	0.251 (0.247-0.476)	1,276,029 (1,252,741-1,299,320)	480,103,479 (471,341,199-488,866,593)
High risk	4,152234	0.481 (0.476-0.486)	1,996,033 (1,975,909-2,016,155)	751,003,373 (743,431,721-758,574,268)
Total	9,227,564	0.355 (0.350-0.359)	3,272,062 (3,228,650-3,315,475)	1,231,106,851 (1,214,772,920-1,247,440,861)

[a] NDSHS (Australian Institute of Health and Welfare, 2020b).
[b] Australian Bureau of Statistics (2018b).
[c] Calculations based on estimated absenteeism means adjusted for age, gender, marital status, and socio-economic status.
[d] Mean days absent multiplied by estimated population.
[e] Excess absence multiplied by $376.248 (2017/18 average daily ordinary time earnings plus 20% employer on-costs).
Totals may not sum due to rounding.

The cost attributable to *alcohol use* related absenteeism (**$1.2 billion)** is likely to be a conservative estimate as it was obtained from a self-report measure of absenteeism that respondents attributed to their alcohol use and was used as our low bound estimate for absenteeism (Table 5.7). The cost attributed to *injury and illness* absenteeism **($6.0 billion)**, however, is likely to be an overestimate as higher proportions of those who use alcohol also smoke tobacco compared to the general working population. Tobacco use has substantial negative impacts on physical health and is unaccounted for in the estimates presented here (e.g. Whetton et al., 2019). The cost attributed to injury and illness absenteeism (Table 5.4) was used as the high bound estimate, the adjusted cost (Table 5.5) was used as the low bound with the mid-point (**$3.6 billion**) used as the central estimate (Table 5.7)[31].

The attributable costs of alcohol use to workplace absenteeism reported in Tables 5.4 and 5.5 reflect likely workplace costs directly associated with paid sick leave only. There are also likely to be other indirect costs, such as the cost of finding and paying replacement workers to backfill the absent employee's work role and/or the cost of lost productivity if a replacement worker cannot be sourced.

5.5 Workplace presenteeism

A recent study examining New Zealand employees found that current drinkers reported an average of 11.49 percent more presenteeism than non-drinkers (Sullivan et al., 2019). In Australia, previous research has estimated that, on average, 6.5 working days of productivity are lost per employee annually as a result of presenteeism due to any cause (Medibank, 2011). National prevalence data (Australian Institute of Health and Welfare, 2020d) indicate that 9,660,929 employed Australians drank alcohol in 2019. Based on these data, it is estimated that current drinkers accounted for 6.6 million extra days of presenteeism each year at a direct cost of $2.5 billion (Table 5.6).

Table 5.6 Excess workplace presenteeism of alcohol consumers (Sullivan data[a]) compared to Australian working population norm for presenteeism (Medibank, 2011 data[b]) and associated 2017/18 costs

Smoking status	Estimated population (95% CI)	Annual presenteeism	Excess days per employee	Total excess (95% CI)	Cost $ (95% CI)[d]
Reference population:					
Abstainers	1,721,515 (1,601,639-1,841,392)	5.92 days	-	-	-
Current drinker	9,660,929 (9,440,016 – 9,881,842)	6.60 days[c]	0.68 days	6,574,140 (6,423,812-6,724,469)	2,473,507,201 (2,416,946,452-2,530,067,951)

[a] Sullivan et al. (2019).
[b] Medibank, (2011).
[c] 11.49 percent excess presenteeism of alcohol compared to abstainers (Sullivan et al., 2019).
[d] Excess presenteeism days multiplied by $376.248 (2017/18 average daily ordinary time earnings plus 20% employer on-costs), essentially using a replacement cost rather than lost economic output measure of cost.
Totals may not sum due to rounding.

Other research suggests that the parameters derived from Sullivan and colleagues may significantly under-estimate the prevalence of alcohol attributable presenteeism. A 2011 study in Australia suggests that presenteeism due to alcohol use is four times the absenteeism rate (Medibank, 2011). Data in Table 5.5 indicates that in 2017/18 an estimated 3.27 million working days were lost due to alcohol attributable absenteeism; if the days lost to presenteeism were four times larger, this would suggest 13.1 million work-days lost. This gives an alternative cost of alcohol-related presenteeism of $4.9 billion. However, due to a lack of consensus on how presenteeism should be calculated and the different estimates derived using the above approaches, presenteeism costs will not be included in the final cost estimate.

5.5 Limitations

5.5.1 Accidents

Alcohol use can impair coordination, distort perception, affect thinking and memory, and decrease reaction time (Australian Safety and Compensation Council, 2007). The impacts of this on road crashes and workplace accidents are explored in Chapter 7 and Section 5.3.1, respectively, however there is also the potential for excess rates of other forms of accidental injury such as vehicle crashes that do not occur on the road, falls, burns and scalds, drowning, and sharp object injuries. Whilst studies have identified that alcohol increases risk of injury (World Health Organization, 2004), there are no reliable estimates at present of the extent to which alcohol contributes to excess rates of these forms of injury in Australian workplaces. As such they were not included in our calculations.

5.5.2 Occupational injuries

Data concerning occupational injuries are limited. At present, annual data are reported only for serious compensable injuries (resulting in ≥5 days off). Data concerning less serious compensable and non-compensable injuries are reported less frequently. Such data are not reported by drug-type and thus costs attributed to alcohol use were estimated by applying formulas considered reliable. Data of this type are limited and thus the true cost of occupational injuries attributable to the use of alcohol may not be accurately reflected.

5.5.3 Absenteeism

Estimates of alcohol-related workplace absenteeism were obtained from a self-report measure. Self-report data may not accurately reflect true absenteeism attributed to illness or injury, and alcohol use. Furthermore, a proportion of the absenteeism costs calculated may have already been accounted for in the alcohol occupational injury estimates if the survey respondent is reporting absenteeism due to an occupational injury.

Absenteeism cost estimates were based on the assumption that people annually worked five days a week over 48 weeks, with four weeks annual leave. This may inadequately reflect the work schedule of employees who work part time, overtime, or longer rosters, and limits assumptions about annual absenteeism rates.

5.5.4 Presenteeism

Some data used to estimate excess rates of alcohol-related presenteeism were based on international research that may not accurately reflect the extent of alcohol drinkers' presenteeism in Australian workplaces.

5.5.5 Reduced participation in the workforce

Evidence suggests that regular alcohol use, and particularly dependent use, is correlated with reduced participation in the workforce. No Australian research has quantified the extent of the impact on employment in terms of its scale, or direction of causation. Direction of causation may be important, as it is unclear whether alcohol use impacts workforce participation or whether reduced workforce participation impacts alcohol use. As such, these costs cannot currently be quantified.

5.6 Conclusions

The total cost of alcohol to Australian workplaces is estimated to be **$4.0 billion** (Table 5.7). As data were only available to determine workplace costs associated with occupational injury and absenteeism, the true cost of alcohol to the workplace is likely to be higher. There are additional costs that cannot currently be quantified, which are discussed below.

Table 5.6: Summary: 2017/18 workplace costs due to alcohol use

Cost area	Central estimate $	Low bound $	High bound $
Occupational injury	400,952,661[a]	176,220,402[b]	625,684,920[c]
Absenteeism	3,591,079,710[a]	1,231,106,851	5,951,052,568
Presenteeism	*4,924,427,406*	*2,473,507,201*	*4,924,427,406*[d]
Total	**3,992,032,371**	**1,407,327,253**	**6,576,737,488**

[a] The mid-point of the low and high bound estimates.
[b] Cost to employer ($34,106,477) plus cost to community ($142,113,925). Employee costs are an internal cost and thus not included in the total cost estimate for occupational injury (see Table 5.3).
[c] Cost to employer ($121,097,830) plus cost to community ($504,587,090). Employee costs are an internal cost and thus not included in the total cost estimate for occupational injury (see Table 5.3).
[d] Presenteeism costs are excluded from the total due to uncertainties around the scale of alcohol attributable presenteeism in Australia. The high bound is also used as the central estimate as it is an Australian specific estimate.
Totals may not sum due to rounding.

5.6.1 Other workplace costs

Additional workplace costs associated with alcohol use that cannot be quantified due to lack of data include those outlined below.

Turnover costs are incurred when employees who leave (either voluntarily or involuntarily) are replaced. Costs are associated with hiring, training, reduced productivity, and lost opportunity. Alcohol use is likely to contribute to these costs if an employee: a) is dismissed for failing a workplace alcohol test; b) leaves because their use has escalated to severe dependence and restricted their ability to work effectively; or, c) is dismissed due to alcohol-related poor performance. The cost of hiring and training new workers was estimated at $8,448 per employee in 2017/18 values ($6,422 in 2006 (Bureau of Infrastructure Transport and Regional Economics, 2009)). However, there are no current reliable data concerning the costs to Australian workplaces due to reduced productivity, lost opportunity, nor the number of staff who left their jobs due to their alcohol use.

Workplace drug testing has become increasingly common in Australian workplaces. The costs incurred in implementing workplace testing include: a) the purchase of testing services; b) lost productivity while employees undergo testing; and, c) legal and industrial relation costs in the establishment of, and possible defence of, workplace testing procedures. Alcohol use substantially contributes to these costs as alcohol is the drug most commonly detected in workplace tests. Across the Australian workforce, the total costs of workplace drug testing are likely to be substantial. Nearly seven percent of the Australian workforce have reported that their workplace conducts drug tests (Pidd et al., 2015). However, accurate data concerning the extent and costs of workplace drug testing across the Australian workforce are not available.

Employee wellbeing costs are incurred when an employee's mental and physical health is affected by the behaviour of co-workers and traumatic workplace incidents. Employed people who use alcohol at high risk levels are more likely to have higher levels of psychological distress (15.3%) compared to employees who do not use alcohol (10.3%) or use alcohol at low risk levels (10.4%) (National Centre for Education and Training on Addiction, 2021). Thus, risky alcohol use may contribute to employees seeking counselling and/or utilising Employee Assistance Programs. Additional costs may also be incurred through impacts on employee safety and productivity due to poor worker wellbeing.

The cost to workplaces attributed to alcohol use are likely to be unevenly distributed across Australian workplaces. Prevalence of alcohol use varies substantially across different occupational and industry groups (National Centre for Education and Training on Addiction, 2021). For example, alcohol use varied from 57.1 percent[32] among workers in the electricity, gas, water and waste services industry to 27.9 percent in the health care and social assistance industry (National Centre for Education and Training on Addiction, 2021). Workplace costs are likely to be higher in industries with a higher prevalence of alcohol use. As noted earlier, the prevalence of alcohol use is also higher among employed males (46.3% vs 28.2% for females) and those aged 18-24 years (48.0% vs 20.3-41.2% for other age groups) (National Centre for Education and Training on Addiction, 2021). As participation in vocational training predominantly involves young employed males, alcohol use may also contribute to training attrition costs.

[32] Estimate has a relative standard error greater than 50 percent and is considered too unreliable for general use.

CHAPTER 6: COST OF CRIME RELATED TO ALCOHOL USE

Steve Whetton & Suraya Abdul Halim

6.1 Alcohol-attributable crime

There are robust links between alcohol intoxication and crime, across time and across countries, particularly in terms of violent crime and disorder offences. In a meta-analysis of meta-analyses, Duke and colleagues found that the link between alcohol and violence was robust to the inclusion of potential confounding variables, and across the type of study, including laboratory experiments (Duke et al., 2018). Overall, the relationship between alcohol and violence was stronger for males (effect size 0.43 compared to 0.23 for females) and for those who combined consumption of alcohol with illicit drugs.

Amongst individuals, alcohol consumption, particularly acute excessive consumption, will have differential effects based on a range of individual and contextual factors which can inhibit or exacerbate the propensity for alcohol to increase prevalence of aggression, however the exact roles of these inhibiting and exacerbating factors are not yet clear (Parrott and Eckhardt, 2018).

Amongst the contextual factors that appear to play a role in the prevalence of alcohol-attributable violence are the availability of alcohol (in term of travel time to a venue, geographic density of outlets, opening hours, and the scale of the outlets) and the extent to which venues manage the drinking and behaviour of their patrons (the latter factor relates primarily to assaults that occur in or adjacent to the premises (Donnelly and Briscoe, 2001)). There are differences in the nature and scale of the harms between outlet types. Density of venues focussed on 'intensive' consumption on-premises such as hotels, taverns and nightclubs appear on average to have a relatively more significant impact on rates of non-domestic violence assaults. The density of packaged liquor outlets appears to have a relatively stronger impact on rates of intimate partner violence for example in the domestic setting (Chikritzhs et al., 2007; Donnelly and Briscoe, 2001; Fitterer et al., 2015; Hobday et al., 2015; Livingston, 2011; Livingston et al., 2015; Trangenstein et al., 2018).

Criminal justice system data are not generally suited to statistical analyses relating to drug use, as information on such intoxication and its alleged role in the offence, is not routinely recorded. If recorded at all, the information is often located in narrative and is not available for analysis without first going through each file individually and coding the relevant data. Instead, analysis of the role of substance use in crime in Australia usually employs the Drug Use Monitoring in Australia (DUMA) survey as this is the only regular survey of police detainees and substance use in Australia (Voce and Sullivan, 2019). The DUMA survey has several shortcomings; most notably that it only surveys offenders from selected police stations, which may not be representative of the population of offenders for the country as a whole[33]. It is not possible to identify whether the rates of alcohol consumption amongst offenders detained by police at the selected DUMA sites are representative of the country as a whole, or under-, or over-estimates it.

[33] For the 2017/18 DUMA survey, data were collected in the following police stations: Adelaide (South Australia), Brisbane (Queensland), Perth (Western Australia) and Bankstown and Surry Hills suburbs of Sydney New South Wales (Voce and Sullivan, 2019)

Other limitations of the DUMA survey are that:

- It can only provide data on those police detainees who were in police custody at the time of the survey (which may over-represent those alleged to have committed more serious offences) and those who consented to participate in the research;

- Attribution to substance use is based on self-assessment by the detainee. It is not known whether there are any systematic biases in the propensity of offenders to attribute their offending to their use of a substance. These biases could potentially include: a) an overestimate of the role of substances in offending, such as falsely attributing offending to a substance as a self-exculpatory strategy; and, b) underestimate the role of substances, such as failing to attribute offending to the substance use that caused it either through underestimating the extent the substance distorted their reasoning or through a concern of being stigmatised for offending under the influence of the substance. This means that there is no basis *a-priori* to assume that these biases in net terms are likely to understate or overstate the role of substances in general, or of any particular substance;

- Detainees are automatically excluded from the sample frame if they are observed to be intoxicated at the time the researcher attends the station. This may lead the survey to understate the role of substances in offending, as those who were intoxicated at the time of the offence are more likely to be excluded than those who were not;

- It is only appropriate as a source of data on the involvement of substances in the offending behaviour of adults, with the sample of juveniles captured in the survey being too small to derive usable attributable fractions (AF). This will tend to understate the impact of substances on crime as at least some juvenile offending is likely to be attributable to substance use.

As with concerns over the representativeness of the sites selected for the survey, it is not possible to determine whether the known limitations of the survey will lead to it over- or under-estimating the role of substance use in offending. Notwithstanding these limitations, the DUMA survey remains the best available source of data on the drug use of offenders in Australia.

Finally, many of the detainees who were identified as using substances in the DUMA survey highlighted a causal role for multiple substances. As there is no basis to assess the relative role of the substances, cases with multiple substance attribution have been excluded from the analysis. This will tend to underestimate the impact of alcohol on crime. The multiple substance attributions are substantial, for example in the 2017/18 DUMA survey, 5.6 percent of violent crime offenders attributed their offending to alcohol ***and*** one or more other substance. This is almost one-third of those who attributed their offending to alcohol only (Australian Institute of Criminology, 2020).

Reported alcohol use amongst the DUMA sample was common and at high levels. “One-third (32%, n=771) of detainees reported having consumed alcohol in the 48 hours before their detention. Both female and male detainees typically consumed a median of 11 (mean=19) total standard drinks before their arrest, at a median rate of three standard drinks (mean=5) per hour. Alcohol consumption was particularly heavy among detainees who consumed multiple types of alcohol. Of these, male detainees consumed 22 standard drinks (median) and female detainees consumed 17 standard drinks (median) before their arrest.” (Voce and Sullivan, 2019, p.6).

For this project, analysis of the DUMA survey data for the 2017/18 financial year was undertaken by the Australian Institute of Criminology (AIC) to identify the proportion of police detainees who attributed their offending to different substances. This method uses the responses to several survey questions to determine the proportion of detainees who attributed their current offending (i.e., offences for which individuals were detained at time of interview), either entirely or partly, to drug use during the past 30 days (Payne and Gaffney, 2012). The detainees were asked to consider the main reason why they had been detained and to indicate via a three-point scale the extent to which their substance use contributed to their present situation. The questions were asked separately for each different drug type so that attributions could be assigned by drug type. Attributions by offence type were estimated by assigning detainees to a most serious offence (MSO) category on the basis of the charges recorded against them for their current detention. The MSO hierarchy included violence, property, illicit drug, traffic or driving under the influence (DUI), breach, public order and other.

Table 6.1 provides the population alcohol-attributable fraction (PAAF) percentages broken down by the MSO category of adult detainees. Overall, the PAAF percentages for alcohol were moderate with 13.7 percent of adult detainees attributing their offending to alcohol. The highest PAAF percentages were found for detainees whose MSO was related to driving under the influence (DUI) (44.8%), disorder (26.8%), other offences (19.2%), and violent crime (18%) (see Table 6.2 for more information about the types of MSO).

The subsequent sections of this chapter focus on costs related to: (i) police; (ii) courts; (iii) the correction system; and, (iv) victims of crime. In each section, national data reported by the ABS will be used and the PAAF percentages shown in Table 6.1 will be applied to the relevant offence categories. This will include the central estimate cost and, also, a low bound and high bound cost based on the 95 percent confidence intervals (CI) shown in Table 6.1.

Table 6.1: Self-reported alcohol-attributable fractions of crime amongst police detainees by most serious offence, DUMA survey July 2017 to June 2018, percent of total offenders

Alcohol-attributable fraction	**Violent**	**Property**	**Drug**	**DUI**	**Traffic**	**Disorder**	**Breaches**	**Other**	**Total**
Central estimate (%)	18.0	8.4	4.4	44.8	7.0	26.8	11.2	19.2	13.7
Confidence Interval (95%)	(15.6, 20.7)	(6.4, 11.0)	(2.3, 8.5)	(28.4, 63.0)	(3.2, 14.4)	(20.1, 34.8)	(8.7, 14.3)	(8.5, 37.9)	(12.4, 15.1)
Sample size (n)	839	572	180	29	86	138	500	26	2,370

Source: Australian Institute of Criminology (AIC) DUMA collection (2020).
Confidence intervals were calculated by authors using the Wilson estimator.
DUI = driving under the influence: DUMA = Drug Use Monitoring Australia.

The ABS defines MSO based on the 16 divisions of the Australian and New Zealand Standard Offence Classification (ANZSOC) (Australian Bureau of Statistics, 2011). Table 6.2 shows how the DUMA's MSO categories (shown in Table 6.1) relate to the ANZSOC divisions. As an example, the PAAF for 'property crime' – 8.4 percent – would be applied to offences categorised as '*Unlawful enter with intent*'; '*Theft*'; and '*Fraud/deception*' offenders to provide the total number of alcohol-attributable 'Property' offenders.

Table 6.2: Mapping of principal offence in Australian Bureau of Statistics data to DUMA most serious offence by ANZSOC Divisions

Most serious offence in DUMA	ANZSOC Principal Offence (Divisions)
Violent	01 Homicide and related offences 02 Acts intended to cause injury 03 Sexual assault and related offences 04 Dangerous/negligent acts 05 Abduction/harassment 06 Robbery/extortion 11 Prohibited/regulated weapons
Property	07 Unlawful entry with intent 08 Theft 09 Fraud/deception
Illicit drug	10 Illicit drug offences
DUI	1431 Exceed the prescribed content of alcohol or other substance limit
Traffic	14 Traffic and motor vehicle regulatory excluding 1431
Disorder	12 Property damage and environmental pollution 13 Public order offences
Breaches	15 Offences against justice procedures, government security and government operations
Other	16 Miscellaneous offences

Sources: Australian Institute of Criminology DUMA collection (2020); Patterson et al., (2018); ABS (2011). ANZSOC = Australian and New Zealand Standard Offence Classification: DUMA = Drug Use Monitoring Australia: DUI = driving under the influence.

6.2 Police and other enforcement costs

The real recurrent expenditure on state and territory police services in Australia was approximately $11.6 billion in 2017/18 (costs related to Australian Federal Police activities outside of general policing in the Australian Capital Territory (ACT) have not been included in this section; costs include user cost of capital, exclude payroll tax and are net of revenue from own sources). However, only a subset of policing costs should be included in the analysis of alcohol-attributable crime, as police perform a range of functions unrelated to, or only partially related to, crime such as protective services, emergency management, policing community events, managing compliance with liquor licensing regulations, and traffic management.

Smith et al. (2014) reported that it is reasonable to allocate 80 percent of police costs to crime, based on 2011 data from New South Wales (NSW) Police. An alternative estimate can be derived from a Western Australian (WA) Police report (Western Australian Police, 2014), which allocated expenditure between activity types (with administrative costs allocated based on their share of operational expenditure). For the purposes of this calculation, “Intelligence and protective services”; “Response to, and investigation of, offences”; and “Services to the Judicial Process” are assumed to be crime related activities. “Crime Prevention and Public Disorder”; “Community Support (non-offence)”; “Emergency Management”; and, “Traffic Law Enforcement and Management” are classed as non-crime activities. This gives an estimate of 64 percent of police time being crime related. As this is a more conservative estimate, we have used the proportion of crime allocated to crime estimated from WA Police data for the central estimate and lower bound, with the 80 percent share used in the calculation of the upper bound.

Police costs used in estimating the costs of alcohol-attributable crime also need to be adjusted down as our PAAF are derived from data on adult offenders and may not be applicable to offenders aged less than 18 years of age. In 2017/18, 13 percent of offenders processed by police were aged 10 to 17 years (Australian Bureau of Statistics, 2019l), and this was used as an approximation of the share of police time spent on juvenile offenders, with 87 percent on adult offending.

Applying these two proportions (64% and 87%) to overall police costs of $11.6 billion gives an estimate of $6.4 billion in police costs that can be attributed to the response to offences committed by adults. This is the base from which the cost of alcohol-attributable police time is calculated.

To allocate the costs of police time across different offence categories, we obtained data on the total number of adult offenders processed by police in 2017/18. This was sourced from the ABS publication "Recorded Crime – Offenders" (Australian Bureau of Statistics, 2019l). Unfortunately, this publication does not report the number of offenders processed for driving related offences, so for these offences the number of adult defendants processed in the courts was used as a reasonable proxy in 2017/18 (Australian Bureau of Statistics, 2019a). Simply allocating costs based on the number of offenders processed by police is likely to overestimate the amount of police time spent on frequent, but relatively straightforward, cases such as driving offences, and underestimate the time spent on cases that involve more intensive investigations, such as murder or major fraud. An approach that has been used previously (Moore, 2005) to weighting the raw numbers is to use data on the total police custody hours by offence category. It should be noted that this relies on 2002 data (Taylor and Bareja, 2005). However, this also has the potential to be influenced by variations in the time taken to arrange bail or to be transferred to remand. Instead, we use court data on the average length of a trial in 2017/18 (Australian Bureau of Statistics, 2019a) as a reasonable proxy for the average complexity of cases by offence category and, therefore, for the cost of the police investigation.

Table 6.3 provides the alcohol-attributable police costs by MSO for adult offenders in 2017/18. The highest alcohol-attributable cost, using the PAAF set out in Table 6.1, was found for violent crime ($363.0 million). The next highest alcohol-attributable costs were for traffic/DUI offences ($320.7 million) and public order offences ($175.5 million). Overall, the estimated total alcohol-attributable police cost was **$1.0 billion**, with a low bound of $0.7 billion and a high bound of $1.8 billion.

The costs of monitoring and enforcement of liquor licensing provisions net of liquor licensing fees, whether undertaken by police or by staff of other regulatory agencies, is a cost of alcohol. However, in most jurisdictions this regulatory activity is undertaken by an agency that is also responsible for regulation of gaming and racing. As a result, it has not been possible to identify the net cost of liquor regulation enforcement.

Table 6.3: Alcohol-attributable police costs by most serious offence, 2017/18[a]

	Violent	Property	Drug	Traffic or DUI	Breach	Public Order	Not allocated	Total
Number of offenders	97,477	51,964	72,317	193,442	26,347	68,869	15,167	525,583
Weighting for relative complexity (from court data)	1.67	1.38	0.99	0.67	0.81	0.77	0.88	1.00
Estimated weighted share of police time on crime (%)	31	14	14	24	4	10	3	-
Estimated value of police time on adult crime ($million)	2,016.7	886.5	885.9	1,573.6	263.5	654.5	165.5	6,446.1
Central estimate of alcohol-attributable police costs ($million)	363.0	74.4	39.4	320.7	29.5	175.5	31.8	1,034.2
Low bound of alcohol-attributable police ($million)	313.6	56.6	20.1	188.3	23.0	131.7	14.1	747.4
High bound of alcohol-attributable police ($million)	524.6	121.8	94.7	616.3	47.2	285.3	78.6	1,768.4

Sources: Australian Bureau of Statistics (2019a); Steering Committee for the Review of Government Service Provision (2019a); Australian Institute of Criminology DUMA collection (2020): calculations by the authors.
[a] Costs relating to juvenile offenders are excluded.
DUMA = Drug Use Monitoring Australia: DUI = driving under the influence.
Totals may not sum due to rounding.

6.3 Court costs

Total recurrent expenditure on criminal courts in Australia (excluding children's courts and payroll tax) was $908.0 million in 2017/18 (Steering Committee for the Review of Government Service Provision, 2019a). These court costs include the cost of operating such specialist courts as drug courts but do not include the cost of Federal courts (which process Commonwealth offences).

Offender based PAAF calculated by the AIC from the DUMA survey in 2017/18 were used to assess the court costs attributable to alcohol. As with police costs, these court costs need to be allocated between offence categories (based on the alleged perpetrator's MSO) so that the relevant PAAF can be applied to them. This allocation was made on the basis of the proportion of total defendant weeks for that level of the court.

Table 6.4 displays the findings from both higher courts (Supreme and District courts) and Magistrates courts in 2017/18. Applying the relevant PAAF gives a central estimate of total court costs attributable to alcohol of **$54.2 million** for higher courts. The low bound of alcohol-related costs was $43.8 million and the high bound of costs was $68.4 million. In Magistrates courts, applying the relevant PAAF gives a central estimate of total court costs attributable to alcohol of **$78.2 million**. The low and high bound estimates of alcohol-related costs in Magistrates courts was $56.3 million and $106.5 million respectively.

Combining Supreme, District and Magistrates court costs, the central estimate of total alcohol-attributable court costs in 2017/18 was **$132.4 million**. The low bound of total alcohol-attributable court costs was **$100.1 million** and the high bound was **$174.9 million**.

Table 6.4: Alcohol-attributable court costs by most serious offence and level of court, 2017/18

	Violence	Property	Drugs	Traffic or DUI	Breach	Disorder	Not allocated	Total
Higher Courts[a]								
Total number of defendants finalised	8,927	1,670	5,034	22	330	415	62	16,460
Total defendant weeks	391,351	80,253	228,040	612	14,619	18,089	3,962	736,925
Assumed court costs ($million)	224.1	45.9	130.6	0.4	8.4	10.4	2.3	421.9
Central estimate of alcohol-attributable court costs ($million)	**40.3**	**3.9**	**5.8**	**0.1**	**0.9**	**2.8**	**0.4**	**54.2**
Low bound of alcohol-attributable court costs ($million)	34.8	2.9	3.0	0.0	0.7	2.1	0.2	43.8
High bound of alcohol-attributable court costs ($million)	46.5	5.0	11.1	0.1	1.2	3.6	0.9	68.4
Magistrates Courts								
Total number of defendants finalised	97,042	54,225	49,082	190,353	40,653	34,589	9,258	475,200
Total defendant weeks	1,795,053	937,826	485,912	1,694,142	426,857	366,198	105,541	5,811,528
Assumed court costs ($million)	150.1	78.4	40.6	141.7	35.7	30.6	8.8	486.1
Central estimate of alcohol-attributable court costs ($million)	**27.0**	**6.6**	**1.8**	**28.9**	**4.0**	**8.2**	**1.7**	**78.2**
Low bound of alcohol-attributable court costs ($million)	23.3	5.0	0.9	17.0	3.1	6.2	0.8	56.3
High bound of alcohol-attributable court costs ($million)	31.1	8.6	3.5	44.3	5.1	10.6	3.3	106.5

Sources: ABS (2019a); Steering Committee for the Review of Government Service Provision,(2019a); Australian Institute of Criminology DUMA collection (2020): calculations by the authors.
[a] Supreme and District.
DUMA = Drug Use Monitoring Australia: DUI = driving under the influence.
Totals may not sum due to rounding.

In addition to the direct costs of the court system, there are also social costs imposed through the costs of public prosecutors (where cases are not prosecuted by police) and legal aid costs, where that is provided to defendants. The costs of counsel funded by defendants themselves are out-of-scope of this report as they are a purely private or internalised cost.

State and territory governments have legal aid commissions that provide legal support in criminal, civil and family law matters. Both Moore (2005) and Ritter et al. (2013) used a top-down approach to allocate a proportion of these costs to substance use, which we replicated. First, we estimated the average proportion of court activity considered attributable to alcohol use (e.g., our estimated alcohol-attributable court costs divided by the total higher and Magistrate's courts estimates, but excluding Children's court costs; see Table 6.4 for the source data). This proportion was estimated to be 14.6 percent.

Expenditure figures were sourced from the annual reports of each of the Legal Aid Commissions across Australia for 2017/18 (Legal Aid Commission New South Wales, 2018; Legal Aid Commission of Tasmania, 2018; Legal Aid Queensland, 2018; Treasury, 2018a; Victoria Legal Aid, 2018). It was not possible to identify the spending on criminal matters for South Australia (SA), the ACT and NT and so these jurisdictions are excluded from the calculation. Legal aid organisations for which data are available are estimated to have spent $314.2 million on criminal matters. Assuming the share of legal aid costs on Children's court matters matches the share of Children's court costs in total court costs, it was estimated that legal aid costs on adult criminal court matters equalled $302.0 million, with a central estimate of alcohol-attributable legal aid costs of **$44.0 million**, with a low bound of $33.3 million and a high bound of $58.2 million (see summary Table 6.18).

State and territory government spending on Department of Public Prosecution (DPP) services was $447.3 million in 2017/18 (Commonwealth Director of Public Prosecutions, 2019; Office of the Director of Public Prosecutions, 2018; Treasury, 2018b, c, d, e, 2019b). As was done for Legal Aid Commission expenditure, we factored down DPP costs to reflect the share of court expenditure on adults, and then used the share of total court costs attributable to alcohol to identify alcohol-attributable DPP costs.

The central estimate of alcohol-attributable DPP costs was **$62.7 million**, with a low bound estimate of $47.4 million and a high bound of $82.8 million (see summary Table 6.18).

6.4 Correction system costs

Conceptually there are two ways that the correction costs attributable to alcohol could be calculated. The first is to calculate the net present value (NPV) of all future corrections related costs arising from alcohol-attributable crime committed in 2017/18. The second approach is to calculate the corrections system related costs attributable to alcohol incurred due to imprisonment in 2017/18, regardless of when the offence itself occurred.

The former approach has the advantage of being based on crime committed in the study year (or at least criminal proceedings finalised in the study year) reflecting the pattern of alcohol use and crime in the study year. The latter has the advantage of being based on known costs and known prison populations.

As the degree of involvement of substances in crime can vary from year to year, this analysis has adopted the approach of calculating present values of current and future costs arising from sentences commencing in 2017/18.

6.4.1 Estimating the unit costs of imprisonment

The ongoing net recurrent costs (including depreciation of capital items) of corrections facilities cost society a total of $4.8 billion in 2017/18. This comprised $3.6 billion in operating costs and $1.2 billion in user costs of capital (Steering Committee for the Review of Government Service Provision, 2019a). On average across the 2017/18 financial year, there were 41,867 individuals detained in the adult corrections system including prisoners on remand (Steering Committee for the Review of Government Service Provision, 2019a). This gives an annual correction system cost per prisoner of $114,260. We have used this average in calculating the detention cost per alcohol-attributable prisoner although this may underestimate the true per prisoner costs, as it excludes some of the costs associated with in-prison drug and alcohol services. We do not have data that would allow us to isolate the cost of these services from the overall prison costs.

There are other less direct costs and offsetting benefits associated with imprisonment, with AIC researchers identifying the below additional forms of cost and offsetting savings (Morgan and Althorpe, 2014).

Costs

- Lost productivity of prisoners (paid and unpaid work);
- Workplace disruption and costs of recruiting replacement employees;
- Lost potential lifetime economic output as ex-prisoners have a lower employment participation rate post release;
- Increased risk of homelessness post release;
- Prison assaults (on both staff and prisoners);
- Additional government payments as a result of household income falling due to imprisonment of a member of the household who was in work;
- Health impacts of imprisonment such as transmission of blood borne viruses;
- Cost of out of home care for children whose custodial parent is imprisoned and who cannot be placed with another member of the immediate family; and,
- Childcare and parenting support costs.

Offsetting savings

- Reduced government payments;
- Incapacitation effect of imprisonment (e.g., it is more difficult for imprisoned offenders to commit additional crime (excluding prison assaults));
- Value of work completed in prison;
- Reduction in illicit drug use by prisoners (although it should be noted that although rates of drug use are likely to fall during imprisonment, the harms per person arising from use may actually increase, for example through increased sharing of needles);
- Reduction in alcohol use (and therefore associated harms) by prisoners; and,
- Reduction in access to welfare services by prisoners.

Unfortunately, many of these costs cannot be accurately quantified from the available data. Our estimate of the net costs of imprisonment was therefore restricted to the following areas (with the method used to quantify the amount set out in the discussion that follows):

- Recurrent costs of corrections facilities: **$114,260** per prisoner (calculation set out above);
- Lost productivity of prisoners in paid work: **$29,079** per male prisoner and **$13,031** per female prisoner;
- Workplace disruption and costs of recruiting replacement employees: **$3,140** per male prisoner and **$1,407** per female prisoner;
- Lost productivity of prisoners in unpaid household work: **$20,483** per male prisoner and **$36,570** per female prisoner;
- Prison assaults (on both staff and prisoners): $642 per assault; and,
- Reduced government payments (offsetting saving): **-$2,956** per male prisoner and **-$3,490** per female prisoner.

6.4.1.1: Lost productivity of prisoners in paid work

A proportion of offenders were in paid work at the time they were arrested. For these individuals there is a social cost from the loss of the economic output that would have been produced had they remained in the labour force. Gross domestic product (GDP) per employee was calculated from current price estimates of GDP for the year to June 2018 from the ABS national accounts and average employment over 2017/18 (Australian Bureau of Statistics, 2021a, d) and was $148,631 in 2017/18.

However, as the lost employee share of this potential output is a private cost to the imprisoned person, it is excluded from the social cost calculation. The 2017/18 labour share of GDP was 47.4 percent, and so only 52.6 percent ($78,245) of the per employee GDP (the national income that would have accrued to business or government) has been included in these cost calculations of reduced economic impact due to imprisonment.

Data from the 2013/14 Victorian crime statistics (Victoria Police, 2014) indicates that 37 percent of male adult alleged offenders and 17 percent of female adult alleged offenders were in employment when they were arrested (more up to date data on the employment status of alleged offenders does not appear to be available). We have assumed that these employment rates are representative of those arrested for alcohol-attributable offences. These parameters give an estimated annual loss to economic output of **$29,079** per male prisoner and **$13,031** per female prisoner.

6.4.1.2: Workplace disruption and costs of recruiting replacement employees

Employers face one-off costs to recruit new employees to replace imprisoned workers, and to train those new workers. We have assumed that these costs match the costs estimated by the Bureau of Infrastructure, Transport and Regional Economics (BITRE) for replacing deceased employees, namely $6,422 in 2006 values (Bureau of Infrastructure Transport and Regional Economics, 2009). Converting to 2017/18 values using the change in the CPI (Australian Bureau of Statistics, 2021b) gives a cost per imprisoned employee of $8,448. Applying the employment shares for alleged offenders (37% for males and 17% for females) (Victoria Police, 2014) gives an estimated average cost to employers of replacing imprisoned workers of **$3,140** per male prisoner and **$1,407** per female prisoner.

6.4.1.3: Lost productivity of prisoners in unpaid household work

The estimated value of labour in the household lost due to imprisonment was calculated on the same basis as that lost due to premature mortality (see Chapter 3). Following Collins and Lapsley (2008), production losses in the household sector are valued on an individual function replacement basis using data from the ABS publication *Unpaid Work and the Australian Economy 1997* (Australian Bureau of Statistics, 1997; Collins and Lapsley, 2008). The total value of male unpaid labour in the household was estimated at $82 billion in 2007 values and female unpaid labour was valued at $154 billion. Converting these figures to per adult estimates using the population data used in the ABS estimates of the value of unpaid household labour (Australian Bureau of Statistics, 1997) and adjusted to 2017/18 values (Australian Bureau of Statistics, 2021b) gives values of unpaid household work of **$20,483** per male prisoner and **$36,570** per female prisoner.

6.4.1.4: Prison assaults

Data from the Review of Government Services Provision (Steering Committee for the Review of Government Service Provision, 2019a) estimates that in 2017/18: 1.3 percent of prisoners were the victim of a serious assault; 11.7 percent were the victim of an assault; 0.08 percent of prisoners committed a serious assault on a prison guard; and, 1.2 percent committed an assault on a prison guard.

The estimated cost per assault was taken from Smith et al.'s (2014) estimates of the costs of crime in Australia (see Table 6.10). Serious assaults were assumed to be equivalent to assaults requiring hospitalisation. Other assaults were costed at the average cost of the other assault categories reported in Smith et al. (2014) and weighted based on their relative frequency amongst assaults. For assaults on prisoners, the productivity costs were not included. Medical costs outside of hospital have been excluded for prisoners as it has been assumed that they are included in the overall recurrent costs of prisons.

It is less obvious whether productivity costs should be included for prison guards; to the extent these costs are borne directly by the corrections system, then they will be included in the overall recurrent operating costs and should not be included in this calculation. However, to the extent they are borne by the employee through unpaid time off, or by workers compensation funds, they will not be included in the recurrent costs and should be included in our costing[34]. The estimated cost per assault on prisoners was $27,397 for serious assaults and $1,718 for other assaults, and the costs per assault on a prison guard were $62,367 and $3,102 respectively if productivity costs are included. Applying the relative frequencies to these unit costs, the estimated annual cost per prisoner from prison assaults (both on other prisoners and on prison guards) is **$642**.

6.4.1.5: Reduced government payments (offsetting saving)

Prisoners are not eligible for government income support payments whilst in detention so, to the extent that detainees were unemployed and on benefits at the time of their offence, there will be a cost-saving for the Australian Government. We have not been able to identify data on the proportion of offenders who were in receipt of income support benefits at the time of their imprisonment, however 2013/14 Victorian crime statistics (Victoria Police, 2014) report that 21 percent of male alleged offenders and 25 percent of female alleged offenders were unemployed at the time of their arrest (with the remainder being not in the labour force or employed). The annual value of Newstart Allowance for singles in 2017/18 was $14,009 (Department of Human Services, 2018)[35]. Assuming these rates of unemployment are representative of prisoners detained for an alcohol-attributable offence at the time of their arrest, and that all unemployed alleged offenders were in receipt of Newstart Allowance at the time of their offence, this gives average offsetting savings of **-$2,956** per male prisoner and **-$3,490** per female prisoner. These estimates are likely to overstate the potential cost-savings, as not all of those who are unemployed are eligible for Newstart allowance (in which case there would be no offsetting benefit) and of those eligible, some would have a partner who was also in receipt of income support benefits (in which case the cost-saving would be the difference between two persons in receipt of the couples Newstart allowance and one person in receipt of the single Newstart allowance, which is $9,771). On the other hand, at least some unemployed prisoners would have been in receipt of a more generous benefit such as the Disability Support Pension or be in receipt of other payments such as rent assistance or family tax benefit, and for those individuals the offsetting saving will be underestimated.

Combining the six sources of cost and offsetting benefit from imprisonment that we were able to quantify gives a total estimated net average annual cost of imprisonment in 2017/18 of $164,505 per prisoner. It is not known whether the net costs would be higher or lower if all unquantifiable costs were able to be quantified.

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[34] The costs of alcohol-attributable prison assaults on prison guards should be additional to any workplace costs reported in Chapter 5. This is because the attribution of workplace injuries to alcohol in Chapter 5 is based on the prevalence of alcohol use of employees as it is reporting the estimated cost of injuries caused by the alcohol use of an employee (whether the injury is to the person who had consumed the alcohol or to one of their colleagues). The estimate in Section 6.4.1.4 is calculating the expected increase in assaults of prison guards due to the higher prison population that results from alcohol-attributable crime; no assumption is made as to whether alcohol consumption has continued in prison

[35] Value calculated by authors as weighted average for the financial year.

6.4.2 Estimating the total costs of alcohol-attributable imprisonment

The estimated total cost of alcohol-attributable imprisonment in 2017/18 can be estimated from the total number of persons sentenced to custody in 2017/18, the expected duration of their sentences, and the proportion of imprisoned persons whose offending was attributable to alcohol (Table 6.5).

The number of persons sentenced to custody was taken from the ABS publication *Criminal Courts*, 2017/18 (2019a) using data on the number of persons found guilty and sentenced to 'custody in a correctional institution'. The duration that will be served by those sentenced in 2017/18 cannot be known at this point in time; as a proxy we used the mean time served by offence category for persons who have completed their sentence from the ABS publication *Prisoners in Australia* (2019j). Alcohol-attributable persons imprisoned were calculated using the PAAF derived from the DUMA survey.

Table 6.5: Adult prisoners sentenced in 2017/18, total and alcohol-attributable by most serious offence

Most serious offence category	Total persons sentenced to custody	Mean duration of time served (years)	Persons sentenced to custody for an alcohol-attributable offence		
			Central estimate	low bound	High bound
01 Homicide and related offences	235	10.8	42.3	36.5	48.7
02 Acts intended to cause injury	11,166	1.0	2,009.6	1,736.3	2,315.8
03 Sexual assault and related offences	1,853	3.4	333.5	288.1	384.3
04 Dangerous or negligent acts endangering persons	2,350	1.0	422.9	365.4	487.4
05 Abduction, harassment and other offences against the person	640	0.9	106.5	92.1	132.7
06 Robbery, extortion and related offences	1,513	2.7	272.3	235.3	313.8
07 Unlawful entry with intent/burglary, break and enter	4,712	1.3	395.4	301.1	516.0
08 Theft and related offences	4,819	0.5	212.3	161.7	527.7
09 Fraud, deception and related offences	1,590	1.0	133.4	101.6	174.1
10 Illicit drug offences	5,225	2.3	232.2	118.6	445.2
11 Prohibited and regulated weapons and explosives offences	1,314	0.7	175.4	151.5	272.5
12 Property damage and environmental pollution	1,151	0.8	246.9	185.3	400.1
13 Public order offences	866	0.7	158.7	119.1	205.7
14 Traffic and vehicle regulatory offences	2,906	0.5	281.3	165.1	431.0
15 Offences against justice procedures, government security and government operations	4,759	0.5	253.2	197.3	679.1
16 Miscellaneous offences	84	1.1	16.2	7.1	31.8
Total	**45,183**	**1.2**	5,292.1	4314.3	7,366.0

Sources: Australian Bureau of Statistics,(2019j); Australian Institute of Criminology DUMA collection (2020): calculations by the authors.
Totals may not sum due to rounding.

The unit cost of imprisonment used was that calculated in Section 6.4.1. This was applied for each year (or fractional year) that a person convicted of that offence would be expected to remain in custody. For instance, for each person convicted of homicide the annual costs are incurred for 15 years, for each person convicted of assault the costs are incurred for two years, and so on. Costs arising from lost economic output and the costs of assaults in prison are to increase at the expected nominal rate of growth in GDP per capita, whereas other costs are expected to grow in line with the CPI. This series of future costs are converted to a present value using a real discount rate of seven percent.

The total estimated cost of alcohol-attributable imprisonment is **$1.2 billion**, with a low bound of $0.9 billion and a high bound of $1.6 billion (Table 6.6). The majority of the costs arise from the costs of operating and maintaining prisons.

Table 6.6: Expected total cost of imprisonment for persons sentenced in 2017/18 for alcohol-attributable crime, present values

Cost items	Present value of cost, central estimate ($)	Present value of cost, low bound ($)	Present value of cost, high bound ($)
Cost of imprisonment	809,962,775	652,096,870	1,103,844,902
Value of lost economic output	200,351,484	161,338,549	272,841,016
Additional recruitment costs	21,472,512	17,287,409	29,263,472
Value of lost labour in household	152,469,728	122,752,595	207,790,947
Cost of prison assault	4,582,123	3,689,881	6,239,990
Offsetting saving in reduced benefit payments	-21,192,786	-17,062.203	-28,882,251
Total net costs	1,167,645,836	940,103,102	1,591,098,076

Sources: Australian Bureau of Statistics (2021a, d); Steering Committee for the Review of Government Service Provision (2019a); Victoria Police (2014); Bureau of Infrastructure Transport and Regional Economics (2009); Department of Human Services (2018); Smith et al. (2014); Australian Institute of Criminology DUMA collection (2020).
Totals may not sum due to rounding.

6.4.3 Community-based correction costs

The cost of community-based corrections arising from alcohol-attributable offences, where the sentence was imposed in 2017/18, was estimated from ABS data on the number of persons sentenced to community service orders (and the average length of the orders) by broad offence type (Australian Bureau of Statistics, 2019a)[36] and data on the total cost of the community corrections system (Steering Committee for the Review of Government Service Provision, 2019a). It was assumed that the cost of a given order was directly proportional to the length of the order, with the average cost per order converted to a per hour cost ($87.56) using the mean number of hours for all orders. The data on the mean duration of community service orders does not include those orders where the MSO was 'homicide and this offence type has been excluded from the calculations. As not all community correction orders had a duration that was known to the ABS, we have assumed that the mean duration of these orders matches the duration of orders in the same MSO category where the duration was known.

Attribution to alcohol was based on the PAAF calculated from the DUMA survey with a central estimate of 541,787 hours of community supervision attributable to alcohol (Table 6.7). This equates to a cost of **$47.4 million** for alcohol-attributable community supervision orders in 2017/18 under the central estimate of alcohol-attribution, with a low bound of $37.1 million and a high bound of $60.5 million.

[36] Note that not all forms of non-custodial orders are included in the ABS statistics. Home detention, probation, good behaviour bonds and suspended sentences are not included. These types of orders generally require minimal administration and supervision, so the impact of their omission is likely to be low.

Table 6.7: Community supervision orders, total and alcohol-attributable, 2017/18

Most serious offence category	Number of community supervision orders	Mean duration (hours)	Alcohol-attributable hours central estimate	Alcohol-attributable hours low bound	Alcohol-attributable hours high bound
01 Homicide and related offences	12	[a]			
02 Acts intended to cause injury	8,588	114.3	176,666.1	152,640.1	203,585.6
03 Sexual assault and related offences	595	159.9	17,123.0	14,794.3	19,732.1
04 Dangerous or negligent acts endangering persons	2,262	117.9	47,997.8	41,470.3	55,311.5
05 Abduction, harassment and other offences against the person	695	94.5	11,820.4	10,212.9	13,621.5
06 Robbery, extortion and related offences	479	106.8	9,207.1	7,954.9	10,610.0
07 Unlawful entry with intent/burglary, break and enter	2,987	88.7	22,233.3	16,930.1	29,011.7
08 Theft and related offences	4,358	75.7	27,684.0	21,080.6	36,124.1
09 Fraud, deception and related offences	1,976	116	19,234.9	14,646.9	25,099.2
10 Illicit drug offences	3,538	112.2	17,642.8	9,011.1	33,821.3
11 Prohibited and regulated weapons and explosives offences	1,523	103.1	28,260.1	24,416.8	32,566.2
12 Property damage and environmental pollution	1,824	57.5	28,120.0	21,101.9	36,456.3
13 Public order offences	1,411	80.6	30,491.9	22,881.8	39,531.4
14 Traffic and vehicle regulatory offences	3,746	105.4	80,459.9	47,235.0	123,290.9
15 Offences against justice procedures, government security & government operations	2,950	75.2	24,846.1	19,366.6	31,656.6
16 Miscellaneous offences	149	[a]			
Total hours of community supervision orders			541,787	423,743	690,418
Total cost of community supervision orders			**$47,438,026**	**$37,102,277**	**$60,451,907**

Sources: Report on Government Services (2019a); Australian Bureau of Statistics (2019a): calculations by the authors.
[a] Duration data is not available for community supervision orders where the most serious offence was homicide and 'Miscellaneous offences' and thus these were excluded from the cost calculations.
Totals may not sum due to rounding.

6.5 Costs to victims of crime

As well as the costs arising from the investigation of crime, the administration of justice and the corrections system, there are also substantial costs incurred by victims of crime. Administrative data from police and courts authorities are generally poor guides as to the extent of crime victimisation, as many victims do not report the offence to the police. Nationally, reporting rates in 2017/18 for selected crimes varied widely, ranging from 20 percent for sexual assault to 95 percent for motor vehicle theft (Australian Bureau of Statistics, 2019b).

The most comprehensive assessment of the prevalence of crime victimisation in Australia is provided by the ABS's survey *Crime Victimisation, Australia* (2019b). The number of persons reporting that they had been a victim of crime (or that their household had been a victim of crime for property offences) is set out in Table 6.8 by offence type. It should be noted that the totals cannot be summed to provide an overall number of persons who have been a victim of crime in the reference year as not all crimes are in scope, and some individuals would have been the victim of more than one type of crime. It is also important to note that not all crimes are included in the survey of crime victimisation and for those types of crime, costs to victims cannot be calculated.

Table 6.8: Number of victims of selected crimes[a], 2017/18

Offence	Number of victims of crime – reported latest incident to police ('000)	Number of victims of crime – did not report latest incident to police ('000)	Total number of victims of selected crimes ('000)
Personal Crimes			
Physical assault	244.9	224.7	472.5
Face-to-face threatened assault	191.9	303.2	500.6
Non face-to-face threatened assault	41.8	115.6	157.9
Robbery	29.4	19.2	50.7
Sexual assault victims aged 18 years or older	10.1	38.1	50.2
Household crimes			
Break and enter	166.8	64.1	231.1
Attempted break and enter	79.4	125.2	205.4
Motor vehicle theft	51.5	2.7	54.5
Theft from a motor vehicle	155.7	129.8	287.2
Malicious property damage	247.1	231.5	477.7
Other theft	83.4	154.0	236.5

Source: Australian Bureau of Statistics (2019b).
[a] Number of victims of crime, not the number of offences. As some victims of crime will have had more than one occasion in the year in which they were the victim of a particular crime type, these data understate the cost of crime to victims.
Totals may not sum due to rounding.

Applying the relevant PAAF to the total number of victims of crime gives the numbers where the crime was attributable to alcohol, see Table 6.9. Overall, we estimate that there were 193,300 victims of at least one alcohol-attributable violent crime in 2017/18, and 213,200 households that were victims of some form of alcohol-attributable property crime.

Table 6.9: Number of victims of selected alcohol-attributable crimes[a], 2017/18

Offence	Number of victims of alcohol-attributable crime – central estimate ('000)	Number of victims of alcohol-attributable crime – low bound ('000)	Number of victims of alcohol-attributable crime – high bound ('000)
Personal Crimes			
Physical assault	85.0	73.5	98.0
Threatened assault	90.1	77.8	103.8
Robbery	9.1	7.9	10.5
Sexual assault victims aged 18 years or older	9.0	7.8	10.4
Household crimes			
Break and enter	19.4	14.8	25.3
Attempted break and enter	17.2	13.1	22.5
Motor vehicle theft	4.6	3.5	6.0
Theft from a motor vehicle	24.1	18.4	31.4
Malicious property damage	128.1	96.1	166.0
Other theft	19.8	15.1	25.9

Source: Australian Bureau of Statistics (2019b); Australian Institute of Criminology DUMA collection (2020): calculations by the authors.
[a] Number of victims of crime, not the number of offences. As some victims of crime will have had more than one occasion in the year in which they were the victim of a particular crime type, these data understate the cost of crime to victims.

DUMA = Drug Use Monitoring Australia.
Totals may not sum due to rounding.

The most comprehensive set of estimates of the costs of crime have been compiled by researchers at the AIC (Smith et al., 2014). Drawing together information from a range of Australian and international sources on the costs of various types of personal and household crime, they distinguish between medical costs, lost output, property loss, property damage, and intangible cost (e.g., pain and suffering). Although not all forms of crime are in scope, the analysis covers the majority of the crime types included in the ABS *Victims of Crime* survey.

Costs of the various forms of personal crime are subdivided by the severity of medical impact on the victim, and the number of victims of alcohol-attributable crime estimated. Table 6.10 has been apportioned between severity categories based on the proportions reported in Smith et al. (2014).

In almost all cases, the parameter values chosen by Smith et al. are consistent with the ranges adopted in comparable international exercises, however the intangible cost estimate adopted for sexual assault is at the lower end of comparable studies (Smith et al., 2014). Smith et al. did not derive a specific estimate for the intangible cost of sexual assault but rather based it on the intangible cost used for assault where the victim was injured, with treatment other than hospitalisation for sexual assault where the victim sustained physical injuries, and assault where the victim was injured and no treatment was required for sexual assault where the victim did not sustain physical injuries (Smith et al., 2014). In contrast, Dolan and colleagues (2005) derive estimates of intangible costs from estimates of the quality of life impact of sexual assault, expressed in terms of disability adjusted life years (DALYs) using a value of 0.56 lost DALYs for rape and 0.16 lost DALYs for other sexual assault. This compared to lost DALYs of 0.19 for assault resulting in serious injury (roughly equivalent to the assault – hospitalised category used by Smith and colleagues (2014)).

The analysis used in the Dolan et al. (2005) estimate of the intangible costs of sexual assault is used in place of those derived by Smith et al.(2014) as it is more closely aligned to the approach taken to intangible costs in other areas of this report.

Unit costs for each cost category were converted to 2017/18 values using the change in current price Gross State Product (GSP) per capita (Australian Bureau of Statistics, 2019c) from June 2011 to June 2018 for intangible costs and lost output, and the CPI for medical costs, property loss and property damage (Australian Bureau of Statistics, 2021b). Table 6.10 sets out the unit costs to victims of personal crime while Table 6.11 reports the unit costs for household crime.

Table 6.10: Unit costs to victims of personal crime converted to 2017/18 values

Personal crime offence	Medical costs ($)	Lost output ($)	Intangible costs ($)
Assault			
Hospitalised	13,213.7	34,970.6	14,183.1
Injured, treatment other than hospital	786.0	2,923.2	3,031.5
Injured no treatment	-	725.4	725.4
No injury	-	43.3	433.1
Sexual assault			
Injury	1,082.2	6,929.2	41,658.3
No injury	-	57.4	10,973.8
Robbery			
Hospitalised	13,213.7	34,970.6	13,988.2
Injured, treatment other than hospital	786.0	2,923.2	3,069.4
Injured no treatment	-	730.8	725.4
No injury	-	43.3	433.1

Sources: Australian Bureau of Statistics (2021a, b); Smith et al., (2014), Dolan et al. (2005): calculations by the authors.
Totals may not sum due to rounding.

Table 6.11: Unit costs to victims of property crime from Smith et al. converted to 2017/18 values

Personal crime offence	Property loss & property damage ($)	Lost output ($)	Intangible costs ($)
Burglary[a]			
Completed	1,988.9	86.6	1,134.6
Attempted	243.8	57.4	755.7
Motor vehicle theft	4,521.1	174.3	2,471.8
Theft from a vehicle[b]	1,181.3	62.8	821.8
Malicious property damage	645.6	46.6	1,346.4
Other theft	582.1	9.7	250.1

Sources: Australian Bureau of Statistics (2021a, b); Smith et al., (2014), Dolan et al. (2005): calculations by the authors.
[a] The unit cost used for burglary is that for burglaries of private residences, as we do not have an estimate for the number of victims of burglaries of commercial properties.
[b] These costs are the average for thefts from private and commercial vehicles.
Totals may not sum due to rounding.

Applying the unit costs outlined in Tables 6.10 to the central estimate of the number of victims of alcohol-attributable crime in 2017/18, gives a total estimated cost to victims of personal crime of **$824.6 million** (Table 6.12). Assaults account for 65 percent of the victims of crime costs, with sexual assault accounting for a further 31 percent. The costs of premature deaths due to alcohol-attributable homicide are not included in these victims of crime cost estimates as they are included in the calculation of alcohol-attributable mortality (see Chapter 3).

Table 6.12: Central estimate of total costs to victims of alcohol-attributable personal crimes by offence type and severity, 2017/18

Offence	No. of alcohol-attributable victims	Medical costs ($)	Lost output ($)	Intangible costs ($)	Total costs ($)
Assault					
Hospitalised	3,469	45,838,815	121,314,135	49,201,708	216,354,658
Injured, treatment other than hospital	29,989	23,571,101	87,665,363	90,912,229	202,148,693
Injured no treatment	51,581	0	37,416,326	37,416,326	74,832,652
No injury	90,096	0	3,901,810	39,018,097	42,919,907
Total	**175,135**	**69,409,916**	**250,297,634**	**216,548,360**	**536,255,910**
Sexual assault					
Injury	4,016	4,345,707	27,825,972	167,290,457	199,462,137
No injury	5,019	0	288,002	55,077,848	55,365,850
Total	**9,035**	**4,345,707**	**28,113,974**	**222,368,305**	**254,827,987**
Robbery					
Hospitalised	319	4,220,032	11,168,472	4,467,389	19,855,893
Injured, treatment other than hospital	1,246	978,975	3,640,991	3,823,041	8,443,007
Injured no treatment	1,629	0	1,190,324	1,181,507	2,371,831
No injury	5,931	0	256,860	2,568,600	2,825,461
Total	**9,125**	**5,199,007**	**16,256,648**	**12,040,537**	**33,496,191**
All Personal Crimes	**193,294**	**78,954,630**	**294,668,256**	**450,957,202**	**824,580,088**

Sources: Australian Bureau of Statistics, (2021a, b); Smith et al., (2014); Dolan et al. (2005); Australian Institute of Criminology DUMA collection (2020): calculations by the authors.
DUMA = Drug Use Monitoring Australia.
Totals may not sum due to rounding.

The costs of alcohol-attributable property crime shown in Table 6.13 are less than half that of personal crime, with the central estimate of the total cost $440.9 million. Malicious damage is the most significant driver of the cost, accounting for 59 percent of the total.

Table 6.13: Central estimate of total costs to victims of alcohol household crimes in Australia by offence type and severity, 2017/18

Offence	No. of alcohol-attributable cases	Costs of property loss & property damage ($)	Cost of lost output ($)	Intangible costs ($)	Total costs ($)
Burglary – Completed	19,393	38,570,580	1,679,714	22,004,257	62,254,550
Burglary – Attempted	17,236	4,201,711	989,058	13,025,708	18,216,477
Motor vehicle theft	4,573	20,677,098	797,201	11,304,410	32,778,708
Theft from a vehicle	24,101	28,469,194	1,513,415	19,804,856	49,787,464
Malicious property damage	128,079	82,694,094	5,962,750	172,448,276	261,105,119
Other theft	19,846	11,552,182	193,383	4,963,507	16,709,072
Total	**213,228**	**186,164,859**	**11,135,521**	**243,551,014**	**440,851,390**

Sources: ABS (2021a, b); Smith et al., (2014), Dolan et al. (2005), Australian Institute of Criminology DUMA collection (2020): calculations by the authors.
Totals may not sum due to rounding.

Tables 6.14 and 6.15 set out the estimated cost of alcohol-attributable crime if the low bound estimate of the share of crime attributable to alcohol is used, and Tables 6.16 and 6.17 show the estimated cost of crime if the high bound estimate for the PAAF is used.

The plausible range of the costs to victims of alcohol-attributable personal crime ranges from a low bound of $709.8 million to a high bound of $946.7 million. Similarly, the plausible range of the costs of alcohol-attributable property crime ranges from a low bound of $327.3 million to a high bound of $563.6 million.

Table 6.14: Low bound estimate of total costs to victims of alcohol-attributable personal crimes by offence type and severity, 2017/18

Offence	No. of alcohol-attributable victims	Medical costs ($)	Cost of lost output ($)	Intangible costs ($)	Total costs ($)
Assault					
Hospitalised	2,997	38,062,751	104,815,814	42,510,439	185,389,004
Injured, treatment other than hospital	25,911	19,572,516	75,743,164	78,548,467	173,864,147
Injured no treatment	44,566	0	32,327,829	32,327,829	64,655,659
No injury	77,843	0	3,371,177	33,711,765	37,082,942
Total	**151,317**	**57,635,267**	**216,257,985**	**187,098,500**	**460,991,751**
Sexual assault					
Injury	3,470	3,608,505	24,041,732	144,539,509	172,189,746
No injury	4,336	0	248,835	47,587,443	47,836,278
Total	**7,806**	**3,608,505**	**24,290,567**	**192,126,952**	**220,026,024**
Robbery					
Hospitalised	276	3,504,149	9,649,597	3,859,839	17,013,585
Injured, treatment other than hospital	1,076	812,902	3,145,828	3,303,120	7,261,850
Injured no treatment	1,407	0	1,028,444	1,020,826	2,049,270
No injury	5,125	0	221,928	2,219,279	2,441,207
Total	**7,884**	**4,317,051**	**14,045,797**	**10,403,064**	**28,765,912**
All Personal Crimes	**167,007**	**65,560,822**	**254,594,349**	**389,628,516**	**709,783,687**

Sources: Australian Bureau of Statistics (2021a, b); Smith et al., (2014), Dolan et al. (2005); Australian Institute of Criminology DUMA collection (2020); calculations by the authors.
DUMA = Drug Use Monitoring Australia.
Totals may not sum due to rounding.

Table 6.15: Low bound estimate of total costs to victims of alcohol-attributable household crimes in Australia by offence type and severity, 2017/18

Offence	No. of alcohol-attributable cases	Costs of property loss & property damage ($)	Cost of lost output ($)	Intangible costs ($)	Total costs ($)
Burglary – Completed	14,767	28,226,901	1,279,060	16,755,691	46,261,652
Burglary – Attempted	13,125	3,074,916	753,143	9,918,751	13,746,810
Motor vehicle theft	3,483	15,132,010	607,049	8,608,025	24,347,084
Theft from a vehicle	18,352	20,834,458	1,152,427	15,080,903	37,067,788
Malicious property damage	96,113	59,639,118	4,474,576	129,408,915	193,522,609
Other theft	15,112	8,454,172	147,257	3,779,586	12,381,014
Total	**160,952**	**135,361,575**	**8,413,512**	**183,551,871**	**327,326,957**

Sources: ABS (2021a, b); Smith et al., (2014), Dolan et al. (2005); Australian Institute of Criminology DUMA collection (2020): calculations by the authors.
DUMA = Drug Use Monitoring Australia.
Totals may not sum due to rounding.

Table 6.16: High bound estimate of total costs to victims of alcohol-attributable personal crimes by offence type and severity, 2017/18

Offence	No. of alcohol-attributable victims	Medical costs ($)	Cost of lost output ($)	Intangible costs ($)	Total costs ($)
Assault					
Hospitalised	3,998	50,766,653	139,799,356	56,698,810	247,264,819
Injured, treatment other than hospital	34,559	26,105,079	101,023,359	104,764,965	231,893,403
Injured no treatment	59,440	0	43,117,632	43,117,632	86,235,265
No injury	103,824	0	4,496,347	44,963,473	49,459,821
Total	201,821	76,871,732	288,436,695	249,544,880	614,853,307
Sexual assault					
Injury	4,628	4,812,887	32,065,950	192,781,313	229,660,150
No injury	5,784	0	331,886	63,470,326	63,802,212
Total	10,411	4,812,887	32,397,836	256,251,639	293,462,362
Robbery					
Hospitalised	368	4,673,701	12,870,267	5,148,107	22,692,074
Injured, treatment other than hospital	1,435	1,084,218	4,195,787	4,405,576	9,685,581
Injured no treatment	1,877	0	1,371,699	1,361,539	2,733,238
No injury	6,835	0	295,999	2,959,991	3,255,990
Total	10,515	5,757,919	18,733,752	13,875,212	38,366,882
All Personal Crimes	**222,748**	**87,442,537**	**339,568,283**	**519,671,731**	**946,682,551**

Sources: Australian Bureau of Statistics (2021a, b); Smith et al., (2014), Dolan et al. (2005), Australian Institute of Criminology DUMA collection (2020); calculations by the authors.
DUMA = Drug Use Monitoring Australia.
Totals may not sum due to rounding.

Table 6.17: High bound estimate of total costs to victims of alcohol-attributable household crimes in Australia by offence type and severity, 2017/18

Offence	No. of alcohol-attributable cases	Costs of property loss & property damage ($)	Cost of lost output ($)	Intangible costs ($)	Total costs ($)
Burglary – Completed	25,305	48,370,041	2,191,817	28,712,804	79,274,663
Burglary – Attempted	22,491	5,269,222	1,290,597	16,996,921	23,556,740
Motor vehicle theft	5,968	25,930,439	1,040,248	14,750,842	41,721,528
Theft from a vehicle	31,448	35,702,240	1,974,817	25,842,861	63,519,918
Malicious property damage	166,049	103,034,580	7,730,431	223,571,266	334,336,277
Other theft	25,897	14,487,195	252,341	6,476,756	21,216,292
Total	**277,158**	**232,793,717**	**14,480,251**	**316,351,450**	**563,625,418**

Sources: Australian Bureau of Statistics (2021a, b); Smith et al., (2014), Dolan et al. (2005), Australian Institute of Criminology DUMA collection (2020); calculations by the authors.
DUMA = Drug Use Monitoring Australia.
Totals may not sum due to rounding.

6.6 Limitations

There are important limitations to the current investigation. Firstly, it relied on the DUMA surveys of detainees to obtain estimates of the attributable role of alcohol across different types of crime. The DUMA survey was only conducted in five police commands across Australia and, as discussed above, it is not known whether detainees' participating in the survey are representative of the broader population of offenders taken into police custody in Australia.

It should be noted that the costs associated with the administration of juvenile justice (e.g., police time, the Children's court, juvenile detention) have not been included, as detailed above, nor have costs related to the Australian Federal Police (except for policing in the ACT). In common with other sections of this report, the issue of poly-substance use is problematic in attempting to assign costs specifically to alcohol. Although the approach used by the AIC attempts to attribute offending to individual substances based on the offender's self-assessment, there are still substantial numbers of offences where attribution is to alcohol and some other substance. These were not included in the calculations.

As detailed in Section 6.4.1, a number of the potential costs of imprisonment arising from alcohol-attributable crime, and a number of the potentially offsetting cost-savings of imprisonment, cannot be reliably quantified or costed.

6.7 Conclusions

This chapter has set out estimates of alcohol-attributable crime costs among adults in Australia during the 2017/18 financial year. The cost estimates are summarised in Table 6.18. A feature of this research was that it used the DUMA survey conducted in several police commands in Australia to obtain estimates of the extent to which detainees arrested for different offence types attributed their arrest to having used alcohol recently. Overall, the alcohol-attributable percentages were moderate with 13.7 percent of adult detainees attributing their offending to alcohol. The highest PAAF percentages were found for detainees whose MSO was related to DUI (44.8%), disorder (26.8%), other offences (19.2%), and violent crime (18%). These alcohol-attributions were then applied to range of different national crime statistics reported by the Australian Bureau of Statistics for 2017/18 (2019a, b, j, l) and to relevant unit cost parameters.

Table 6.18: Summary of alcohol-attributable crime costs, 2017/18

Cost area	Central estimate ($)	Low bound ($)	High bound ($)
Police (Table 6.3)	1,034,202,561	747,374,010	1,768,433,732
Court (Table 6.4)	132,405,477	100,058,422	174,918,568
Legal Aid	44,043,489	33,283,533	58,185,085
Public Prosecutors	62,697,859	47,380,584	82,829,048
Prisoners sentenced (Table 6.6)	1,167,645,836	940,103,102	1,591,098,076
Community correction (Table 6.7)	47,438,026	37,102,277	60,451,907
Personal crime victim (Tables 6.12, 6.14, 6.16)	824,580,088	709,783,687	946,682,551
Household crime victim (Tables 6.13, 6.15, 6.17)	440,851,390	327,326,957	563,625,418
Total tangible costs	3,059,356,511	2,369,232,186	4,410,201,205
Total intangible costs	694,508,216	573,180,387	836,023,182
Total	**3,753,864,728**	**2,942,412,573**	**5,246,224,387**

Totals may not sum due to rounding.

Overall alcohol-attributable crime was estimated to result in social costs of **$3.8 billion** in 2017/18 (low bound, $2.9 billion; high bound, $5.2 billion). There are three key drivers of these costs: police costs ($1.0 billion); the costs of imprisonment ($1.2 billion); and, victims of crime ($1.3 billion). Violent crime was the largest cost driver across all the cost categories, particularly victim of crime costs.

Acknowledgements

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CHAPTER 7: ROAD TRAFFIC CRASHES

Steve Whetton & Tania Dey

7.1 Alcohol misuse and road crashes

Alcohol consumed above a low level has long been identified as a significant risk factor in road crashes and other traffic accidents. The increase in risk arises from:

- impairment to the cognitive and psychomotor skills necessary to drive safely, for example reductions in attentiveness;
- poor judgement and increased impulsiveness;
- reduced lane control, increased reaction times;
- increased risk of losing consciousness; and,
- other impairments to fine and gross motor skills (Drummer et al., 2004; Verstraete and Legrand, 2014).

In addition to a higher risk of being responsible for any crash, intoxication is also linked to a higher propensity to be involved in an accident that causes injury or death (Drummer et al., 2004; Verstraete and Legrand, 2014).

Evidence from crash studies suggests that alcohol and cannabis are the substances that contribute to the greatest number of road crash fatalities and hospitalisations, due to a combination of their greater population prevalence and the nature of their effect on cognitive and psychomotor skills (Ch'ng et al., 2007; Drummer et al., 2003; Verstraete and Legrand, 2014).

The extent of alcohol's involvement in serious road crashes has declined significantly since the introduction of random breath tests (RBTs). Meta-analysis of Australian studies concluded that fatal road crashes had fallen by 33 percent, and injury crashes by 17 percent, since the introduction of RBTs in the early 1980s. Lowering the legal blood alcohol level has also had benefits (e.g. Jiang et al., 2015; Peek-Asa, 1999). Nonetheless, alcohol is still responsible for a substantial proportion of serious road crashes. For example, Drummer and Yap (2016) found that 23.6 percent of drivers in fatal road crashes occurring between 2007 and 2013 had a blood alcohol content above the legal limit ($\geq$0.05%). Drivers with a blood alcohol level of 0.08 percent or above had a very high odds ratio (OR) for their culpability for the accident (OR=12.4).

The current analysis of road crash costs used the same population alcohol-attributable fractions (PAAF) that were calculated from the InterMAHP tool (see Chapter 3 for details) to be consistent with mortality and morbidity calculations in earlier chapters. These are likely to understate the extent of alcohol's causal role in road crashes, as there are a substantial number of culpable drivers in fatal crashes (roughly half as many again as the alcohol only drivers) with both alcohol and some other drug in their system (Drummer and Yap, 2016). As it is not possible to reliably ascribe a level of causal involvement to alcohol in these cases, they have not been included in the calculations.

7.2 Road crash frequency, 2015/16

The frequency of road crashes can be difficult to quantify, as lower severity crashes are underreported because they do not have to be reported to police and there are likely to be disincentives to do so for those who have been drinking. There are also differences in the way transport crashes are classified between different jurisdictions. Even for serious accidents, Australian states and territories use varied definitions of what constitutes a serious accident. The two reliable and consistent forms of data on road crash frequency (and transport accidents more broadly) are deaths arising from road crashes and hospital separations caused by road crashes.

The most recent comprehensive assessment of road crash frequency and costs, including quantification of accident frequency by severity, was undertaken by the Bureau of Infrastructure, Transport and Regional Economics (BITRE) in 2009 with a reference year of 2006 (Bureau of Infrastructure Transport and Regional Economics, 2009). BITRE estimated the total number of crashes in the reference year by applying estimates of the proportion of unreported crashes by severity to data provided by state and territory governments on the number of reported road crashes.

There were 1,602 deaths as a result of road crashes in 2006, with a further 31,204 persons admitted to hospital, 216,500 persons who were injured but did not need to be admitted to hospital, and 438,700 crashes in which no persons were injured (Bureau of Infrastructure Transport and Regional Economics, 2009) (Table 7.1).

Table 7.1: Estimated number of road crashes resulting in injury by severity of injury, 2006

Severity level	Number of crashes	Number of persons injured by severity	Number of vehicles involved
Fatalities	1,455	1,602	1,886
Hospitalised injury	25,498	31,204	n/a[a]
Not hospitalised injury	188,200	216,500	n/a
All crashes resulting in injury			428,643[a]
Non-injury crash	438,700	-	715,862
Total	**653,853**	**249,306**	**1,146,391**

Source: Bureau of Infrastructure Transport and Regional Economics (2009, pp. 10, 13, 14).
[a] Road crash data do not disaggregate the number of vehicles involved in crashes which resulted in injury by those which are or are not hospitalised.
Totals may not sum due to rounding.

Data on the number of fatal road crashes in 2017/18 were taken from the national road fatalities database (Bureau of Infrastructure Transport and Regional Economics, 2021). Data on road transport crashes resulting in hospitalisations in 2017/18 were taken from a Bureau of Infrastructure, Transport and Regional Economics report (2020). More recent estimates are not available for the number of road crash accidents whose consequences are less severe than hospitalisation. We have assumed that the number of other accidents has changed at the same rate as land transport accident hospital separations over the period. This rate of increase roughly reflects the increase in population over this period (Table 7.3).

An average AF for premature mortality and hospital separations was calculated from the data extracted for this report and presented in Chapter 3 (National Drug Research Institute, 2021). Total numbers of alcohol-attributable deaths and hospital separations used for these road crash calculations differ from the data in Chapter 3. There are two reasons for this: the deaths data in Chapter 3 covers the calendar year 2017, whereas these estimates are for 2017/18; and, these estimates include deaths and hospital separations amongst those aged less than 15 years, which were excluded from Chapter 3 to maintain consistency with NAIP data.

Applying the PAAF for road crashes to the severity categories suggests that there were 200 premature deaths, and 6,144 hospitalised injuries caused by alcohol-attributable road crashes in 2017/18 (Table 7.2).

Table 7.2: Estimated road crash frequency by severity, 2017/18

Severity level	Injuries by severity	Estimated alcohol-attributable
Fatalities[a]	1,213	200.0
Hospitalised injuries[a]	39,330	6,143.7
Not hospitalised injuries[a]	272,880	42,626.0
Non-injury crashes[b]	552,944	86,374.2

Sources: Bureau of Infrastructure, Transport and Regional Economics, (2020, 2021); National Drug Research Institute(2021).
[a] Number of injuries: [b] Number of crashes.
Totals may not sum due to rounding.

7.3 Costs of road crash accidents

There is a range of harms and costs that can arise from transport accidents including:

- Premature mortality;
- Hospital separations;
- Permanent disability;
- Non-hospitalised injuries;
- Damage to property; and,
- Costs of insurance administration.

The tangible and intangible costs of premature mortality due to alcohol-attributable road transport crashes are included in the broader estimates of premature mortality costs (see Chapter 3). The impact on hospital separations and other medical costs arising from alcohol-attributable road crashes are included in Chapters 3 and 4, respectively. Quantification of the costs of other road crash related harms is provided in this chapter.

There are two broad approaches that could be taken to estimating the impacts of long-term injuries and medical treatment resulting from road crashes: i) calculating the costs of each specific form of harm individually (e.g., outpatient medical care and, where the injury was severe enough to result in long-term impairment, lost lifetime output in the workplace, lifetime value of lost household labour, modifications to dwellings and vehicles to adjust for impairment, and long-term care costs over the lifetime); or, ii) using compensation payments for injuries where long-term costs are 'capitalised' into a single lump sum payment in the study year.

The former approach will result in estimates that are consistent with the valuation of other forms of cost in this study (e.g., valuation of lost workplace and household labour and of lost DALYs) and as such has much to recommend it. However, using the value of compensation payments has the advantages of avoiding any uncertainty of the expected years of life remaining after a road crash resulting in a severe impairment and giving a cost that is incurred entirely in the study year. This approach may, however, understate the intangible costs relative to society's willingness to pay to avoid them. Therefore, we used the compensation payments approach to calculate the low bound of costs (Section 7.3.2), the specific costs-based approach to calculate the high bound (Section 7.3.3), and the average of the two approaches as the central estimate.

7.3.1 Property damage caused by alcohol-attributable road crashes

The BITRE (2009) estimated that property damage resulting from road crashes cost Australia $3.9 billion in 2006. Converting this to 2017/18 values using the CPI (Australian Bureau of Statistics, 2021b) and dividing by the estimated number of road crashes in 2006, gives an estimated average property damage per road crash of $4,443 in 2017/18.

Our central estimate is that there were just over 135,000 alcohol-attributable road crashes in 2017/18, giving an estimated cost of property damage of **$0.6 billion** (see summary Table 7.5).

The costs of insurance administration for claims related to road accidents were estimated by BITRE to be $257.5 million in 2006, with legal actions costing a further $231.3 million (Bureau of Infrastructure Transport and Regional Economics, 2009). Combining these two cost items, converting them to 2017/18 values using the CPI (Australian Bureau of Statistics, 2021b), and dividing by the estimated number of road crashes in 2006 gives a per crash estimate of $983. Multiplying by the estimated number of alcohol-attributable road crashes gives a central estimate of insurance administration and legal costs of **$0.1 billion**.

Finally, BITRE (2009) estimated that road crash injuries created workplace disruption costs (including replacement costs for temporarily impaired workers, and the costs of recruitment and training to replace those unable to return to their previous employment) to employers of $77.7 million in 2006. Converting this to 2017/18 values using the change in the CPI (Australian Bureau of Statistics, 2021b), and dividing by the estimated number of road crashes in 2006, gives an estimated average property damage per road crash of $88 in 2017/18. Multiplying by the estimated number of alcohol-attributable road crashes gives a central estimate of the cost of workplace disruption to employers of **$11.4 million**.

7.3.2 Long-term costs of road crash injuries

We used two approaches in estimating the long-term costs of road crash injuries. These formed the low and high bounds of our estimate, with the mean of the two approaches being our central estimate of long-term costs.

7.3.2.1 Compensation paid approach (low bound)

The low bound approach to estimating the long-term costs of road crash injuries makes use of compensation payments made by third party insurance providers.

The Transport Accident Commission (the Victorian provider of third-party injury insurance) paid out $1.0 billion in compensation for non-fatality claims in 2017/18 (Transport Accident Commission, 2018). Victoria on average accounted for 20 percent of road crash fatalities in 2015 and 2016 (Bureau of Infrastructure Transport and Regional Economics, 2017), which implies national costs of $5.3 billion.

Applying our estimate of the proportion of road crashes attributable to alcohol gives an estimate of compensation awarded for long-term injuries arising from alcohol-attributable road crash costs of **$0.8 billion**.

7.3.2.2 Long-term care costs approach (high bound)

The BITRE (2009) estimated that serious injury road crashes will lead to some degree of permanent impairment in around 15 percent of cases, with the degree of permanent impairment ranging from 'profound limitations' (2.2% of serious injury accidents) to 'mild limitations' (4.9% of serious injury accidents).

Applying these frequencies to the estimated 39,330 road crash hospital separations in 2017/18 suggests just over 4,600 persons would be expected to have an on-going impairment due to road crashes injuries.

Average unit costs of disability by severity are taken from BITRE (2009) and these, updated to 2017/18 values using the CPI (Australian Bureau of Statistics, 2021b), are shown in Table 7.3.

Table 7.3: Estimated unit costs of equipment and care costs due to permanent impairment from road crash injuries, 2017/18

Severity of impairment	Equipment purchase & dwelling modification (one-off) $	Care costs (annual) $	Equipment maintenance (annual) $	Ongoing medical (annual) $
Profound[a]	51,991	271,591	1,217	7,426
Severe[a]	51,991	72,186	1,217	7,426
Moderate	18,864	22,795	442	4,456
Mild	9,432		221	2,673

Source: Bureau of Infrastructure Transport and Regional Economics (2009); Australian Bureau of Statistics (2021b). Totals may not sum due to rounding.

[a] The "duplicate" values for profound or severe impairment are as reported in the source document.

These unit cost estimates were multiplied by the estimated number of impairments of the relevant severity from alcohol-attributable road crashes and, where costs extend into the future, discounted back to 2017/18 terms using the Australian Government's recommended discount rate of seven percent. Expected years of life remaining after the accident were assumed to be 30 years. This gives a present value of equipment and care costs of **$0.9 billion**. Table 7.4 includes the costs for each of these components: equipment, support workers and medical costs.

In addition to these costs relating to dealing specifically with the impairment arising from road crashes, disabilities also impact the probability of employment. The extent of the impact on employment will vary depending on the severity of the impairment, and the extent to which the injured individual's form of employment (or skill set and aptitudes) are amenable to modification to adjust for the impairment. Estimates presented by BITRE suggest that the reduction in employment probability ranges from 95 percent for those with profound limitations to a 30 percent reduction in the probability of employment for those with mild limitations (Bureau of Infrastructure Transport and Regional Economics, 2019).

Data on the estimated age at the point of injury, expected years of working life for that age group and gender, and the estimated reduction in the probability of employment were used to develop estimates of the (discounted) years of working life lost due to impairment resulting from alcohol-attributable road crashes. The central estimate was a (discounted) loss of 7,283 years of expected working life. Using the same approach as in the premature mortality calculations (Section 3.6), each discounted year of working life lost was valued at $148,748, giving a total impact of years of life lost (YLL) to impairment of **$1.4 billion**.

Permanent impairment also reduces the potential for individuals to contribute to unpaid household labour. It was assumed that the impact of impairment on the ability to contribute (unadjusted for labour force status) was used as the basis for the calculation, giving an estimated (discounted) number of years of household labour lost due to alcohol-attributable impairment of 1,297 (low bound 453, high bound 1,731). This was valued following the same approach as used for the premature mortality calculation, valuing each year of household chores at $19,685 for males and $35,146 for females. Applying this to the estimated (discounted) number of years of chores lost gives an estimated cost of **$0.3 billion**.

As shown in Table 7.4, the central estimate for the lifetime care costs approach for estimating the long-term costs arising from alcohol-attributable road crashes is **$2.5 billion**.

Table 7.4: Estimated total long-term costs, lifetime care approach

Cost domains	Central estimate ($million)
Equipment costs	28.2
Ongoing support worker costs	820.9
Ongoing medical costs	56.5
Lost economic output from reduced employment	1,365.5
Lost value of household labour	253.7
Total	2,524.9

Source: Bureau of Infrastructure Transport and Regional Economics (2009); Australian Bureau of Statistics (2021b).
Totals may not sum due to rounding.

7.3.2.3 Central estimate of long-term costs

The compensation paid approach gives a low bound estimate of these costs of $0.8 billion (the central estimate of that approach). The calculation approach based on the disaggregated lifetime costs gives a high bound of $2.5 billion (the central estimate of that approach). Taking the mean of the two approaches gives a central estimate of long-term care costs of **$1.7 billion**.

7.4 Limitations

Whilst data on accidents resulting in premature death or hospital separations are available at a level of disaggregation that supports alcohol-attribution, data on property damage and long-term care costs are not. As such we have assumed that:

- the share of 'property damage only' road crashes attributable to alcohol matches the share of road crash hospital separations attributable to alcohol;
- the average property damage for an alcohol-attributable road crash matches the overall average by vehicle type; and,
- the average rate of long-term injury arising from hospitalised injury crashes attributable to alcohol is stable.

Given that there is evidence that alcohol intoxication of the at-fault driver is linked to relatively more severe accidents (see, for example, Drummer and Yap (2016) and Baldock and Lindsay (2020), and also noting that the alcohol-attributable fraction for road crash deaths is slightly higher than the PAAF for road crash hospitalisations), the first of these assumptions is likely to tend to over-estimate the costs of alcohol-attributable road crashes and the second and third assumptions are likely to under-estimate the costs of alcohol-attributable road crashes.

In addition, whilst it remains an excellent reference work, BITRE's *Road Crashes in Australia* (Bureau of Infrastructure Transport and Regional Economics, 2009) is now dated given its reference year of 2006. Costs have been updated in most cases using the CPI but components of those costs may have changed at faster or slower rates than the CPI as a whole. Changes in car safety equipment may have also changed the average costs by level of severity (for example, cars are on average better at preventing serious injury or death for a given severity of crash, so it may be the case, for example, that the average property damage of a hospitalised injury road crash is now much higher than it was in 2006 where a relatively lower level of vehicle damage could lead to a hospitalised injury.)

There are a substantial number of at-fault drivers who have consumed both alcohol and some other substance with the potential to impair driving (this represented a population equal to around an additional 40 percent of the drivers who had consumed alcohol only in Drummer and Yap's dataset (2016). These have not been included in this analysis as it is not possible to reliably separate the extent of attribution to alcohol compared to the other substance(s), however it is likely that alcohol had a causal role in at least a proportion of these crashes. Finally, there are potential impairments which could result in crashes (e.g., hangover) where a blood alcohol reading would be near or at zero, and where alcohol would not be identified as a contributory factor (Gunn et al., 2018).

7.5 Conclusions

Alcohol intoxication, particularly driving with a BAC in excess of 0.1, is one of the most significant risk factors for road crashes. Although the share of accidents caused by driving whilst intoxicated by alcohol has decreased significantly since the widespread use of RBT, alcohol is still estimated to cause around 16.5 percent of road crash deaths, and 15.6 percent of road crashes resulting in hospitalised injuries. This may slightly underestimate alcohol's role in causing road crashes, as it does not include those crashes where the at-fault driver was intoxicated by both alcohol and some other substance.

The costs arising from premature deaths and hospital separations from road crashes attributable to alcohol are set out in Chapter 3. The other costs of alcohol-attributable road crashes are estimated to have cost society **$2.4 billion** in 2017/18 (low bound $1.6 billion, high bound $3.2 billion). The most significant contribution to these costs comes from the long-term costs of impairment resulting from road crashes ($1.7 billion) followed by the cost of property damage ($0.6 billion) (Table 7.5).

Table 7.5: Alcohol-attributable road crash cost summary

Cost domains	Central estimate ($)	Low bound ($)	High bound ($)
Premature mortality	[a]	[a]	[a]
Hospital separations	[a]	[a]	[a]
Costs of property damage	571,507,007		
Costs of insurance administration and legal costs	133,090,832		
Costs of workplace disruption	11,361,076		
Long term costs (average of approaches)	1,679,931,785	835,006,661	2,524,856,909
Total road crash costs not included elsewhere	**2,395,890,700**	**1,550,965,576**	**3,240,815,824**

[a] Estimated in Chapter 3 and excluded from here to prevent double counting.
Totals may not sum due to rounding.

CHAPTER 8: TENTATIVE ESTIMATE OF HARMS TO RESIDENT OTHERS

Steve Whetton & Robert J. Tait

8.1 Background

The methods used in social cost studies are suited to quantifying and costing tangible harms arising from drinking – whether to the drinker or to another person harmed by their drinking – and intangible harms that affect the drinker themselves. For example, there are established methods and sources of data that allow the identification of premature death and illness or injury attributable to drinking, and to estimate the social costs of these harms. There are also established methods to estimating the intangible cost of being a dependent alcohol user.

However, alcohol consumption can also impose a range of intangible costs on others. Affected family members, in particular parents, partners and children living with a person with alcohol dependence have an increased likelihood of experiencing intangible costs through reduced quality of life, and they may also incur tangible costs (although many of the potential tangible costs are included in other sections of the report). There are a range of issues that may impact quality of life including: violence; emotional abuse; impaired mental wellbeing; increased ill-health; diminished family relationships; and, alienation from friends and the wider community (Orford et al., 2013; Orford, 2015). There may also be concerns about legal repercussions stemming from alcohol-affected behaviour (e.g., "drink driving", assault). For children living with an alcohol dependent adult, some of the harms are likely be similar to those experienced by adults, but there may also be unique experiences in terms of hurt, shame and embarrassment, early caring responsibilities, and potentially family breakdown (Arria et al., 2012; Orford, 2015). There are also less severe, but still meaningful impacts on quality of life from another's drinking, such as the impact of anti-social behaviour by intoxicated persons on other members of the community. Quantifying and valuing these impacts is an emerging research focus (Callinan et al., 2016; Laslett et al., 2011; Nayak et al., 2019), but one without broad consensus on methods.

In the previous reports in this series on other drug types (Whetton et al., 2016; Whetton et al., 2019; Whetton et al., 2020a, b), and due to the formative stage of research on this chapter's topic, intangible costs affecting people residing with a dependent user were calculated but not included in the overall estimate. The focus is on harms to those who reside with a dependent person because the evidence base is strongest for that set of harms; however, it should not be taken to imply that broader community intangible costs are not meaningful. Even though there is a more extensive literature on the intangible costs of living with an alcohol dependent person, these costs were calculated but not included in the overall total to provide consistency. In addition, and in common with the earlier reports, determining the number of adults or children living with an alcohol dependent person is uncertain. Finally, some, if not the majority, of the intangible costs to people co-resident with an alcohol dependent person may be included elsewhere, for example, in the intangible cost to victims of crime. Thus, excluding these intangible costs ensured that double counting was avoided.

8.2 Number of people resident with a person dependent on alcohol

The number of alcohol dependent persons was estimated via the Global Burden of Disease (GBD) compare tool (Institute for Health Metrics and Evaluation, 2020) (see Section 2.6 and Table 2.1), which provided a central estimate of 481,548 people, with a range of 329,096 to 665,875. These latter figures were used in calculating the low and high bound costs. Unfortunately, this information does not include any details on the household structure of the person dependent on alcohol. Instead, these data were derived from the National Drug Strategy Household Survey (NDSHS) (Australian Institute of Health and Welfare, 2020b), which includes data on the household situation of respondents, including resident dependent children. However, the NDSHS does not capture alcohol dependence, instead reporting on the frequency and quantity of use. Smith and colleagues (2019) used the demographic and household characteristics of those individuals reporting alcohol consumption at 2016 NDSHS 'risky lifetime' values[37] as a proxy for the characteristics of those with alcohol dependence. As noted in Section 2.5, the 2019 NDSHS included the short-form alcohol, smoking and substance involvement screening test (ASSIST-lite) (Ali et al., 2013). Using the ASSIST-lite 'high risk' category for drinking behaviours as a proxy for alcohol dependence, 4.5 percent of females and 10.3 percent of males (Table 2.2), or 1,505,000 people, were classified as 'dependent' (compared to 3.3 million who drink at levels in excess of the NHMRC lifetime risk guidelines). In this analysis we have preferred the narrower definition available from the inclusion of the ASSIST-lite questions. It is not possible to identify how closely the demographic characteristic of the population categorised in GBD as dependent matches the characteristics of the age group and gender matched population identified as 'high risk' by the ASSIST-lite.

Using these two datasets, the number of people living with an alcohol dependent person was estimated in a two-stage process. First, 10-year age-group and gender specific estimates of the average number of dependent children[38], the average number of resident partners, and the average total number of other persons resident with a person who fulfilled the ASSIST-lite proxy criterion for alcohol dependence were calculated from the NDSHS. These 'per person' 'alcohol dependent' averages were then applied to the gender and 10-year age-group estimates of the total number of alcohol dependent persons from the GBD. The number of children resident may be underestimated using this approach, as the NDSHS records the number of children as 0, 1, 2, or 3+; the latter category was coded as 3 children.

The calculated number of co-residents are shown in Table 8.1, and, based on the central estimate of the number of persons who are dependent on alcohol, there are about 356,000 children, 320,000 partners and 105,000 others who were living with a person dependent on alcohol.

Table 8.1: Estimated number of persons co-resident with a person who is dependent on alcohol

Persons co-resident	Central	Low bound	High bound
Dependent children	355,882	245,594	482,900
Partners	319,330	220,945	435,947
Other co-residents	104,651	61,573	166,370

Sources: National Drug Strategy Household Survey (Australian Institute of Health and Welfare, 2020b); Global Burden of Disease (Institute for Health Metrics and Evaluation, 2020).

8.3 Quantifying the impact on household members

Living with a substance dependent person is likely to have a substantial impact on the quality of life for these people, but quantifying this impact is difficult. This report used disability adjusted life years (DALYs) in estimating reduced quality of life, following the Global Burden of Disease (GBD) approach (e.g., (World Health Organization, 2016)). DALYs measure the number of healthy years of life lost due to disability

[38] The NDSHS questionnaire defines dependent children as: "children aged 0 – 14, or older children who are still financially dependent, such as full-time students" (Australian Institute of Health and Welfare, 2019a, p3)

(e.g., with a year of perfect health having a DALYs of 0, while a year with a condition that reduces the quality of life by 20% having a DALYs of 0.2).

There are estimates of the DALYs lost due to substance use disorders, including alcohol use disorders, but no specific estimates of the quality of life impact on partners or dependent children were located. A recent estimate of the DALYs for moderate severity alcohol dependence was 0.373 (Degenhardt et al., 2018a). A review of the benefits gained from the treatment of alcohol disorders suggests that the benefits for family members are of a similar magnitude to the gains for the treated individual (Mortimer and Segal, 2006). However, an alternative estimate reported that the impact on a co-resident adult from the successful treatment of another's alcohol disorder was 0.108 quality adjust life years (QALYs) gained (Salize et al., 2013). An approximate conversion formula for QALYs to DALYs (Sassi 2006) gives a value of 0.154 DALYs for a 35-year-old family member, which is just under half the DALYs arising from moderate alcohol dependence (0.373 DALYs). From the GBD compare tool (Institute for Health Metrics and Evaluation, 2020), the mean total DALYs for alcohol use disorders in 2017 and 2018 was 67,053, giving a mean per person in Australia with alcohol use disorders value of 0.139 DALYs. Therefore, a low and high range was constructed using the estimated impact relativities from Salize (2013) (half the impact of alcohol dependence) and from Mortimer and Segal (2006) (equivalent impact to alcohol dependence) (0.0696-0.1392 DALYs).

Applying these values to the co-residents from Table 8.1 results in an estimated number of 37,166 DALYs lost by resident children of dependent alcohol users (low bound, 17,099 DALYs; high bound, 67,241 DALYs) and 33,349 DALYs lost by the resident partners of dependent alcohol users (low bound, 15,383 DALYs; high bound, 60,703 DALYs) (see Table 8.2).

Table 8.2: Estimated quality of life (DALYs) lost by resident family members of dependent alcohol users

		Central estimate	Low bound	High bound
Resident Children	Low DALYs	24,777	17,099	33,621
	High DALYs	49,555	34,198	67,241
	Mean	37,166	25,648	50,431
Resident partners	Low DALYs	22,233	15,383	30,352
	High DALYs	44,465	30,766	60,703
	Mean	33,349	23,074	45,528

Sources: National Drug Strategy Household Survey (Australian Institute of Health and Welfare, 2020b); Global Burden of Disease (Institute for Health Metrics and Evaluation, 2020).
Totals may not sum due to rounding.

8.4 Intangible costs to family members

Having estimated the number of DALYs lost by co-resident family members, these then need to be converted to monetary values. This approach is not without criticism (Baker et al., 2010; Dolan, 2010; Donaldson et al., 2011; Miller and Hendrie, 2011). In some cases, the value of a year lived with disability has just been equated to the value of a statistical life year (VoSLY) (e.g., Moore (2007), Nicosia et al., (2009)), an approach that has also been recommened for use in governmental cost-benefit analyses (Abelson, 2008). In calculating the VoSLY, the same approach is used as in calculating the annual payment for an annuity of a given value and is based on the expected average years of life for the individual (typically 40 years). The formula used is,

$$VoSLY_{t=1} = VoSL \times \frac{(1-(1+g)/(1+r))}{(1-(\frac{1+g}{1+r})^{years})}$$

Where:

VoSL = estimated value of a statistical life
g = annual escalation factor for VoSLY, typically the long-run real growth rate in per capita GDP
r = the discount rate being used, in Australian studies this is usually a real annual rate of seven percent
years = assumed average years of life remaining at the time of the study for the sample used to derive the VoSL estimate.

However, this simple approach has been criticised in that the VoSLY varies depending on many factors including: age; health state; expected years of life remaining; the ability to pay; and, the person's preference on the distribution of resources over their lifetime (Baker et al., 2010; Dolan, 2010; Donaldson et al., 2011). It is also not clear if the prospective expressed willingness to accept less years of life to avoid a particular health condition is accurate given the degree of adaption shown by those people with the health condition (Dolan, 2010).

An alternative approach to the estimation of DALYs is via specific studies on the preferences of the population of interest. The disadvantages of this approach are that preference studies are costly and time consuming to conduct, and they may result in 'bespoke' values largely driven by variations in the sample selected rather than the 'true' value of averting death or ill health. Therefore, an estimate based on the VoSLY was adopted.

As detailed in Section 3.8, the preferred value for a statistical life in 2017/18 was $4.96 million (Abelson, 2008). From this, the value of a *single year* of life was calculated and hence a VoSLY in 2017/18 of $309,157. Plausible bounds were then placed around that value using the implicit threshold value per DALYs from PBS approvals of $47,267 as the low bound (Community Affairs References Committee, 2015; Harris et al., 2008). The high bound was calculated using the VoSLY derived from the VoSL used by the US Department of Transport (2015), which equated to $872,275: both figures adjusted to 2017/18 values (Australian Bureau of Statistics, 2021b).

An additional complication is the nature of the relationship between the alcohol dependent person and other co-residents. For example, it is arguable that partners and children are likely to incur greater lost quality of life than housemates. The data in the NDSHS only allowed us to separately estimate "partners", "dependent children" and "other" co-residents. Other co-residents were excluded from the preferred estimate. The costs relating to other co-residents were estimated using the lower value DALYs and are included in the table for completeness but were not added to the total cost.

The estimate of the lost quality of life for dependent children and partners resident with an alcohol dependent person was the sum of the two central values, **$21.8 billion**, with a range of $2.3 billion to $83.8 billion (Table 8.3).

Table 8.3: Tentative estimate of harms to resident others

Variable		Central estimate	Low bound	High bound
Value used per DALYs		$309,157	$47,267	$873,272
Resident Children	Low DALYs	7,660,104,015	808,211,210	29,360,006,565
	High DALYs	15,320,208,029	1,616,422,420	58,720,013,129
	Mean	11,490,156,022	1,212,316,815	44,040,009,847
Resident partners	Low DALYs	6,873,343,832	727,096,867	26,505,324,329
	High DALYs	13,746,687,663	1,454,193,735	53,010,648,658
	Mean	10,310,015,748	1,090,645,301	39,757,986,494
Total cost partners and children	**Sum of means**	**21,800,171,769**	**2,302,962,116**	**83,797,996,341**
Other persons resident	Low DALYs	2,252,540,190	202,627,103	10,115,193,376
Total cost including other co-residents		24,052,711,960	2,505,589,218	93,913,189,716

Sources: Global Burden of Disease (Institute for Health Metrics and Evaluation, 2020), National Drug Strategy Household Survey (Australian Institute of Health and Welfare, 2020b).
DALYs = disability adjusted life year.
Totals may not sum due to rounding.

8.5 Conclusions

The research field on alcohol's harm to others is of growing interest, including to global policy bodies, such as the World Health Organization (Callinan et al., 2016; Laslett et al., 2011; Laslett et al., 2019; Nayak et al., 2019; Stanesby et al., 2017; Wilsnack et al., 2018). In a comparative analysis of the harms to the drug consumer and the harms to others, alcohol was the only substance rated as causing more harms to others than the actual consumer (Nutt et al., 2010), with a recent Australian study reaching a similar conclusion (Bonomo et al., 2019). Overall, it was estimated that the combined value of alcohol-related lost quality of life to resident partners and dependent children was $21.8 billion (Table 8.4). Consistent with earlier reports in this series (e.g., (Whetton et al., 2020a, b)), this value was not included in the total social cost of alcohol.

Table 8.4: Summary of alcohol-attributed and alcohol-related harms to others

Domain	Central estimate $ billion	Low bound $ billion	High bound $ billion
Lost quality of life living with dependent other[a]	21.80	2.30	83.80

[a] Excluded from the overall total cost.

We estimated the extent of quality of life lost and associated monetised values for children and partners, but there are potentially many other categories of persons both within the household and externally who could be impacted by the alcohol use of others. Of particular note was the fact that about 45 percent of those who were co-resident were children, a group where harms would possibly be expected to be the most substantial and persistent, including increased risk of developing alcohol use disorders or depression in adulthood (Anda et al., 2002). It was estimated that between 246,000 and 483,000 financially dependent[39] children were living with a parent or guardian who was dependent on alcohol:

[39] Note the survey asks "Are there any dependent children in this household? (Dependent children are defined as children aged 0 – 14, or older children who are still financially dependent, such as full-time students)." This refers to financial rather than clinical dependence.

there may be further children living with an adult who was dependent on alcohol but who were not financially dependent on that adult.

As noted above, the number of co-residents were adjusted to reflect the prevalence of dependence in the GBD data. Also, weighted data were used as the different age and gender profiles could impact on co-residents and number of children. Nevertheless, if the GBD cohort represents those with more severe dependence and those identified in the NDSHS cohort via a proxy measure of “dependence” have less severe problems, then the household structure of those with clinical dependence compared with the proxy measure may differ, and hence may have under- or over- estimated the number exposed.

Additionally, assortative mating and concordant alcohol behaviours means that more children will reside in households where both parents / guardians have alcohol disorders than would be expected by chance (Grant et al., 2007; Howe et al., 2019). This seems likely to increase the DALYs lost by those children, but it is unclear what the impact on the DALYs for each respective partner in a concordant relationship would be. Finally, this chapter focused on the intangible costs of living with a person dependent on alcohol. Chapter 10 addresses a sub-set of tangible costs: those due to alcohol-related family violence such as health care and reduced economic opportunities.

CHAPTER 9: INTERNALITIES

Steve Whetton, Steve Allsop & Robert J. Tait

9.1 Background

In Section 2.2 it was noted that, in general, an analysis of social costs would not include any harms to the individual consumer arising from their own use. This exclusion assumes that the consumer will incorporate any potential harms into their purchasing decision along with the purchase price. As such, the total cost, including any harms, will be outweighed by the benefits that the consumer perceives from the consumption. However, the rational model of consumption (Becker and Murphy, 1988) does not appear to be well suited to explaining the consumption of substances when the consumer becomes dependent (see Section 2.2). Further, because the 'benefits' of consumption are likely to be more immediate to the consumer and the harms potentially distant, this undermines the plausibility that the dependent consumer might be maximising their lifetime utility at their current level of consumption.

Given that the costs to a substance dependent person do not meet the typical definition of social costs, they are differentiated as "internalities" or "private costs". These internalities are the total costs borne by the consumer themselves but that were not factored into the original consumption decision. In some analyses, for example, the Productivity Commission's inquiry into the social costs of gambling, an attempt was made to assess what level of gambling and associated harms would occur if these consumers were not dependent (Productivity Commission, 1999). In other analyses, all costs borne by dependent users are treated as internalities. However, those consumers who are not dependent are excluded from the internalities estimate, as it is less clear that these people depart from the assumptions underpinning the rational model.

In estimating the cost of internalities, there is the potential for double counting in that the value of a statistical life (VoSL) may include the potential loss of future earnings (Tilling et al., 2012). Therefore, if both the VoSL, and lost lifetime earnings for a person with substance dependence are included as internalities, then there may be some double counting. Similarly, it is unclear precisely what negative impacts underpin the evaluation of disability adjusted life years (DALYs) lost by people with drug dependence (see, for example, (Degenhardt et al., 2013; Pyne et al., 2008)) so one cannot be certain that any harms that occur to the consumer and captured as internalities are excluded from DALYs. Therefore, a conservative approach was adopted and it was decided to use ***either*** the quality of life impact ***or*** the estimated internalities, plus the expenditure by dependent users on alcohol. However, the use of a single approach may underestimate the true extent of the internalities as the two measures are likely to only partially overlap in terms of the harms they capture. The study therefore assessed these costs via the quality of life impact plus the cost of alcohol purchases.

9.2 Estimated quality of life impact of dependent alcohol use

The quality of life lost from dependence on alcohol can be quantified in terms of DALYs, as used elsewhere in this report. This measure assesses the departure from a year in full health. Thus, a condition rated with a DALYs of 0.2 equates to an average person with that condition having a quality of life equal to 80 percent of a person in full health.

From the GBD compare tool, the mean of the central value for 2017 and 2018 was 67,053 DALYs lost by those with alcohol dependence (Table 9.1). The previously described methods and assumptions (Section

8.4) were used in estimating a monetary value for each DALYs, and it should be remembered that there remains considerable debate about the best approach to identifying monetary values for lost DALYs. The central cost estimate was based on the VoSL (Abelson, 2008) updated from 2007 values to 2017/18 values using the change in the average nominal national per capita income over that period, giving a VoSL of $4.96 million. When this figure was converted to an annualised form, the VoSLY was $309,157 and hence the value for each DALYs lost. The low bound per DALYs lost was estimated from the implied threshold value used for PBS approval of $47,269 (Community Affairs References Committee, 2015; Harris et al., 2008). The high bound per DALY lost used the VoSLY derived from the annualised value of the VoSL used by the US Department of Transport (2015), which equated to $872,275 in 2017/18 (Australian Bureau of Statistics, 2021b).

These values were then applied to the central estimate of DALYs lost due to alcohol dependence (Table 9.2), and to the low and high bound values. The central estimate, based on the value calculated using the Abelson VoLSY was, **$20.7 billion**, with a range of $2.4 billion to $77.1 billion. Appendix 9.1 shows the full potential range of the estimated value across the range of the number of people with alcohol dependence.

Table 9.1: Estimated DALYs from Global Burden of Disease (mean 2017 and 2018: aged 15+ years).

Value	Central estimate	Low bound	High bound
Disability adjusted life years	67,053	49,700	88,330

Source: (Institute for Health Metrics and Evaluation, 2020).

Table 9.2: Estimated value of disability adjusted life years lost to alcohol dependence

Value	Central estimate ($309,157)	Low bound ($47,269)	High bound ($872,275)
Lost disability adjusted life years (67,053)	20,730,614,727	2,349,262,278	77,047,670,533

Source: (Institute for Health Metrics and Evaluation, 2020).

9.3 Cost of alcohol purchases

The cost of alcohol purchased by those with alcohol dependence was considered eligible for inclusion as an internal cost. However, no social costs studies were located that have included this item in the rapid review of recently published studies (2015-2020: Appendix 1.1). Nevertheless, there are national and international data on the cost of alcohol consumed by different consumer categories. In the US, the top 10 percent of drinkers consume 55 percent of alcohol, but accounted for 33 percent of expenditure on alcohol (Kerr and Greenfield, 2007). In England, the top four percent (or “harmful” drinkers) consumed 30 percent of the total alcohol consumed and accounted for 23 percent of alcohol sales revenue (Bhattacharya et al., 2018), and, in Australia the top five percent of alcohol consumers were estimated to account for 37 percent of all alcohol consumed (Livingston and Callinan, 2019). The cost analyses by Collins and Lapsley estimated 20 percent of alcohol was consumed by “addicted” consumers and that 30 percent was “abusive” or “misused alcohol”, that is, use by non-dependent persons but with adverse outcomes such as domestic violence and traffic accidents (Collins and Lapsley, 2008).

From the GBD it was estimated that there were 481,548 people classified with alcohol dependence, or 2.39 percent of those[40] aged 15 years and older (Institute for Health Metrics and Evaluation, 2020). As

[40] Based on a population of 20.13 million (Australian Bureau of Statistics, 2019h).

noted above, the heaviest five percent of drinkers account for 36.6 percent of consumption (Livingston and Callinan, 2019). Among the cohort who drank the most (defined as the top decile), they on average paid $1.47 per standard drink compared with $1.81 by other consumers (Livingston and Callinan, 2019). Therefore, any estimate of the costs of alcohol purchases by those with the heaviest consumption of alcohol has to be factored down to account for the cheaper alcohol typically selected by this group.

In 2015/16, average weekly household expenditure on alcohol was $31.95 (Australian Bureau of Statistics, 2017a), or $33.12 in terms of 2017/18 prices (Australian Bureau of Statistics, 2021b). In 2017/18 there were about 9.3 million households in Australia (Australian Bureau of Statistics, 2019i) which equates to $16.0 billion spent on alcohol. After combining these data, it was estimated that those with alcohol dependence spent **$2.3 billion** or 14.2 percent of the total spending on alcohol, assuming that those with alcohol dependence consumed an equivalent amount to the top five percent of alcohol consumers.

However, this total includes the goods and services tax (GST) and other alcohol duties: these components should not be included in the cost estimate as they constitute transfer payments. In 2017/18, the Australian Government received $6.5 billion in excise, duty and wine equalisation tax (Morrison and Cormann, 2018). The tax payable on alcohol is complex, with the calculation including the value, volume, type of beverage and the strength of the alcohol (Parliamentary Budget Office, 2015). Therefore, the value of GST paid (1/11th of the cost) on the alcohol purchased by those who were dependent was subtracted and 14.2 percent for the other duties and taxes collected on alcohol was also subtracted. Total spending on alcohol by those with alcohol dependence, excluding taxes was **$1.1 billion** (Table 9.3).

Table 9.3: Alcohol purchases by those with dependence

Variable	Value	Central estimate ($)
Number of households	9,270,400	-
Spending / year on alcohol	($33.12 * 52)	15,965,853,696
Proportion of spending by top 5%	36.6%	5,843,502,453
Proportion spent by alcohol dependent	2.39%	2,793,194,172
Adjustment for lower cost alcohol	81.2%	-524,688,408
Total	**-**	**2,268,505,764**
Minus goods & services tax (GST) (1/11th)	206,227,797	2,062,277,968
Minus proportion of other duties & excise (14.2%)	924,972,307	1,137,305,661
Total excluding GST and other taxes		**1,137,305,661**

Totals may not sum due to rounding.

9.4 Conclusions

Internal costs are seldom included in social cost studies, even for those investigating substances with potential for dependence. In conducting a rapid review on alcohol social cost studies (Appendix 1.1), no studies estimated the lost quality of life from people with alcohol dependence. Subsequently, Smith and colleagues (2019) reported that in the Northern Territory (Australia), the intangible value of this lost quality of life was in the range of $438 million to $1,261 million. The rapid review also found no studies that included the cost of alcohol purchases by those with alcohol dependence. However, pre-dating the timeframe of the review, these costs have been included in earlier Australian estimates (Collins and Lapsley, 1996, 2002, 2008) and a South Korean evaluation (Chung et al., 2006). By way of comparison, a recent analysis of the social cost of tobacco estimated that those dependent on tobacco in Australia spent $5.5 billion on tobacco purchases in 2015/16 (Whetton et al., 2019). The cost of illicit drug purchases has also been estimated for those with other drug dependencies (Jiang et al., 2017b; Lin et al., 2013; Whetton et al., 2016; Whetton et al., 2020a, b).

Other (non-social cost) studies have investigated both the costs of alcohol consumption by adults with alcohol use disorders and alcohol consumption by those under the legal age of alcohol purchase (Foster et al., 2006). In the US, it was estimated that "underage consumption" (e.g., < 21 years) contributed 17.5 percent of total spending on alcohol, with 20.1 percent of spending by those matching the diagnostic criteria for "alcohol abuse" or dependence (Foster et al., 2006). Therefore, the estimate of 14.2 percent of spending appears to be potentially conservative and substantially lower than the 30 percent allocated to "abusive" consumption in earlier Australian reports (Collins and Lapsley, 2008).

Our estimate of the overall internal costs arising from alcohol purchases and the reduced quality of life for persons dependent on alcohol was **$21.9 billion** (Table 9.4).

Table 9.4: Summary of internalities for those with alcohol dependence

Component	Central estimate ($)	Low bound estimate ($)	High bound estimate ($)
Value of disability adjusted life years lost	20,730,614,727	2,349,262,278	77,047,670,533
Alcohol purchases	1,137,305,661	[a]	[a]
Total	**21,867,920,387**	**3,486,567,938**	**78,184,976,194**

[a] Central estimate included in total – no separate low or high bound estimate.
Totals do not sum due to rounding.

This report is one of the few studies on the social cost of alcohol to include an analysis of the cost of alcohol purchases for those who are alcohol dependent. The estimate was predicated on the assumption that the spending by this group was of the same magnitude as others in the top five percent of consumers. In addition, the estimate of costs was based on household surveys and, as such, these will be likely to miss the most marginalised members of society (for instance, those who are homeless or in unstable accommodation, in care, or prison) where substance use problems are perhaps more prevalent (Australian Institute of Health and Welfare, 2019b, Table S3.16), and thus under-estimate spending on alcohol. A previous analysis, estimated that those dependent on alcohol were responsible for 20 percent of consumption (Collins and Lapsley, 1996). Their subsequent report increased this to 30 percent to include the "misuse of alcohol" by those who were not "addicted" (e.g., road traffic crashes caused by those who were not dependent) and valued at $1.7 billion or approximately $2.3 billion in 2017/18 terms (Australian Bureau of Statistics, 2021b; Collins and Lapsley, 2008). The current estimate was more conservative, with those classified as dependent responsible for about 14 percent of spending on alcohol. Further, in contrast to some estimates (Foster et al., 2006), no component for the purchase of "misused" alcohol nor a value for the purchase of alcohol by underage[41] drinkers was included.

The study attempted to adjust the estimate of spending on alcohol to remove taxes and duties from the total. Given the complexity of the alcohol taxation regime in Australia, this was at best an approximation. Although the study subtracted 14.2 percent of total taxes received from alcohol, the exact figure will depend on the specific types of alcohol purchased. Purchase of "duty free" alcohol should be captured

[41] Alcohol cannot be legally purchase by those aged under 18 years. Secondary supply laws mean that those aged under 18 years can legally drink alcohol under specific provisions that vary by jurisdiction (Department of Health, 2020).

by the household expenditure survey (Australian Bureau of Statistics, 2017a) but there was no correction in estimating the taxes not applicable to these duty free purchases: this will over-estimate the tax contribution and under-estimate spending on alcohol by those with alcohol dependence. No costs were included for the production of 'home brewed' alcohol. Less than one percent of people list home-brewed beer as their most typically consumed form of alcohol (Australian Institute of Health and Welfare, 2020c), so this omission is likely to have a minor impact. Further, the amount of alcohol consumed by individuals in the tail of the distribution is likely to be highly skewed. For example, the top five percent consumed 36.6 percent of alcohol by volume while the next five percent consumed 17.8 percent (Livingston and Callinan, 2019). While those with alcohol dependence would be expected to be towards the extreme of the distribution, no further correction was made for the amount they consumed, as this might be off-set by the selection of alcohol that had a lower cost per unit.

CHAPTER 10: OTHER ALCOHOL-ATTRIBUTABLE COSTS

Robert J. Tait, Steve Allsop & Steve Whetton

10.1 Prevention programs

One commonly used model of prevention invokes the idea of three levels of prevention: primary prevention (e.g., preventing the uptake of any non-medicinal drug use); secondary prevention (e.g., reducing the uptake of risky drug use); and, tertiary prevention (e.g., reducing behaviours or practices that lead to significant social and/or individual harms, such as reducing the risk of overdose (e.g. Gellman and Turner, 2013)). An alternative structure was offered by the US Institute of Medicine (National Drug Research Institute, 1997). This approach also has three levels: universal prevention (targeting whole populations); selective prevention (targeting specific groups with above average risk); and, indicated prevention (targeting individuals with emerging problems). It is not intended to go into detail about the relative merits and demerits of each model, nor to consider criticisms (e.g. Perman-Howe et al., 2018), but rather to highlight that there is no single approach to prevention. Thus, diverse approaches and strategies are indicated, targeting distinct issues and risks, contexts of use, behaviours and/or populations.

In this section, costs are estimated for what can be considered as primary and secondary levels of prevention: tertiary programs may overlap with the costs included in Section 4.3.6 on specialist drug treatment.

10.1.1 Primary prevention

A detailed analysis of spending on prevention programs reported a total cost of $156.8 million in 2009/10, of which $79.2 million related to primary prevention programs in schools (Ritter et al., 2013). Drawing on a report produced by the Auditor General of Victoria (2003), the proportion of time spent addressing licit *versus* illicit drugs varies with the age-grade of the students. In year 8 and below, 25 percent of drug education focused on illicit drugs with 75 percent on licit drugs (Ritter et al., 2013). For those in grade 9 and above, there was an approximate 50:50 split in time. In primary schools the average exposure to drug specific[42] education was 12 hours and among secondary school students it was 10 hours with a range of 7.1 to 13.0 hours, depending on grade.

The Auditor General also provided a guideline for sequential, age appropriate topics, with alcohol, tobacco, steroids and cannabis addressed from year 5 onwards (2003). Therefore, in this analysis for primary students in grades 5 to 7, 9 hours per student were allocated to addressing licit drugs (with 4.5 hours to alcohol and 4.5 hours to tobacco). Across all secondary school students, the central estimate used 5 hours on licit drugs (split evenly between alcohol and tobacco). The low and high bound estimates used the range (7.1 and 13.0) to allocate 3.55 hours to licit drugs (alcohol 1.78 hours) and 6.5 hours (3.25 hours to alcohol).

In 2017/18 total spending on schools by national, state and territory governments was $61.5 billion (Steering Committee for the Review of Government Service Provision, 2020). For government secondary schools, the cost was $20,115 per student and in primary schools, $16,081 per student. For non-government schools, the cost was $11,193 (Steering Committee for the Review of Government Service

[42] This excludes time spent on social competence skills.

Provision, 2020). Assuming that the cost of each hour of alcohol education was similar to the cost of other hours of education, the percentage of alcohol education hours out of total education hours was used to attribute a proportion of total costs to alcohol education (Table 10.1). The central estimate for school-based alcohol prevention programs was **$95.9 million**.

The above cost only included government spending on education. There are additional contributions, especially by parents in fees for non-government schools. Further, the estimate of time spent on alcohol education programs is based on data from only one state and which is now quite dated (Auditor General Victoria, 2003). Finally, the Auditor General's report noted that the drug curriculum was voluntary in non-government schools, so the extent and content of teaching outside the government sector was unclear.

Table 10.1: Estimated hours of alcohol education and costs for school students in 2017/18

	Central estimate	Low bound	High bound
Secondary			
Alcohol education (hours)	2.5	1.78	3.25
% of total education hours	0.21	0.15	0.27
Alcohol education cost ($)	**59,286,822**	**42,212,217**	**77,072,868**
Primary			
Alcohol education (hours)	4.5	-	--
% of total education hours	0.38	-	-
Alcohol education cost ($)	**36,584,285**	a	a
Total alcohol education cost ($)	**95,871,107**	**78,796,502**[a]	**113,657,153**[a]

Sources: Student numbers and costs (Steering Committee for the Review of Government Service Provision, 2020): Alcohol hours (Auditor General Victoria, 2003; Ritter et al., 2013).

[a] Central estimate included in total – no separate low or high bound estimate.

Totals may not sum due to rounding.

10.1.2 Secondary prevention

As noted above, a detail analysis of Australian prevention programs identified $156.8 million spent on prevention programs in 2009/10. Of this, $77.6 million was on secondary prevention, comprising $53.7 million by the states and territories with the federal government spending a further $18.9 million on general population programs, and about $5 million as part of the Closing the Gap strategy (Dick et al., 2008; Ritter et al., 2013).

In WA, the Mental Health Commission publishes the per capita spending on programs which either delay the uptake or reduce the harm associated with alcohol and other drugs. In 2017/18, $4.92 was spent for each person aged 14 years or older (Mental Health Commission, 2018). The mean Australian population of this age in 2017/18 was 20.4 million (Australian Bureau of Statistics, 2019h, Table 59). If the level of spending on secondary prevention was similar across Australia, the cost would be $100.4 million. The division of spending by category of substance was unknown: Ritter and colleagues estimated a 50 percent split for licit and illicit drugs (2013). In the current report, of the licit drug costs, 50 percent was allocated to alcohol and 50 percent to tobacco, with a resultant cost of $25.1 million for alcohol prevention initiatives. These assumptions were retained in estimating the high bound.

Data from Victoria show that $34.2 million was spent on drug prevention and control in 2017/18 (Victorian Department of Health and Human Services, 2018) at a time when the population was approximately 6.4

million people (Australian Bureau of Statistics, 2019h, Table 4). This equated to a cost of $5.34 per person (with no age restrictions). Extrapolating to the Australian population, this equated to $132.4 million, and using the assumptions from above, $33.1 million for alcohol-related prevention. These two estimates ($25.1 million and $33.1 million) provided the low and high bounds with the mid-point being the central estimate, **$29.1 million** (Table 10.7).

It was not possible to disaggregate the relevant cost for federal government expenditure, so the actual cost is likely to be closer to the high bound figure than the central estimate. Assuming the proportion reported by Ritter et al. (2013) and the allocation to alcohol were still applicable, the federal contribution would add about 31 percent to the total (approximately $9.0 million). Given the uncertainty, this was not included in the total estimated for secondary prevention.

10.2 Child protection system costs

The broad issue of harms to others is addressed in Chapter 9: here the specific costs relating to the child protection system are estimated and the long-term costs to survivors of child abuse are explored in Section 10.3. While the precise definitions of child neglect vary across jurisdictions, there are similarities in the stages and processes involved between the initial notification of cases and substantiated outcomes (Bromfield and Higgins, 2005). Data for substantiated cases in 2017/18 were not available for NSW, so these cases were estimated from the proportion of cases in 2016/17 reported in NSW (38.4 percent of the national total). From this, in 2017/18 it was estimated that there were approximately 51,774[43] substantiated cases (Steering Committee for the Review of Government Service Provision, 2019b).

There are limited publicly available data on the reasons for substantiation in child protections cases. Therefore, the number of alcohol-attributable cases was estimated from two sources. First, a report on substantiated cases in Victoria, where 35.3 percent of cases involved a history of parental substance abuse (Laslett et al., 2010; Laslett et al., 2013) with likely alcohol "abuse"[44] by a parent or carer documented in 33.2 percent of substantiated cases (Laslett et al., 2013). Further, the odds ratio for substantiated case for alcohol abuse was reported at OR = 1.23 (Laslett et al., 2010). Using the formula provided by Grant (2014) this was converted to a RR (RR = 1.143): from the prevalence of 33.2 percent, this gave an AAF = 0.045.

The second source involved data from a South Australia study of new child protection cases (n = 467) (Jeffreys et al., 2009). The report also included a detailed sub-analysis of 99 case files, which revealed 75 (75.8%) involved the use of alcohol or other drugs, with alcohol being the most frequently identified substance, occurring in 58 out of 75 cases. The report also documented all the factors that were noted as contributing to the decision to take a child into care. These factors were not weighted or prioritised, for example in terms of severity or impact on the care decision. Therefore, it was assumed that each factor contributed equally to the decision to take a child into care. Applying these factors to the larger cohort (Table 10.2) resulted in 2,285.4 factors involved in the 467 child protection cases, of which alcohol use accounted for 11.1 percent.

[43] There were 32,031 excluding NSW in 2017/18 (Steering Committee for the Review of Government Service Provision, 2019b).

[44] In this instance "abuse" was the term used in the Victorian coding system (Laslett et al., 2013), and does not represent a formal diagnostic category.

Table 10.2: Factors influencing decision to take a child into care in South Australia for the first time by whether substance use was noted in the case file, 2006

Factor influencing decision to take into care	Substance use: No[a] % with factor	Substance use: Yes[b] % with factor	Substance use: No[a] # of times with factor	Substance use: Yes[b] # of times with factor	All cases # of times with factor	All cases % of total factors
Alcohol use	-	77.3	-	253.5	253.5	11.1
Cannabis use	-	53.3	-	174.8	174.8	7.6
Amphetamine use	-	50.7	-	166.3	166.3	7.3
Heroin use	-	12.0	-	39.4	39.4	1.7
Prescription drug use	-	10.7	-	35.1	35.1	1.5
Intravenous substance use	-	4.0	-	13.1	13.1	0.6
Methadone use	-	2.7	-	8.9	8.9	0.4
Ecstasy use	-	1.3	-	4.3	4.3	0.2
Inhalant use	-	1.3	-	4.3	4.3	0.2
Parental mental health	54.2	65.3	75.3	214.2	289.5	12.7
Domestic violence	16.7	69.3	23.2	227.3	250.5	11.0
Homelessness	8.3	28.0	11.5	91.8	103.4	4.5
Financial difficulties	0.0	29.3	0.0	96.1	96.1	4.2
Parental incarceration	4.2	25.3	5.8	83.0	88.8	3.9
Housing instability	8.3	24.0	11.5	78.7	90.3	3.9
Transience	0.0	22.7	0.0	74.5	74.5	3.3
Criminal activity	0.0	20.0	0.0	65.6	65.6	2.9
Abandonment	4.2	17.3	5.8	56.7	62.6	2.7
Social isolation	20.8	12.0	28.9	39.4	68.3	3.0
Parent abused as a child	0.0	13.3	0.0	43.6	43.6	1.9
Family breakdown	12.5	13.3	17.4	43.6	61.0	2.7
Parental intellectual disability	25.0	2.7	34.8	8.9	43.6	1.9
Child behaviours	16.7	4.0	23.2	13.1	36.3	1.6
Parent/child conflict	16.7	4.0	23.2	13.1	36.3	1.6
Parent hospitalisation	12.5	4.0	17.4	13.1	30.5	1.3
Other jurisdiction CP involvement	4.2	4.0	5.8	13.1	19.0	0.8
Parent ex-GOM	12.5	1.3	17.4	4.3	21.6	0.9
Young parents	8.3	2.7	11.5	8.9	20.4	0.9
Parental death	0.0	4.0	0.0	13.1	13.1	0.6
Adolescent at risk	4.2	1.3	5.8	4.3	10.1	0.4
New arrivals	4.2	1.3	5.8	4.3	10.1	0.4
Support to relative carers	4.2	1.3	5.8	4.3	10.1	0.4
Unaccompanied minor, refugee program	8.0	0.0	11.1	0.0	11.1	0.5
Child disability	4.2	1.3	5.8	4.3	10.1	0.4
Child mental health	0.0	1.3	0.0	4.3	4.3	0.2
Child intellectual disability	0.0	1.0	0.0	3.3	3.3	0.1
Previous CP history	4.2	0.0	5.8	0.0	5.8	0.3
Recovery order	4.2	0.0	5.8	0.0	5.8	0.3
Total number of factors					**2,285.4**	**100.0**

Sources: Jeffreys (2009); Whetton (2016).
Table reproduced with permission (Whetton et al., 2016).
[a] 139 cases; [b] 328 cases.
CP = child protection: GOM = Guardianship of the Minister

With 51,774 substantiated cases nationally, the low bound was 2,330 cases and the high bound was 5,747 cases, giving a central estimate of 4,038 alcohol-attributed cases (Table 10.3). The total cost of child protection services, including out-of-home care, family support and intensive family support services in 2017/18 was $5,835 million (Steering Committee for the Review of Government Service Provision, 2019b). Applying the proportion of alcohol-attributed to total substantiated cases gave a central estimate of **$455.1 million.**

Table 10.3: Alcohol-attributed child protection cases and costs, from 51,774 substantiated cases

Variable	Central estimate	Low bound	High bound
Alcohol-attributable fraction		0.045[b]	0.111[c]
Alcohol-attributed cases	4038.4	2329.8	5746.9
Cost (as % of child protection cost)[a]	$455,139,438	$262,580,445	$647,698,431

Source: [a] Steering Committee for the Review of Government Service Provision (2019b)
Calculated from: [b] Laslett et al. (2010): [c] Jeffreys et al. (2009)

There are clear caveats that should be considered in interpreting these costs. The estimate of the number of cases potentially "caused" by alcohol use was based on two restricted samples. Even where "alcohol abuse" is noted in the child protection system, the implications for costs under the counterfactual scenario of 'no alcohol' are unclear – that is, would harm still occur to the child? The Steering Committee report (2019b) identified wide variations in the cost of services between jurisdictions, so if alcohol cases are not proportionately distributed across jurisdictions, the cost may be under- or over-estimated. Further, there were more than 245,000 notifications, the substantiated cases only represent a fraction of cases, and it is unclear if alcohol's involvement is equivalent across these cases. Indeed, there are data to indicate that the prevalence of likely alcohol use disorder[45] increases with the severity of the presentation (Laslett et al., 2012) e.g., notification; substantiation with no intervention; substantiation with intervention; and, substantiation with court order (Laslett et al., 2012). Nevertheless, a conservative approach was adopted and the study used AAF ranging from 0.045 to 0.111, even though there may be a greater representation of alcohol use disorders in more complex and costly cases. Finally, alcohol cases may not be evenly distributed across all the services that Child Protection provides. For example, alcohol-attributed cases may constitute different proportions of residential and non-residential care cases. These services have markedly different baseline costs, and thus could result in under- or over-estimations of alcohol-attributable costs (Steering Committee for the Review of Government Service Provision, 2019b).

10.3 Survivors of child abuse

In addition to the costs in the child protection system, there are further costs associated with child abuse, both in the short-term, and, potentially, extending across the lifetime (McCarthy et al., 2016). Survivors of child abuse are likely to incur: elevated levels of alcohol and other drug use disorders; other mental health conditions; poorer physical health; increased offending and rates of incarceration; homelessness; and reduced lifetime employment and productivity (Australian Institute of Family Studies, 2018; Taylor et al., 2008). In 2015, the impact on government budgets (Federal, State and Territory), was estimated at $6.8 billion from childhood abuse (sexual, physical and emotional) or $9.1 billion if the broader category of childhood trauma was considered (Kezelman et al., 2015).

In 2014, the tangible costs were estimated at $176,437 per case with an additional $328,757 from intangible costs due to reduced quality of life and premature mortality (McCarthy et al., 2016). Some of these tangible costs have been addressed elsewhere in this report. Table 10.4 shows the costs updated from 2014/15 to 2017/18 (Australian Bureau of Statistics, 2021b) and also indicates which costs have already been estimated in other sections of the report. The most financially significant tangible elements

[45] The cited publication uses the older term "alcohol abuse".

arising from child abuse were long-term health costs, reduced productivity and deadweight losses through taxation forgone, for example from lower levels of employment than people who have not suffered childhood abuse (McCarthy et al., 2016). However, the value of the lost quality of life was nearly double that of all tangible costs combined.

The estimated cost per person (excluding costs reported elsewhere) of $495,257, was multiplied by the estimated number of alcohol-attributed child protection cases (n=4,038, Table 10.3.) to obtain the central estimate of just over **$2.0 billion** (Table 10.7), with the low and high bound figures derived from the low and high estimate of the number of alcohol-attributed child protection cases.

Table 10.4: Per person costs of child abuse (2017/18)

Domain	Eligible for inclusion	Estimated cost
Tangible costs		
Health system – short term	No (Chapter 3/4)	38
Health system – long term	Yes	65,671
Special education	Yes	3,909
Criminal justice – short term	No (Chapter 6)	4,317
Criminal justice – long term	Yes	13,681
Housing & homelessness	Yes	919
Child protection system	No (Chapter 10.2)	16,286
Productivity losses	Yes	50,357
Deadweight losses	Yes	30,262
Total Tangible	**-**	**185,438**
Total Tangible excluding costs reported elsewhere	**Yes**	164,799
Intangible costs		
Lost quality of life	Yes	330,458
Premature mortality, direct result abuse / neglect	No (Chapter 3)	15,072
Total Intangible	-	**345,530**
Total Intangible excluding costs reported elsewhere	Yes	330,458
Total cost per person	-	530,968
Total cost per person excluding costs reported elsewhere	Yes	495,257

Sources: McCarthy (2016): (Australian Bureau of Statistics, 2021b): calculations by authors.
Note: although justice system costs related to child abuse are reported in Chapter 6, the estimates of the quality of life impact on victims of crime is based on a survey of Australian adults and therefore does not include the intangible costs of crime experienced by child victims. As such these costs are included in this section.
Totals may not sum due to rounding.

10.4 Domestic, family and intimate partner violence[46]

In 2017/18, there were 76 domestic homicides including 46 intimate partner homicides (33, 72% female) (Bricknell, 2020). In addition, about 2.2 million Australians have been the victim of intimate partner violence or abuse since the age of 15 (Australian Institute of Health and Welfare, 2019e). In 2015/16, it was estimated that violence against women and children cost Australia $22 billion, with 52 percent of that cost borne by victims and survivors (KPMG, 2016). The largest cost was that of premature mortality and from reduced quality of life, at $10.4 billion (KPMG, 2016). However, the report did not address the issue

[46] Intimate partner violence equates to violence against a romantic or spousal partner while family violence comprises violence against other family members (e.g., parent, child, sibling): domestic violence incorporates both (Miller et al., 2016).

of alcohol-related violence. The *Alcohol/Drug-Involved Family Violence in Australia* project used both survey data and police reports to capture the extent of alcohol-related domestic violence (Miller et al., 2016). The survey data revealed that alcohol was involved in about 30 percent of both intimate partner and family violence, while in police reported incidents, about 40 percent of intimate partner reports involved alcohol. Alcohol-involved reports to police of family violence (32.7%) had similar results to survey data on alcohol-involved family violence (29.4%) (Miller et al., 2016). It should be noted that given their timing, these estimates may overstate the role of alcohol in intimate partner and family violence as the relative role of methamphetamines as a causal factor in violent crime appears to have increased over the mid- to late-2010s, with alcohol accounting for a somewhat smaller proportion of violent crime.

The costs arising from the police, court system and correction system costs of alcohol-related domestic violence reported to police are captured in Chapter 6. The short-term tangible costs and impacts on quality of life for adult victims of alcohol-attributable violence (including estimates for costs to victims who did not report the crime to police) are also included in Chapter 6. It is also likely that the estimates of the impact of living with someone dependent on alcohol reported in Sections 8.3 and 8.4 are partly a result of crime victimisation. However, there are also other tangible costs that accrue from domestic violence, for example, lost wages including reduced life-time earnings with impacts on work productivity and taxation contributions (Chan and Cho, 2010): these have not been included in other sections of the report. Therefore, these estimates of alcohol-attributable harms serve to illustrate the magnitude of the economic consequences of alcohol-attributed domestic violence. It is also the case that it is difficult to ascertain whether all of the victims of intimate partner violence would have reported their assault(s) if they happened to be included in the sample frame for the Crime Victimisation survey and so Chapter 6 could underestimate the number of persons who were victims of an assault or sexual assault.

Deriving PAAF for violence is problematic using traditional methods. However, aggregate-level analyses offer a potential solution (Rossow and Bye, 2012). This involves using time series data to assess the relationship between overall alcohol consumption and rates of violent offences: using this approach the AF for homicides was greater than or equal to 0.5 in seven studies from 20 countries (Rossow and Bye, 2012). The authors also note that these aggregate-level PAAF tend to be higher than those obtained using traditional approaches. For example, in the US, it is estimated that the PAAF for offences against family and children is 0.125, forcible rape 0.283 and homicide 0.470 (The Lewin Group, 2013).

These values were used to form the low (0.125 – from the time series approach) and high (0.50 – from the traditional approach) bound estimates with the attributable fraction for violent crime estimated in Chapter 6 used as the central estimate. Most of the KPMG cost categories overlap with items included elsewhere in the report. The highest cost category, premature mortality (Section 3.9) and reduced quality of life, overlaps with the costs estimated elsewhere[47]. Similarly, justice system costs and direct economic impacts on victims of crime and imprisoned perpetrators are captured in Chapter 6, and health system costs from assault are captured in Chapter 3. Costs related to transfer payments and the cost of funerals are considered out-of-scope for the report (Section 3.7). Therefore, these categories from the KPMG report were excluded when calculating the total cost to avoid the potential for double counting and to ensure consistency. The values from 2015/16 (see Table 10.5) were then adjusted for inflation to 2017/18 values (Australian Bureau of Statistics, 2021b). The central estimate was **$0.88 billion** with a range of $0.66 billion to $2.48 billion.

[47] Reduced quality of life was estimated in Chapter 8, but not added to the total cost of alcohol use.

Table 10.5: Cost of domestic, familial and intimate partner violence 2015/16

KPMG categories	KPMG total ($ billion)	Central estimate (AF = 0.180) $ billion	Low bound (AF = 0.125) $ billion	High bound (AF = 0.50) $ billion
Premature mortality & lost QoL[a]	10.4	*1.9*	*1.3*	*5.2*
Health system[b]	1.4	*0.3*	0.2	0.7
Workplace costs[b]	1.9	*0.3*	0.2	1.0
Economic opportunities	4.4	0.8	0.6	2.2
Intergenerational costs	0.3	0.1	0.04	0.2
Justice, services & funerals[c]	1.7	*0.3*	*0.2*	*0.9*
Transfer payments[d]	1.6	*0.3*	*0.2*	*0.8*
Total	21.7	3.91	2.74	11.00
Eligible Total ($ 2015/16)	**4.7**	**0.85**	**0.64**	**2.40**

Source: KPMG (2016).

[a] Excluded from total as some costs will be included in premature mortality, Chapter 3.

[b] Costs to victims of crime from impact on the health system are captured in Chapters 3 and 6, lost economic output for victims of crime, and for imprisoned perpetrators are included in Chapter 6.

[c] Excluded from total as some justice costs will be included in Chapter 6 and funeral costs were excluded in Section 3.7.

[d] Transfer costs excluded as they are a transfer of resources within society not a social cost or are recorded elsewhere.

Totals may not sum due to rounding.

10.5 Child death reviews

The cost associated with premature mortality was addressed in Chapter 3. However, there are additional specific costs associated with some childhood deaths. The WA Ombudsman provides an estimate of the cost of investigating those deaths that fulfil the criteria from the applicable legislation e.g., where in the past two years the child's or a child relative's safety has been raised with the Department for Child Protection and Family Support, or the child or child relative is in their care. The Ombudsman can also review any other notified death. In 2017/18, the Ombudsman reviewed 23 deaths at a cost of $17,438 per review (Ombudsman Western Australia, 2018). Child deaths typically involve multiple social or environmental risk factors, with alcohol use identified as a factor in 45 percent of deaths (Ombudsman Western Australia, 2018). Importantly, the Ombudsman notes that the identification of a risk factor does not imply that it caused the death (Ombudsman Western Australia, 2018). Further, the alcohol use could be by the decedent, perpetrator or both. Therefore, as a proxy for the potential involvement of alcohol, the proportion of episodes where alcohol was the principal drug of concern (35%) in alcohol and other drug treatment episodes was used (Australian Institute of Health and Welfare, 2019c). Assuming that this figure translates to WA, then 35 percent of cases equates to eight deaths where alcohol use was potentially a contributory factor. The same approach was used in estimating the deaths in other jurisdictions (Table 10.6) and the cost-per-case for WA was used as the multiplier.

Table 10.6: Child protection deaths (child death reviews)

State or Territory	Source	Reviews
New South Wales	NSW Child Death Review Team (2018)	20
Queensland	Queensland Family and Child Commission (2018)	[a] 48
South Australia	Child Death and Serious Injury Review Committee (2019; 2017)	[b, c] 29
Tasmania	Council of Obstetric & Paediatric Mortality & Morbidity (2019, 2020)	[b, d] 4.5
Victoria	Commission for Children and Young People (2018)	[a] 26
Western Australia	Ombudsman Western Australia (2018)	[e] 23
Australian Capital Territory	ACT Children & Young People Death Review Committee (2018, 2019)	[b, d, f] 3.5
Northern Territory	NT Child Deaths Review & Prevention Committee (2018, 2019)	[b, d] 14.4
Total		**168.4**

[a] Known to the child protection system in the year prior to death.
[b] Known to the child protection system in the 3 years prior to death.
[c] South Australia reports deaths since 2005: difference between 2017/18 and 2018/19 reports.
[d] Mean of 2017 and 2018.
[e] Known to the child protection system in the 2 years prior to death.
[f] Australian Capital Territory reports in 5-year blocks.

There were 168 reviewable deaths reported for 2017/18. Extrapolating from the cost reported for WA and attributing 35 percent of these as alcohol-attributed (59 deaths) resulted in a total cost of **$1.0 million** in conducting child death reviews**.** With respect to child death reviews, there are differences among jurisdictions in the cases that are investigated, so the figures presented in Table 10.6 should not be used to compare jurisdictions. Further, the figures presented are the number of cases, not the rate, as they were not corrected to reflect the eligible populations.

10.6 Fetal alcohol spectrum disorder

A recent diagnostic guide divided fetal alcohol spectrum disorder (FASD) into two sub-categories: those cases with three sentinel facial features; and, those with less than three of these features with the diagnostic characteristics covering neurodevelopmental impairment in up to 10 domains (Bower et al., 2017). A population-based estimate conducted in Canada found that the prevalence of FASD was between 1.8 and 2.9 percent, depending on the criteria used (Popova et al., 2019). An earlier Canadian study, which used a less rigorously obtained prevalence estimate of 0.9 percent, calculated a cost of CAD1.8 billion in 2013 despite being unable to include some major domains (e.g., courts, policing, caregivers' lost productivity) (Popova et al., 2016). Pre-dating these findings, a Canadian analysis identified the cost of an individual case at CAD21,642 per year with a societal cost of CAD5.3 billion per year in 2007 (Stade et al., 2009). The current study intended to include the costs due to prenatal alcohol exposure that resulted in FASD in the analysis. However, the lack of Australian data on the prevalence of FASD meant that the costs of prenatal alcohol exposure outcomes were unable to be estimated with sufficient certainty to be included in the overall total.

An inquiry by the NT government noted that FASD was implicated in significant costs especially in relation to the justice system and juvenile justice, health and education (Legislative Assembly of the Northern Territory Select Committee on Action to Prevent Foetal Alcohol Spectrum Disorder, 2015). The extent of this over representation was evidenced by a WA study where among a sample of youth offenders it was found that 89 percent had severe neurodevelopmental impairment in at least one domain and that 36 percent fulfilled the full criteria for FASD (Bower et al., 2018). Similarly, the Australian Paediatric Surveillance Unit reported that 67 percent of FASD cases were known to community services, including child protection (Elliott et al., 2008). However, the NT report did not provide an estimate of the overall cost either to the NT or Australia. A submission to an Australian Senate inquiry, extrapolating from international data (USD22,810 per child per year (Greenmyer et al., 2018)), estimated that the cost of FASD to Australia would be more than $16 billion per year, if the prevalence of FASD was two percent (Reid et al., 2019). Applying the prevalence data from Canada (1.8% to 2.9%) gives a low and high band of $14.4 billion to $23.3 billion. Thus, the omission of FASD from the current analysis is likely to result in a significant under-estimation of the full cost of alcohol-caused harm in Australia.

10.7 Litter

Discarded glass (3.9%) and metal (3.4%) alcohol containers are both in the top 10 most frequently occurring items reported by *Clean-up Australia,* with broken glass (4.3%) also in the same list (Clean-up Australia, 2018). While there has been considerable public concern about discarded illicit drug paraphernalia, the extent of discarded alcohol containers, especially broken glass may constitute a greater environmental hazard (Forsyth and Davidson, 2010). However, quantifying the cost of removing this litter is challenging (Collins and Lapsley, 2008; Jones et al., 2010) and no direct estimate of these costs was located.

There have been estimates of the cost of removing smoking-related litter (cigarette butts and packaging) in Australia (Creating Preferred Futures, 2018), the United Kingdom (Nash and Featherstone, 2010), and, Wales (Grant, 2013): these informed the method used in the estimate of the social costs of tobacco (Whetton et al., 2019). In 2018, the estimated cost of removing litter in Australia was $1 billion[48] (Keep Queensland Beautiful, 2018) from which 10 percent was allocated to tobacco-related litter – with cigarette butts alone representing 8.3 percent of items collected. If the costs of removing alcohol-related litter reflect the proportion of litter collected (7.3%) then the cost would be $73.0 million. As broken glass will also include other sources of glass in addition to alcohol containers, this element was excluded, even though the costs of effectively removing broken glass are likely to greatly exceed those of removing unbroken containers.

Many jurisdictions are following the lead of SA (Government of South Australia, 1975), and introducing (e.g., WA) or planning to implement (e.g., Victoria (Engage Victoria, 2020)) container deposit schemes. However, these do not include all alcoholic beverage containers, with the WA legislation excluding wine and spirit bottles (Government of Western Australia, 2019). By the target year (2017/18), container deposit schemes were in place or being implemented in SA, NT, ACT, NSW and QLD (Australian Beverages, 2020). Subsequently, there has been some reduction in alcohol-related litter, with glass alcohol containers representing 3.9 percent of items collected and metal alcohol containers no longer listed in the top 10 items in 2019 (Clean-up Australia, 2019). Thus, it was anticipated that these costs will decline in the future.

10.8 Limitations

The definition of child abuse used by McCarthy and colleagues (2016), in addition to physical sexual and emotional abuse, included witnessing family violence. As such there is the potential that part of the lost quality of life noted in Table 10.4 would also appear in Table 10.5, in the costs attributed to domestic family and intimate partner violence. Therefore, these intangible costs were excluded in the latter table.

[48] The derivation of this figure is not clear.

10.9 Conclusions

This chapter examined a number of areas where there are clearly costs associated with alcohol consumption but where there are less well-established methods for attributing a portion of specific budgets to its use. Therefore, the same approaches were used as in the earlier reports on other drugs where there were common domains under consideration (Whetton et al., 2016; Whetton et al., 2019; Whetton et al., 2020a, b). For example, child death reviews were included in each of the illicit drug reports but not as a component with respect to tobacco consumption: these review costs were included here using the same approach as for illicit drugs.

The costs in this chapter are dominated by those attributed to: domestic violence ($3.1 billion); child protection ($0.5 billion); and, child abuse ($0.7 billion tangible and $1.3 billion intangible), with the latter two areas not explored in detail in the seminal work of Collins and Lapsley (2008). However, the role of alcohol and the need for child protection services is investigated in the 'harms to others' literature (Laslett et al., 2010; Laslett et al., 2013; Laslett et al., 2015). In 2010, it was estimated that alcohol-related child protection, including out-of-home care and intensive family support services, totalled $671.6 million[49] (Laslett et al., 2010). The current estimate also included family support services which were not listed as part of child protective services at the time of the earlier calculation (Steering Committee for the Review of Government Service Provision, 2019b). Given that a greater proportion of cases that are recurrent or have more severe outcomes involve alcohol than the cases at the lower end of the severity spectrum (Laslett et al., 2012; Laslett et al., 2013), there is the potential that alcohol-related child protection costs are higher than the central estimate.

Table 10.7: Summary of other alcohol-attributable costs 2017/18

Domaine	Central estimate	Low bound	High bound
Prevention			
Primary prevention	95,871,107	78,796,502	113,657,153
Secondary prevention	29,105,548	25,106,696	33,104,400
Child abuse and related costs			
Child protection & services	455,139,438	262,580,445	647,698,431
Child abuse (tangible)	665,561,810	383,970,361	947,136,779
Child abuse (intangible)	1,334,600,014	769,946,294	1,899,220,687
Child death reviews	1,027,796	[a]	[a]
Domestic violence			
Domestic, family & intimate partner violence	874,084,227	661,333,333	2,480,000,000
Other costs			
Fetal alcohol spectrum disorder [b]	16,000,000,000	14,400,000,000	23,300,000,000
Litter	73,000,000	[a]	[a]
Total	**3,528,389,940**	**2,255,761,427**	**6,194,845,246**

[a] Central estimate used in totals.

[b] Not included in total cost: Source Reid et al. (2019): prevalence estimate from Canada (Popova et al., 2019).

Totals may not sum due to rounding.

[49] The analysis used 31.3 percent as a multiplier across all cases based on NSW data on alcohol's role in notifications.

Laslett et al., (2010) included costs from domestic and other forms of family violence, for example health costs (emergency department, hospital), damage to property, opportunity costs of reporting episodes that are incurred, but did not include other police and criminal justice costs. Based on the analysis conducted by KPMG (2016), a more comprehensive analysis of the long-term costs has now been provided. Even so, the substantial costs in the criminal justice system were omitted to ensure that they did not double count episodes included in Chapter 6. The study is indebted to the extensive works on the long-term costs of child abuse and broader works on the costs of domestic, family and intimate partner violence (e.g. Kezelman et al., 2015; KPMG, 2016; McCarthy et al., 2016; Taylor et al., 2008) that allowed an estimation of a component due to alcohol, which appears not to have been included in earlier analyses of the social costs of alcohol use. Finally, although there are multiple sources of information that suggest alcohol is a causal factor in domestic and intimate partner violence, there is no definive evidence for the precise scale of the role, indeed it may not be possible ethically to produce such evidence (Leonard, 2005; Wilson et al., 2014). Despite this uncertainly, AFs have been derived for violence crimes, and hence these costs were considered as eligible for inclusion.

The potential for lifelong harms arising from child abuse or, in this case, the proportion of cases attributable to alcohol, especially the loss of quality of life, makes this the costliest element included here. Nevertheless, it is important to note that there were insufficient data to estimate the impact of FASD in Australia: drawing on international data, a figure of $16.0 billion per year has been suggested (Reid et al., 2019). Given the potential magnitude of this preventable condition, this should be a priority area for research, interventions and support programs. Establishing reliable and valid estimates of prevalence is a critical step.

Chapter 11 REVENUE IMPLICATIONS AND INCIDENCE OF COSTS

Steve Whetton & Suraya Abdul Halim

11.1 Taxation Revenue

In 2017/18, the Australian government received $6.514 billion in alcohol tax receipts from alcohol excise ($5.62 billion) and wine equalisation tax revenues ($0.894 billion) (Treasury, 2019a).

The Australian government further collected (for distribution to state and territory governments) an estimated $1.864 billion from the goods and services tax (GST) on sales of alcoholic beverages (GST calculated as 1/11th of total expenditure on alcoholic beverages (Australian Bureau of Statistics, 2019m))). Only a proportion of the additional GST revenue is a net addition to state and territory government taxation revenue because if alcohol were not available for purchase then it is likely that household consumption expenditure would be roughly at its current level but with a different distribution of expenditure (across all consumption spending). GST revenue will only be a net increase in revenue to the extent that the alternative set of goods and services that would be purchased in the absence of alcohol had a lower effective rate of GST than alcoholic beverages.[50] However, the exact level of additional revenue cannot be estimated without research identifying how spending by alcohol consumers would differ, if they were not purchasing alcoholic beverages.

11.2 Incidence of Costs

In addition to the total social costs arising from the use of alcohol, it is interesting to understand which groups in society are bearing the costs; this is known as the incidence of the costs. The costs can initially fall on one or more of three broad community groups:

- Households (whether consumers of the substance, or those harmed by another's consumption);
- Businesses; and,
- Government.

For instance, in relation to alcohol the incidence of the costs may fall on:

- People consuming alcohol (e.g., increased healthcare spending, reduced income from labour);
- Other individuals (e.g., costs to victims of alcohol attributable violence, individual property damage from alcohol attributable road crashes);
- Business (e.g., the cost of alcohol attributable absenteeism); and,
- Government (e.g., healthcare costs).

The tangible costs arising from a non-dependent person's own drinking, have been excluded from the social cost calculations in this report, in so far as it is possible. If all costs borne by drinkers as a result of their own alcohol consumption were included, the incidence on households would be significantly greater.

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[50] A number of types of household consumption expenditure are exempt from GST such as education, healthcare and fresh food. In 2017/18 total GST revenue was $64.1 billion (Australian Bureau of Statistics, 2021c), and total final consumption expenditure was $1,042.7 billion (Australian Bureau of Statistics, 2021a) for an average GST rate across all household consumption of 6.1 percent.

Public finance literature makes the distinction between the legal (or initial) incidence and the economic (or effective) incidence of a cost. Legal incidence refers to who faces a legal requirement to pay the cost, however it does not take into account whether that cost can be subsequently passed on to other stakeholders. Economic incidence refers to who ultimately bears the cost after all the economic responses to its initial imposition have been worked through. For example, where they have market power, businesses may be able to pass on the costs of property damage, or lower workforce productivity, to consumers in the form of higher prices or in the form of lower wages to their workers. Whereas businesses that do not have market power will need to absorb the cost through lower margins. In general, the economic incidence is preferred as it measures where the impacts of costs ultimately sit, rather than the group which is first affected by them.

Unfortunately, identifying the economic incidence of social costs arising from substance use is generally very difficult due to data limitations. Thus, social cost studies typically focus on the initial incidence of the costs, as these can be more clearly identified (Collins and Lapsley, 2008; Single et al., 2003). We followed that approach in this report. Collins and Lapsley, in their study into the social costs of substance use in 2004/05 found that 23.1 percent of the tangible social costs of alcohol fell on households, 50.4 percent on businesses and 26.4 percent on governments (Collins and Lapsley, 2008) [51].

Table 11.1 illustrates the distribution of the estimated ***tangible*** social costs of alcohol between different groups of stakeholders in the community. In this analysis, households are treated as one group, regardless of whether the cost burden is imposed on drinkers themselves or on others (although as noted previously, costs arising from non-dependent drinkers incurred on themselves, have been excluded where feasible).

The assessment of incidence relies on a number of assumptions about the proportions of various cost items that are borne by specific stakeholders, and thus, the calculation should be treated as an approximation. Intangible costs are not included in this assessment, as by definition, all of the intangible costs fall on households. Households bear just over one-third of the total tangible costs of alcohol (37%), with the next largest share borne by businesses (26%) and state and territory governments (24%).

The initial incidence of costs on government of $6.7 billion is broadly in line with the taxation revenue from alcohol-specific excises and the wine equalisation tax ($6.5 billion), however the distribution is not aligned with costs that the Australian Government receives from all excise revenue but reflects just over one-third of the costs to government. This does not mean that alcohol taxation revenue is set at its optimal level. Optimal 'Pigovian' tax rates aimed at addressing goods or services that result in externalities (costs imposed on people other than the consumer) should be set at a level that leads the consumer to bear the full cost of the externalities, i.e., the full social costs (Harmer et al., 2010).

[51] This allocation did not include the revenues from alcohol. Collins and Lapsley did include these revenues in their estimate of the impact of alcohol on the budget, which they estimated delivered a net increase to Australian Government surpluses of $1.8 billion in 2004/05 (e.g., the additional alcohol specific tax revenue was $1.8 billion greater than the costs borne by the Australian Government), with a net cost to state and territory governments of $0.4 billion (Collins and Lapsley, 2008).

Table 11.1: Incidence of the tangible social costs of alcohol use, 2017/18

	Australian Government	State / Territory / Local Govt	Businesses	Households	All of society
Tangible costs of premature mortality					
NPV of lost economic output (non-employee)	233.6	46.1	750.9	1,076.7	2,107.2
Recruitment/training costs to employers	0.0	0.0	17.5	0.0	17.5
NPV of value of lost unpaid household work	0.0	0.0	0.0	951.4	951.4
NPV of healthcare costs avoided	-192.4	-121.8	0.0	-153.0	-467.2
Medical costs					
Hospital separations	256.4	298.6	33.0	128.7	716.7
Ambulance costs	10.1	104.9	3.2	23.3	141.5
Emergency Department costs	100.6	117.2	13.0	50.5	281.3
Outpatient care costs	68.9	80.3	8.9	34.6	192.6
Primary healthcare - GP Visits	141.4	0.0	17.3	10.8	169.5
Primary healthcare - Referred Medical services	241.9	0.0	0.0	33.2	275.1
Drug treatment services	186.7	0.0	0.0	0.0	186.7
Community mental health	1.6	11.6	0.3	0.2	13.8
Medications	106.8	0.0	0.7	103.9	211.4
Dental services	6.9	3.7	0.2	34.9	45.7
High-level residential care	139.8	3.2	0.0	0.0	143.0
Other aged care services	65.8	1.5	0.0	0.0	67.3
Informal carers	0.0	0.0	0.0	333.0	333.0
Workplace costs					
Injury	2.7	50.8	347.5	0.0	401.0
Absenteeism	19.0	361.6	2,473.6	736.9	3,591.1
Other costs					
Crime - Police, courts, prisons	139.1	2,243.4	191.3	485.5	3,059.4
Road traffic accidents - Injuries and properties	422.5	422.5	501.5	1,049.5	2,395.9
Expenditure on alcohol by dependent drinkers	0.0	0.0	0.0	1,137.3	1,137.3
Intimate partner violence and child abuse/neglect nec	230.4	652.9	443.1	669.4	1,995.8
Other tangible costs	40.7	157.3	0.0	0.0	198.0
Total Tangible Costs	**2,222.4**	**4,435.6**	**4,801.8**	**6,706.9**	**18,166.7**
	12.2%	**24.4%**	**26.4%**	**36.9%**	**100.0%**

Source: Collins and Lapsley (2008): calculations by authors.
NEC = not elsewhere classified: NPV = net present value
Note: totals may differ slightly from those published elsewhere due to rounding.

The key assumptions about costs that are split between stakeholder groups are:

- Lost economic output was split between stakeholders based on data from the national accounts on the distribution of the income measure of GDP (and between levels of government based on data from Government Financial Statistics (Australian Bureau of Statistics, 2016, 2019g, m, 2021a);
- Expenditures on healthcare (and savings from healthcare costs avoided) were split between stakeholder groups based on the data on funding sources for healthcare (Australian Institute of Health and Welfare, 2017c);

- Expenditure on high-level residential care, and on other aged care services was split between levels of government based on the expenditure shares from the Review of Government Services Provision (Steering Committee for the Review of Government Service Provision, 2019b);
- Absenteeism was split between households and employers based on data on the proportion of employees not entitled to paid sick leave (allocated to households), with employers allocated the cost of employees entitled to sick leave, and of employees who were owner/managers of the business (Australian Bureau of Statistics, 2018e). The Australian Government and State / Territory / Local Government were allocated a share of employer costs based on their share of employees (Australian Bureau of Statistics, 2021d) with the remainder of employer costs allocated to business; and,
- All costs of litter removal were allocated to state/territory governments.

11.3 Limitations

The most significant limitation in these calculations is that they can only capture initial incidence, and not final incidence of the costs. That is, because we cannot accurately model the specific dynamics in these costs as they playout we cannot identify, for example, whether the cost of covering alcohol-attributable absence is borne by the employer through reduced margins, or whether the employer is able to pass it through to consumers through higher prices, or to employees through reduced wages or benefits. If the first case is correct, then the final incidence remains with business, if the business can actually pass on the costs to its customers or employees then the final incidence is with households.

There are also uncertainties around whether the alcohol specific costs have the same distribution as broader costs in each category. For example, the incidence of alcohol attributable absenteeism has been divided between employers and households by the proportion of employees who are eligible for sick pay. If employees with access to sick pay were more likely to drink at a level risking a hangover, or were more likely to take a day off when hungover, compared to those employees who would not be paid when off work, then a greater proportion of the incidence would fall on employers and a smaller share on households.

Chapter 12 DISCUSSION

Tanya Chikritzhs, Robert J. Tait, Steve Whetton, Aqif Mukhtar & Steve Allsop

12.1 Overall findings

This report is the fifth in a series of reports addressing the social costs of licit and illicit drugs (Whetton et al., 2016; Whetton et al., 2019; Whetton et al., 2020a, b) and is the first comprehensive assessment of social costs due to alcohol use in Australia since Collins and Lapsley's (2008) analysis of the costs of 'alcohol misuse' in 2004/05. The overall total cost attributed to alcohol in the current report was **$66.8** billion (Table 12.1). In common with a recent report on tobacco-attributable costs (Whetton et al., 2019), a conservative approach was taken. Some significant harms were identified where an estimate was calculated but not included in the overall total due to limitations of the available data. This can be considered in the context of a potential additional (but excluded) cost of $42.7 billion due to: lost quality of life from being the partner or child of a person with alcohol dependence ($21.8 billion); fetal alcohol spectrum disorder ($16.0 billion); and, alcohol-attributed presenteeism ($4.9 billion).

A recent systematic review of costs from preventable disease risk factors in Australia reported the tangible costs of alcohol in 2016/17 to be approximately $16.2 billion (Crosland et al., 2019). These costs covered, productivity, traffic crashes, criminal justice, and the health system, with the first two domains accounting for 42.1 and 25.5 percent, respectively. The current study reported a higher overall cost with workplace costs the largest tangible cost domain, but only representing 22 percent of the total and nnoting that some costs such as workplace deaths and hospital treated work-related injuries were included in other domains.

12.2 Changes from 2004/05 to 2017/18

Over the period 2004/05 to 2017/18: the Australian population increased from 20.1 million to 24.8 million (Australian Bureau of Statistics, 2019h); although the Australian population aged between 2004/5 and 2017/18, median age increased by less than a year (Australian Bureau of Statistics, 2019h); per capita alcohol consumption in Australia declined from 10.3 litres to 9.5 litres (See Figure 1.1) (Australian Bureau of Statistics, 2019f); the prevalence of 'reported at-risk' drinking[52], based on 2020 guidelines, fell from 40 percent to 33 percent (Australian Institute of Health and Welfare, 2021b); and, more recent birth cohorts appear to have lower prevalence of drinking and consume less alcohol than past cohorts of the last few decades (Livingston et al., 2016).

In addition to these social and demographic trends, there have been some notable changes in the list of conditions widely accepted as either partially or wholly attributable to alcohol since 2004/05 (Collins and Lapsley, 2008)[53]. These changes had a considerable impact on the overall magnitude of alcohol-attributable costs. For instance, colorectal cancer, pancreatic cancer and stomach cancer brought more than 700 deaths to the new estimate (which were absent from the 2004/5 estimate), while lower-respiratory infections added a further 230 cases. Overall, new conditions added 1,019 deaths. However, there were some conditions included by Collins and Lapsley (2008) such as heart failure, cholelithiasis,

[52] The current guidelines incorporate both short- and long-term elements into a single health risk (Australian Institute of Health and Welfare, 2021b).

[53] Collins and Lapsley (2008) also noted changes in PAAFs since earlier reports, again reflecting the evolving knowledge base in this field.

and gastro-oesophageal haemorrhage that were no longer considered eligible (i.e., due to changes in evidence or coding procedures) for inclusion, based on the study's key source (Sherk et al., 2017a).

Also, interpretation of epidemiological evidence with respect to cardio-protection has been challenged (e.g. Chikritzhs et al., 2015; Sherk et al., 2019) and evidence for alcohol's impact on cancer risk has been extended (National Health and Medical Research Council, 2020; University of Sydney, 2018). Due to the relatively high prevalence of ischemic heart disease (IHD) in Australia (i.e. 11.6 percent of all deaths, Australian Bureau of Statistics, 2019k), change in underlying assumptions about direction or magnitude of IHD risk from alcohol use can substantially alter burden of disease estimates overall. A recent analysis of deaths from IHD (Sherk et al., 2019) under different risk assumptions, reported a 57 percent difference in the number of deaths in Australia between scenarios.

12.3 Health impacts

Across the health sector (Chapters 3 and 4), alcohol-attributable conditions were estimated to cost $5.4 billion in tangible costs with a further $25.9 billion from intangible costs of premature death. After taking into account 1,491 'averted' deaths, the central net estimate of alcohol-attributable deaths was 5,219. The range was 4,278 to 7,396 deaths depending on underlying assumptions about protective effects. The low range value used estimates from Roerecke and Rehm (2010, 2011, 2012) for cardiovascular diseases and, for women only, the relative risk from Knott et al. (2015) for type 2 diabetes mellitus and included 2,432 averted deaths. The high estimate assumed no protective effect for any condition. By comparison, in 2004/05 it was estimated that alcohol use caused 3,494 deaths and averted 2,437, leaving 1,057 net deaths (Collins and Lapsley, 2008).

As for deaths, inclusion of additional alcohol-attributable conditions made a substantial impact on the number and cost of hospital separations. For example, colorectal cancer and lower respiratory tract infections were the fourth and fifth leading cost diagnoses attributed to alcohol (after falls, alcohol dependence and alcoholic liver cirrhosis).

With respect to alcohol-attributable hospital separations, estimated using the same protective effect scenarios applied to deaths, there were 26,000 separations averted, resulting in a central estimate of 127,000 separations, with a range of 106,000 to 151,000. The central cost estimate for alcohol-attributable hospital separations in 2017/18 was $0.7 billion. Notably, direct comparison between 2017/18 and 2004/05 estimates for hospital inpatient cost is not advisable since Collins and Lapsley (2008) applied hospital bed-days rather than separations as their metric[54]. It is worthwhile, however, re-iterating the cautions required when interpreting 'averted' deaths or hospital events noted by Collins and Lapsley (2008). That is, the impact of policy should be measured against the actual (gross) number rather than net values because harms occur to people, while 'averted' events are theoretical in the sense that no specific person benefits from these averted deaths or separations.

[54] In 2017/18 terms (Australian Bureau of Statistics, 2021b), the gross hospital cost estimated by Collins and Lapsley (2008) was $952.7 million.

Table 12.1: Tangible and Intangible costs of alcohol, 2017/18

Cost areas	Central estimate ($)	Low bound ($)	High bound ($)
Tangible costs			
Tangible net costs of premature mortality (Chapter 3)			
NPV of lost economic output (non-employee)	2,107,217,652	1,991,214,186	2,207,940,308
Recruitment/training costs to employers	17,454,113	15,946,659	19,399,332
NPV of value of lost unpaid household work	951,431,406	902,853,566	1,018,809,876
NPV of healthcare costs avoided	-467,152,809	-412,700,962	-569,736,108
Total tangible costs of premature mortality	**2,608,950,363**	**2,497,313,449**	**2,676,413,408**
Healthcare (Chapters 3 and 4)			
Hospital separations (Chapter 3)	716,743,492	489,846,757	972,514,246
Other healthcare costs (Chapter 4)	1,517,684,195	1,107,711,842	2,179,179,247
Aged care (Chapter 4)	210,278,579		
Informal carers (Chapter 4)	332,987,622	317,575,515	414,337,906
Total healthcare costs	**2,777,693,887**	**2,125,412,693**	**3,776,309,978**
Other workplace costs (Chapter 5)			
Injury	400,952,661	176,220,402	625,684,920
Absenteeism	3,591,079,710	1,231,106,851	5,951,052,568
Total workplace costs	**3,992,032,371**	**1,407,327,253**	**6,576,737,488**
Crime (Chapter 6)			
Police	1,034,202,561	747,374,010	1,768,433,732
Courts	239,146,825	180,722,539	315,932,701
Prisons	1,215,083,862	977,205,379	1,651,549,983
Victims of crime	570,923,263	463,930,258	674,284,789
Total crime costs	**3,059,356,511**	**2,369,232,186**	**4,410,201,205**
Road traffic accidents (Chapter 7)			
Impairment	1,679,931,785	835,006,661	2,524,856,909
Property & other costs	715,958,915		
Total road traffic accidents costs	**2,395,890,700**	**1,550,965,576**	**3,240,815,824**
Other tangible costs (Chapters 9 and 10)			
Expenditure on alcohol by dependent drinkers (Chapter 9)	1,137,305,661	[a]	[a]
Other domestic, family & IPV (Chapter 10)	874,084,227	661,333,333	2,480,000,000
Other tangible costs (Chapter 10)	1,319,705,699	824,481,800	1,815,624,559
Total other tangible costs	**3,331,095,587**	**2,623,120,794**	**5,432,930,220**
TOTAL TANGIBLE COSTS	**18,165,019,419**	**12,573,371,951**	**26,113,408,123**
Intangible costs			
VoSL due to premature mortality (Chapter 3)	25,891,775,743	17,046,019,369	108,705,701,428
DALY victims of crime (Chapter 6)	694,508,216	573,180,387	836,023,182
DALY lost due to alcohol dependence (Chapter 9)	20,730,614,727	2,349,262,278	77,047,670,533
DALY lost due to child abuse (Chapter 10)	1,334,600,014	769,946,294	1,899,220,687
TOTAL INTANGIBLE COSTS	**48,651,498,700**	**20,738,408,328**	**188,488,615,830**
TOTAL COSTS	**66,816,518,119**	**33,311,780,279**	**214,602,023,953**

[a] Central estimate used in calculating totals: Totals may not sum due to rounding.
DALYs = Disability adjusted life years: IPV = interpersonal violence: VoSL = Value of a statistical life.
Totals may not sum due to rounding

Impacts of alcohol use were apparent across the health sector. The role of alcohol-attributable harms in ED has received particular attention, with about 1 in 10 presentations due to alcohol (Egerton-Warburton et al., 2018). Although the highest prevalence was in young- to middle-aged adults (18-45 years), earlier Australian data reported more than six percent of adolescent ED presentations involved alcohol use (Hulse et al., 2001). The estimated cost of ED presentations did not include a component for disruptions in the care of other patients or for physical violence or verbal aggression against staff (Egerton-Warburton et al., 2016; Gunasekara et al., 2011).

One of the assumptions underpinning the estimation of alcohol-attributable-harm is that harm is related to the quantity and pattern of alcohol (ethanol) consumed rather than the type of alcohol consumed (aside from methanol or other toxic exposures) (Rehm et al., 2017; World Health Organization, 2018). However, there is increased interest in harms from more concentrated forms of alcohol (e.g., spirits), with the potential that their use results in more rapid intoxication and higher blood alcohol concentration with increased risk of alcohol poisoning and injuries, although this does not appear generalisable to all harms (Rehm and Hasan, 2020). If this is confirmed, any change to PAAF and hence costs are likely to be minimal compared to the overall total, but nonetheless serves to illustrate the evolving understanding of harms attributable to alcohol.

This report has largely focused on overall costs attributed to alcohol. However, there are specific concerns about the effects of alcohol on older consumers. The volume of alcohol consumed peaks across middle age, before declining in older adults (Livingston et al., 2016). In addition, the use of prescription and over-the-counter medication tends to increase with age, many of which have contra-indication for use with alcohol. Furthermore, there are potential age-related changes in body composition and metabolism, which may increase the level of intoxication which has implications for increased mortality from falls, road traffic crashes and suicide (Choi et al., 2017). Addressing alcohol use, even at comparatively low levels, in an aging population is likely to require novel interventions, which should be rigorously evaluated (Armstrong-Moore et al., 2018; Kelly et al., 2018).

12.4 Workplace

As detailed in Chapter 5, economic impacts of alcohol in the workplace are considerable, estimated at $3.6 billion for absenteeism and $0.4 billion for injury. Lack of reliable data, or an agreed method for measuring or monetarising presenteeism, prevented inclusion of costs due to alcohol-attributable presenteeism (reduced levels of on-the-job performance due to alcohol or alcohol-attributable hangovers and illness) (Anderson, 2012; Thørrisen et al., 2019). Therefore, although a presenteeism value ($4.9 billion) was calculated, it was not included in the overall total. However, a recent New Zealand study (Sullivan et al., 2019), and an earlier Australian study (Medibank, 2011), estimated presenteeism costs at more than four-times those of alcohol-attributable absenteeism: thus the exclusion of presenteeism may result in a substantial underestimation of alcohol's impact in the workplace. Recent data from Europe have suggested that there may be further potential costs of alcohol use in work settings where there is alcohol consumption with co-workers, with about 17 percent of workers reporting verbal abuse, physical abuse, unwanted sexual attention or social exclusion at least once in the previous year (Moan and Halkjelsvik, 2020).

12.5 Crime

In 2010, it was estimated that alcohol's impost on the criminal justice system was nearly $3.0 billion (Manning et al., 2013) or approximately $3.4 billion after adjustment to 2017/18 costs (Australian Bureau of Statistics, 2021b). Notably, eight percent of the total cost of alcohol to the criminal justice system was for child protection and support services, which were itemised separately in the current report (see Chapter 10). In the current study, the 2017/18 estimate was $3.8 billion. The main cost domain was the prison system at $1.2 billion, although overall costs to victims of crime, including the intangible costs from reduced quality of life for victims, was of a similar magnitude. In estimating the costs of crime, the study relied on the DUMA survey, which is conducted with a sample of those held in police custody (Voce and Sullivan, 2019). While this has limitations, it remains the best-established approach.

12.6 Road traffic crashes

A review of road trauma fatalities in Victoria, Australia, found that alcohol was the most frequently detected drug, at more than 21 percent (Schumann et al., 2021). It is relevant to note that alcohol use aftereffects (e.g., hangover) may contribute to driving impairment with no detectable levels of alcohol in the individual (Gunn et al., 2018). The incident rate ratio with any alcohol detected declined by nine percent per year between 2006 and 2016. Given that the detected prevalence of some drug-related road fatalities (e.g., methylamphetamine) increased by seven percent per year, this reduction in alcohol-detected cases is unlikely to be due to improved vehicle safety and may indicate the impact of alcohol policies or changing patterns of alcohol consumption and/or driving whilst intoxicated (e.g., amongst younger drivers). Nevertheless, the cost of alcohol-attributable road traffic crashes was $2.4 billion in 2017/18: a figure that does not include the costs of premature mortality or hospital separations, which were accounted for elsewhere. Further, the cost did not include crashes where both alcohol and other drugs were detected (see Chapter 7).

12.7 Alcohol's harm to others

Alcohol's harm to others has been the focus of a separate stream of research (Callinan et al., 2016; Laslett et al., 2011; Nayak et al., 2019). The current study did not attempt to replicate these methods, in particularly those of Laslett et al. (2010; 2011), which combined survey methods with social cost approaches to quantify harms ranging from inconvenience through to deaths resulting from the drinking of another person. Harms were primarily identified via the concept of DALYs to account for the reduced quality of life from living with a person who was dependent on alcohol: the same approach as prior analyses in this series. On this basis, considering just partners and (financially) dependent children, alcohol-attributable reduced quality of life was valued at $21.8 billion. Nevertheless, due to the novelty of this approach, this cost was not included in the overall harms caused by alcohol. Other harms and costs due to the use of alcohol by other people, for example road traffic crashes, child protection services and both tangible and intangible costs for victims of alcohol-attributable crime, have been included as methods underpinning their calculation are more well established. Separate quantification of alcohol's harms to others still appears to present a challenge, especially in domains where alcohol use can be a contributory factor in both receipt and perpetration of harms (Curtis et al., 2019; Wilsnack, 2012). Further, use of DALYs to estimate harms to co-resident partners and children in the current report would, for instance, clearly overlap with lost quality of life estimates included in the victims of crime estimation, although the extent of that overlap is unclear.

12.8 Comparison with tobacco

In selecting methods for estimation of alcohol-attributable costs, one consideration was application of methods comparable to those used to estimate harms and costs of tobacco use. Above all, however, it was crucial that methods were applied that best matched the available data. Table 12.2 provides a summary of broad similarities and differences in methods used in this report and the previous tobacco analysis (Whetton et al., 2019). Notably, there were some areas (e.g., crime, traffic crashes, child maltreatment) where costs relating to tobacco were not estimated as there was no, or insufficient, evidence of a causal link between tobacco use and the harm. The social and economic cost of tobacco was estimated at $142 billion (adjusted for inflation to 2017/18) (Australian Bureau of Statistics, 2021b; Whetton et al., 2019).

Table 12.3 summarises the main cost domains for alcohol and tobacco, with the costs for tobacco increased by CPI from 2015/16 to 2017/18 values (Australian Bureau of Statistics, 2021b). With more than 20,000 deaths attributed to tobacco use, compared to just over 5,200 net alcohol attributable deaths, the *intangible* costs of premature mortality far exceed those from alcohol. However, *tangible* costs of premature mortality were higher for alcohol than for tobacco. This is largely due to the younger average age of alcohol attributable mortality leading to more years of working life lost per premature death and a lower present value of avoided healthcare costs (as those avoided costs were much further in the future than was the case for tobacco).

Table 12.2: Comparison of methods used in estimating alcohol and tobacco costs

Domain	Alcohol	Tobacco	Comments on difference
Tangible			
Mortality	†	†	AFs for alcohol calculated using a dose-response relationship using the INTERMAHP tool
Avoided health care cost	✓	✓	
Hospital separations	†	†	AFs for alcohol calculated using a dose-response relationship using the INTERMAHP tool
Primary care	†	†	See Appendix 4.4 for details
Informal carers	✓	✓	
Crime	✓	n/a	
Workplace absenteeism	✓	✓	
Workplace presenteeism	x	✓	Unable to estimate presenteeism for alcohol
Workplace injuries	✓	✓	
Road traffic crashes	✓	x	Unable to estimate RTC for tobacco
Child maltreatment	✓	n/a	
Prevention	✓	x	Tobacco costs excluded by convention
Drug purchase	✓	✓	
Intangible			
Premature mortality	✓	✓	
Ill-health	†	†	Alcohol costed directly from GBD DALYs estimate for dependence: Tobacco costed for specific diseases, estimated from GBD
Harms from living with a dependent person	✓	n/a	

Sources: Tobacco data (Whetton et al., 2019): alcohol current report.
✓ calculated via similar methods: † calculated via different methods: x not able to calculate: n/a not applicable.
DALYs = disability adjusted life years: GBD = Global Burden of Disease.

For dependent users, the cost of tobacco purchases was more than five times that of alcohol purchases, reflecting the significantly higher share of tobacco users assessed as dependent. The definition of tobacco dependence was 'daily' smokers (which equated to about 2.4 million people in 2015/16). These people consumed an estimated 98 percent of all tobacco sold (Whetton et al., 2019). By comparison, some 482,000 alcohol dependent users were responsible for about 14 percent of the spending on alcohol in Australia. It is perhaps not surprising that the larger number of people with tobacco compared to alcohol dependence resulted in higher purchase costs for tobacco. Given the high prevalence of comorbid alcohol and tobacco dependence, many will incur both these financial costs (Weinberger et al., 2019), plus co-use has multiplicative impacts on health risks compared with either substance alone (Pelucchi et al., 2006). Overall, the costs due to tobacco use ($142 billion) are more than twice those from alcohol use ($66.8 billion)[55], with this difference largely accounted for by the intangible costs of premature mortality.

Table 12.3: Comparison of alcohol- versus tobacco-attributable costs, 2017/18

Domain	Tobacco costs[a] ($)	Alcohol costs ($)	Difference (tobacco - alcohol) $	Multiple (tobacco v alcohol)
Tangible costs				
Premature mortality (lost economic output)[b]	3,512,772,108	2,107,217,652	1,405,554,456	1.7
Premature mortality (other tangible)	675,638,413	968,885,520	-293,247,107	0.7
Premature mortality (lifetime healthcare costs avoided)	-2,359,456,726	-467,152,809	-1,892,303,917	5.1
Hospital inpatient care (net)	1,576,612,379	716,743,492	859,868,887	2.2
Selected other health care[c]	5,459,693,708	1,884,517,367	3,575,176,341	2.9
Other workplace costs	5,168,338,286	3,992,032,371	1,176,305,915	1.3
Criminal justice	n/a	3,013,915,451	n/a	
Road traffic crashes	n/a	2,395,890,700	n/a	
Alcohol/tobacco purchase	5,750,773,958	1,137,305,661	4,613,468,297	5.1
Other domestic, family & IPV	n/a	874,084,227	n/a	
Miscellaneous costs	159,746,368	1,319,705,699	-1,159,959,331	0.1
Total tangible costs[c]	**19,944,118,493**	**17,943,145,330**	**2,000,973,163**	1.1
Intangible costs				
Premature mortality	95,489,259,985	25,891,775,743	69,597,484,242	3.7
Victim of crime	n/a	659,478,250	n/a	
Morbidity (dependence)	26,500,625,521	20,730,614,727	5,770,010,794	1.3
Child abuse	n/a	1,334,600,014	n/a	
Total (intangible)	**121,989,885,506**	**48,616,468,734**	**73,373,416,772**	2.5
TOTAL COST	**141,934,003,999**	**66,559,614,064**	**75,374,389,936**	**2.1**

[a] Sources: Tobacco-related costs from Whetton et al. (2019): converted from 2015/16 to 2017/18 values (Australian Bureau of Statistics, 2021b).
[b] The higher number for deaths due to tobacco, translates to a lower cost for tobacco, as this category includes 'savings' in health costs avoided due to premature death.
[c] For the purpose of this comparison table, the alcohol costs estimated for allied health services, pathology, imaging and dental care were excluded, as the relevant data were not available when the tobacco analysis was conducted.
Totals may not sum due to rounding.

[55] $59.2 billion if just the categories where values are available for both alcohol and tobacco (e.g. excluding criminal justice, road traffic crashes, victims of crime, child abuse).

12.9 Future research

Fundamental to social cost evaluations is the issue of identifying and apportioning costs. While this has been noted throughout the report, there were three areas identified for particular consideration. First, in relation to alcohol-attributed harms to people resident with an alcohol dependent person. Although likely to be among those most severely affected, co-residents represent only a subset of the much larger group affected by alcohol drinkers. Previous assessments have included the broader community, not just co-residents (e.g. Laslett et al., 2010). In addition, harm can also accrue to people living with someone who is not dependent but who, when they drink, does so to significant levels of intoxication. Research evidence regarding alcohol's harm to others, especially in terms of lost quality of life, is limited and increasingly dated. According to Mortimer and Segal (2006) for instance, the most recent study included in their review was published in 2001 and another study by Salize (2013) was based on data from only 48 families collected between 2005 and 2009. Addressing this knowledge gap is readily achievable with adequate funding to ensure representativeness, and may bolster justification for improved resourcing of effective support services.

Second, the project had planned to include FASD in the cost analyses, however, the absence of reliable prevalence data precluded this. An analysis of data from the USA and Canada estimated that an intervention targeting high-risk pregnancies could result in savings that were 62 times the cost of the program, in terms of the discounted lifetime costs of a person with FASD (Greenmyer et al., 2020). This is a key point – as FASD has impacts over the entire life of the individual. Savings are likely to accrue (both to carers and the affected person) in relation to the health system, (special) education, criminal justice system and workplace productivity (Greenmyer et al., 2020). Given that one estimate of the costs of FASD in Australia is approximately $16 billion per year (Reid et al., 2019), there are strong financial as well as ethical incentives to address this problem. The Australian Government Department of Health has recognised the importance of FASD, with the 2018-2028 Strategic Action Plan setting out national priorities in the area, including funding of $10.5 million for the four years 2016/17 to 2019/20 (Department of Health, 2018a); $7.2 million for a population level program (Department of Health, 2018b); $25 million for FASD diagnosis and support services (Frydenberg and Cormann, 2019); and, $27.4 million for a National Awareness Campaign for Pregnancy and Breastfeeding Women (personal communication, Delaine 2021). A number of states and territories also have their own FASD plans and initiatives.

While these initiatives provide targeted support and programs for those impacted by FASD and attempt to prevent new cases, the extent of the problem in terms of epidemiology is unclear. The *Strategic Plan* includes objectives to develop new screening tools and improve the coverage and quality of the FASD Australian Register (Department of Health, 2018a). Australian data on the prevalence of FASD would be a key starting point to identify reliable and valid costs of FASD. In addition, there are growing concerns about infant exposure to alcohol via breastmilk (Anderson, 2018).

Third, some critical sources of information are now dated. Most notably, the most recent evaluation conducted by the ABS on the economic contribution of unpaid labour was undertaken in 1997, which produced an estimate ranging from $238 billion to $339 billion depending on the approach used (Australian Bureau of Statistics, 1997). Its preferred estimate was $261 billion (or about $426 billion in 2016 (Australian Bureau of Statistics, 2021b)). A more recent estimate for 2016 placed a value of $556 billion on unpaid labour (PwC, 2017). Given changes in the nature of work and workforce participation since the end of the twentieth century, a revised ABS figure is urgently required. Although not as dated as the unpaid labour estimate, a need for more contemporary evidence was also identified for the following areas: the severity of road crash injuries (Bureau of Infrastructure Transport and Regional Economics, 2009); school curricula (Auditor General Victoria, 2003); and, juvenile offenders (Prichard and Payne, 2005).

One of the reasons for conducting this study was that patterns of alcohol use appear to be changing in Australia, with more recent birth cohorts having lower levels of consumption than earlier cohorts, although this difference narrows with age (Callinan et al., 2020) and, as noted above, changes in research which informs us about alcohol-attributable cost. Declining youth consumption has been reported in Australia (Livingston and Dietze, 2016) and internationally (Looze et al., 2015). There have also been declines in alcohol-related deaths in some age-cohorts. For example, in the UK, between 2001 and 2019, the alcohol-specific death rate fell for those aged 30-49 years, including a decline of 22 percent for people aged 30-34 years (Holmes and Angus, 2021; Office for National Statistics, 2021)[56]. Further, modelling of European data suggests that alcohol-attributable mortality will decline in the long-term (through to 2060) (Janssen et al., 2020). Therefore, close monitoring of the rate of alcohol-attributed injuries and deaths in Australia is required to determine if declines in alcohol use by young people generalise to the youth population, rather than being specific to those people who respond to surveys. If these findings are representative of the population, it would be expected that reductions in alcohol-attributable injuries would be detected. However, as most alcohol-attributable deaths occur in those over age 35 years (see Tables 3.1 and 3.2), changes on this measure may take some time to materialise.

On the other hand, it has already been noted that ageing cohorts in a number of countries, including Australia, has resulted in an increasing population over 65 who are taking quite different and potentially risky drinking histories into their later years. We have a dearth of information about impacts and effective interventions for specific age-groups (Armstrong-Moore et al., 2018; Kelly et al., 2018; Wilkinson et al., 2016). We are also just beginning to estimate if there are any health implications from the consumption of higher strength alcoholic beverages such as spirits (Rehm et al., 2017; World Health Organization, 2018).

12.10 Conclusions

Alcohol has played a major health, social and economic role in Australia's more recent history and forms part of its cultural mythology and stereotypes (Midford, 2005). However, that role is associated with considerable costs to individuals and the economy more broadly. The *National Alcohol Strategy (*the *Strategy) 2019-2028* (Department of Health, 2019) sets out four priority areas to address alcohol-related harms: improving community safety and amenity; managing availability, price and promotion; supporting individuals to obtain help, and systems to respond; and, promoting healthier communities. Each priority area has associated policy options with responsibility for implementation at local, state, territory and national government levels on an issue-by-issue basis. Importantly, the *Strategy* emphasises the critical role of evidence-based interventions, with monitoring implementation and progress the responsibility, at the time of writing , allocated to the *National Drug Strategy Committee* (Department of Health, 2019).

The *Strategy* identified relevant indicators in each area. Many of these indicators (e.g., alcohol-related ED presentations, hospital separations, deaths, crime) directly underpin the current estimation of costs, while others, like the prevalence of people exceeding low-risk consumption guidelines, are indicators of

[56] This should be tempered with the findings of an increase of up to 49 percent in some older age groups (Holmes and Angus, 2021; Office for National Statistics, 2021).

current and future harms and costs. Therefore, this analysis of social and economic costs provides a baseline measure of critical aspects of the *Strategy*, and one that can be replicated throughout the life of the current *Strategy,* even though it does not specifically quantify costs from all indicators included in the *Strategy* (e.g., age of first alcohol use).

The total cost of alcohol-attributable harm, as estimated in this study, was $66.8 billion in 2017/18 (tangible $18.2 billion: intangible $48.6 billion**). In addition, there was a cost of some $42.7 billion** to areas where costs were clearly incurred but where absence of sufficiently detailed and representative data precluded inclusion in the overall total. Moreover, there were other areas where costs were also clearly incurred but for which reliable estimates of social and economic impacts could not be provided at this time. Hence, the total central estimate provided in this report is likely to be a conservative representation of the true cost of alcohol-attributable harm to contemporary Australian society.

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APPENDIX CHAPTER 1: INTRODUCTION

Appendix 1.1: Rapid Review of Alcohol Social Cost Studies Between 2015-2020

Seraina Agramunt, Tania Dey, Robert J. Tait, Steve Whetton, William Gilmore, Alice McEntee, Aqif Mukhtar, Ann Roche, Steve Allsop & Tanya Chikritzhs

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Executive summary

Background: Alcohol use is the seventh leading risk factor for global disease burden and in 2016 it accounted for 2.8 million deaths worldwide. Among those aged 15-49 years, alcohol was the leading cause of death and disability. In addition to quantifying the harms from alcohol use in terms of deaths and disability-adjusted life years, there is also interest in quantifying the social and economic costs arising from alcohol consumption.

Objective: This study aimed to identify and summarise recent evidence on the social costs of alcohol consumption.

Methods: Searches were conducted of the international scientific literature to identify studies on the social costs of alcohol consumption and related problems published between 2015 and August 2020. Peer-reviewed and grey literature were searched using Pubmed, EconLit, the Cochrane Library, as well as Google Scholar. Search terms included cost-of-illness, cost, economy, social cost, societal cost, expenditure, economic burden, health care cost, healthcare cost, budget, alcohol, misuse, abuse, addiction, overdose, disorder, dependence, and harm. Social cost studies were included only if they were published in English and reported on monetary outcomes. Books, theses, systematic reviews, meta-analyses, commentaries, issues, brief notes, and summaries were excluded from the analysis.

Results: From 4,642 non-duplicate articles, 4,397 were excluded based on titles and abstracts. Two hundred and forty-five full texts were examined, and 11 studies deemed eligible (0.2%). All reported on health-related costs. Other major cost domains were workplace disruption, the criminal justice system and road traffic accidents.

Conclusions: Despite the heterogeneity of eligible studies and difficulty of cross-country comparisons, there was consensus that harms related to alcohol consumption caused significant costs to broader society including substantial monetary impacts on health care, criminal, and workplace systems.

Keywords: cost-of-illness, alcohol, societal cost, burden, direct, indirect, tangible, intangible

A1 Introduction

Alcohol use is the seventh leading risk factor for global disease burden and in 2016 it accounted for 2.8 million deaths. Among those aged 15-49 years, alcohol was the leading cause of death and disability (Griswold et al., 2018). Alcohol-related harms occur across the full spectrum of use and among all age groups, genders and socio-economic strata, and incorporate harms arising from the drinking of others (Laslett et al., 2010; Laslett et al., 2015; Orford et al., 2013). In addition to quantifying the harms from alcohol use in terms of deaths and disability-adjusted life years, there is also interest in quantifying the social and economic costs arising from alcohol consumption (Bouchery et al., 2011; Laramée et al., 2013; Mohapatra et al., 2010; Sacks et al., 2015). It has been estimated that in 2010 “excessive drinking”[57] cost the United States (US) approximately USD250 billion, and across a range of high-income countries the impact has been quantified at 1.58 percent of gross domestic product (Mohapatra et al., 2010; Sacks et al., 2015).

In 2004/05, it was estimated that the social cost of alcohol consumption to Australia was $15.3 billion, comprising $10.8 billion in tangible and $4.5 billion in intangible costs (Collins and Lapsley, 2008). However, that estimate factored in 2,437 deaths that were “prevented” and more than 114,000 hospital bed-days that were “saved” by the moderate use of alcohol. Recently released, updated Australian guidelines (National Health and Medical Research Council, 2020) for low-risk alcohol consumption recognise that epidemiological evidence for causal effects of alcohol on a range of conditions has changed considerably over time. They note in particular that evidence for apparent protective effects of low-level alcohol use on cardiovascular diseases has been increasingly challenged by new studies with improved design and methods. Collectively, these studies suggest that apparent cardio-protective effects indicated by earlier observational studies may be an artefact of design weakness and methodological error (Chikritzhs et al., 2015; Sherk et al., 2019). In comparison, evidence for causal effects of alcohol on cancer, even at low levels of use, has strengthened and the range of cancer types associated with alcohol has increased in the past 15 years or so (National Health and Medical Research Council, 2019). Major changes in the underlying epidemiological evidence for causal relationships such as these can have substantial impacts on the magnitude of social cost estimates.

In Australia, per capita alcohol consumption[58] declined from 13.26 litres in 2004/05 to 12.43 litres in 2017/18 (Australian Bureau of Statistics, 2019). It has been suggested that declining alcohol use by young adults is largely responsible for the downward trend in national per capita consumption (Livingston and Dietze, 2016), although there is also evidence of increased consumption among older adults (Australian Institute of Health and Welfare, 2020a). This may be indicative of a cohort effect whereby people continue their previous drinking patterns, at least in part, into their later years. Age differences in alcohol use are also reflected in treatment services: in 2018/19, among those seeking treatment, alcohol was the principal drug of concern for the majority of clients aged 50 and older (Australian Institute of Health and Welfare, 2020b). Given changing patterns of consumption, and changes in the evidence of associated harms, it is important to update estimates of the social costs arising from alcohol use.

[57] “defined as binge drinking (four or more drinks per occasion for women; five or more drinks per occasion for men); heavy drinking (more than eight drinks per week for women; and ≥15 drinks per week for men); any alcohol consumption by youth aged <21 years; and any alcohol consumption by pregnant women.” (Sacks 2015, p.e73)

[58] Adjusted for the drinking population: those who have drunk alcohol in the past 12 months and aged 15 or older.

This rapid review aimed to identify and summarise recent evidence on the social costs of alcohol consumption across whole populations. Rapid reviews are a simplified version of systematic reviews that offer greater efficiency when time and resources are limited. Rapid reviews apply systematic search strategies, synthesise research evidence and draw evidence-informed conclusions in a manner to similar systematic reviews but limit the scope of materials included and concentrate on key items (Tricco et al., 2015).

A1.1 Research question and objectives

This rapid review aimed to answer the following questions:

i.) Are there any recent studies that have estimated the societal costs associated with alcohol consumption nationally (Australia) and internationally?
ii.) To what extent does alcohol consumption have an economic impact on society?
iii.) Are the costs associated with alcohol consumption comparable across studies?

A2 Methods

Systematic searches of the international and national literatures published on the social costs of alcohol consumption and related harms were undertaken in August 2020 for relevant documents published from 2015 onwards. Data collection focused on key study characteristics including year(s) costed and country of origin, study aim and target population, cost estimate, as well as causes of costs and factors assessed. Studies were also examined for salient methodological limitations and comparability.

A2.1 Eligibility criteria for the review (PICOS elements)

Table A1.1 sets out the specific information about Participants, Interventions and Comparators, Outcomes, and Study Design (PICOS) that was eligible for inclusion in this rapid review.

Table A1.1: Eligibility criteria (PICOS elements)

Participants	**Interventions and Comparators**	**Outcomes**	**Study Design**
Participants of all ages were included, regardless of their gender, degree of alcohol consumption or diagnostic status, and the presence of any comorbidities.	Any social costs studies aiming to identify the social costs (direct, indirect, and intangible costs) of alcohol consumption were included. Studies using social cost methods in limited populations or a sub-set of a domain were ineligible for the main analysis but are reported in supplementary tables.	Any studies reporting on alcohol-related societal costs in terms of monetary outcomes were included. These included direct, indirect and intangible costs (e.g. health care, treatment costs, loss of productivity, premature mortality, traffic accidents, crime, and disability adjusted life years).	Eligible study designs were economic, cost-of-illness studies, interventions, and observational studies. Ineligible were: systematic or other reviews, books, theses, summaries, meta-analyses, brief notes, issues, conference abstracts, commentaries, letters, case studies, editorials, guidelines, recommendations, non-human models, and other types of non-scientific papers (e.g. interviews).

To be eligible for inclusion, full-texts had to be available in English and report alcohol-related societal costs in terms of monetary outcomes. Studies using social cost methods in limited populations or only part of a cost domain were excluded from the main analysis but reported in supplementary tables. Due to the difficulty of comparing costs between countries, the review was restricted to reports from Australia, New Zealand, the European Union and the United States. Data from social cost studies in other countries were reported in supplementary tables. Studies reporting general substance use societal costs without making a distinction between costs associated with alcohol use *versus* other substances were also excluded. Documents published as narrative or rapid reviews, systematic reviews, meta-analyses, books, theses, summaries, brief notes, issues, conference abstracts, commentaries, letters, case studies, editorials, guidelines, recommendations, non-human models, and other types of non-scientific papers (e.g. interviews) were excluded.

A2.2 Search strategy

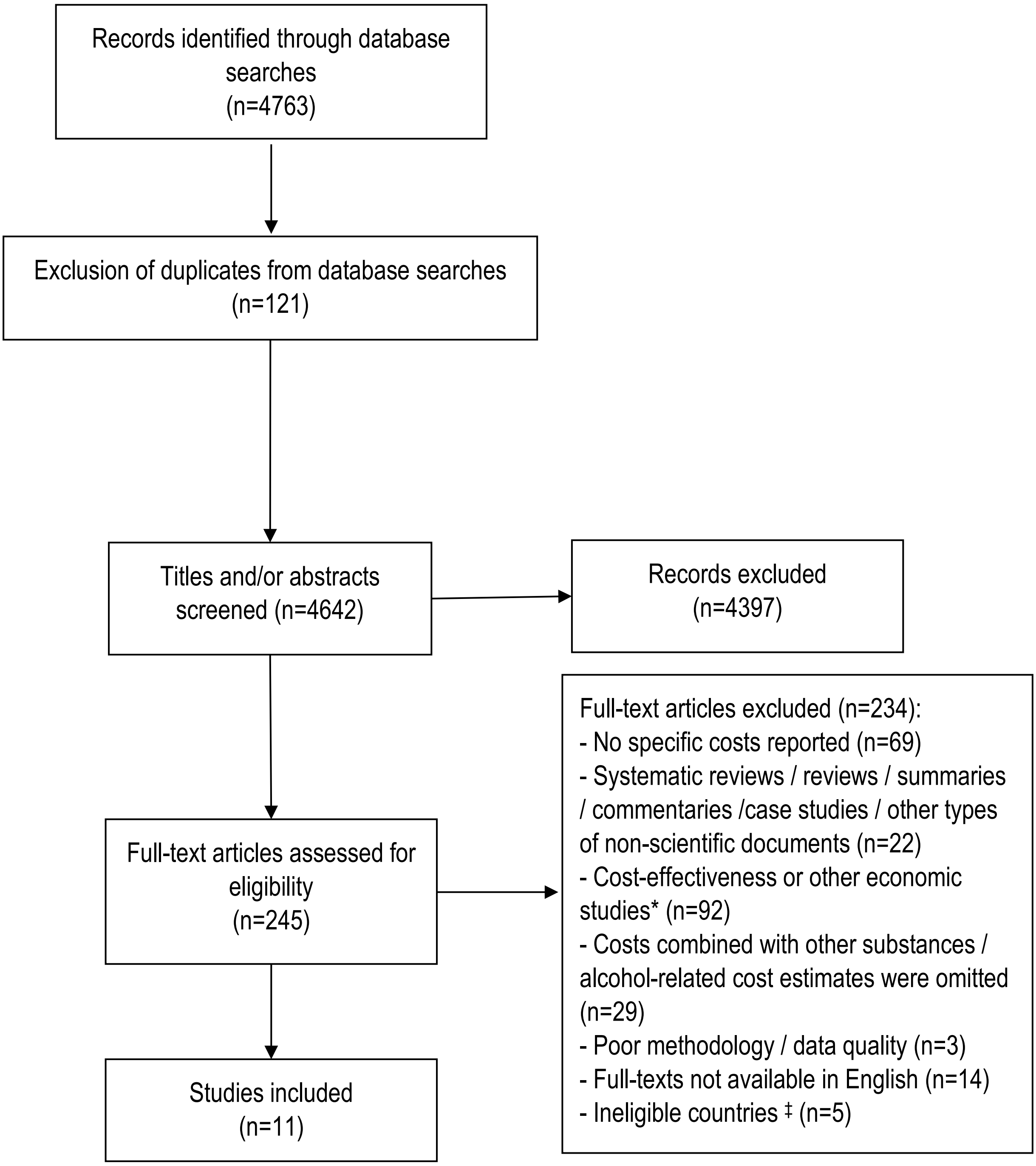
Peer-reviewed literature, as well as grey literature, were searched. Pubmed, EconLit, the Cochrane Library, as well as Google Scholar were searched. Search terms included: cost-of-illness, cost, economy, social cost, societal cost, expenditure, economic burden, health care cost, healthcare cost, budget, alcohol, misuse, abuse, addiction, overdose, disorder, dependence, and harm. Only the first 400 publications listed on Google Scholar were searched (13%) due to the high number of publications recorded (n=3060). Search references from the four databases were then merged on Endnote X8 Software. One author (SA) reviewed titles and abstracts to identify potentially eligible studies and then assessed full-texts of studies deemed eligible. Studies were then further classified as eligible or ineligible and reasons for the latter recorded in Endnote.

A3 Results

Key word searches identified 4,763 documents across the four databases. One-hundred and twenty-one studies were excluded as they were duplicates (see Figure A1.1). After analysis of the titles/abstracts, 245 documents appeared to meet the selection criteria and the full papers were assessed. After further analysis, 234 documents were excluded for the following reasons: no costs were reported (n=69); documents were either systematic reviews, reviews, summaries, commentaries, case studies, or other types of non-scientific documents (n= 22); documents were cost-effectiveness or other economic studies (n = 92); costs were either combined with other substances or alcohol-related cost estimates were omitted (n=29); methodology or data quality were poor (e.g. health service cost of treating alcohol were based on limited data) (n=3); studies were from non-eligible countries (n = 5); and, full-texts were not available in English (n=14). The remaining 11 studies were included in analysis: none were from Australia.

Three studies were conducted in Belgium (Lievens et al., 2015; Lievens et al., 2017; Verhaeghe et al., 2017), three in the United States (Miller et al., 2017; Sacks et al., 2015; Trangenstein and Jernigan, 2020), two in Canada (Sherk, 2020; Sorg and Wren, 2016) and one each in France (Kopp and Ogrodnik, 2017) and Germany (Effertz et al., 2017), and a multinational study in the European Union (Łyszczarz, 2019).

Figure A1.1: Study flow diagram



‡ Data listed in supplementary tables S1 and S2.
* 9 studies used social cost methods in a limited population – these are reported in supplementary tables S3 and S4.

Table A1.2 provides a summary of the main findings for the studies identified as eligible. To make a meaningful comparison of values across countries, societal costs were converted to USD monetary values if they were provided in another currency via Purchasing Power Parity (Organisation for Economic Cooperation and Development, 2019). This method has been used in a previous cost-of-illness systematic review on tobacco to standardise different monetary values (Makate et al., 2019). Table A1.3 provides descriptive information about the studies, such as year(s) costed, country and eligible costs. Table A1.4 provides the costs adjusted to USD 2018 including purchasing power parity (where required).

A3.1 Health care costs

All the studies identified as eligible reported on alcohol-related health care costs. For example, Verhaeghe et al. (2017) reported that direct health care costs due to alcohol consumption contributed an estimated EUR906.1 million in 2013, while indirect costs accounted for a further EUR642.6 million and intangible costs were EUR6.3 billion. In the US, tangible health care costs were estimated for excessive drinking (defined as $\geq$ 4 or $\geq$ 5 drinks for women and men respectively, and any drinking for those aged $\leq$ 21 years): these costs summed to USD28.4 billion (Sacks et al., 2015). In Canada, the health-related costs of alcohol were CAD4.2 billion in 2014, which represented about 29 percent of total alcohol-attributed costs (Sherk, 2020).

A3.2 Workplace productivity loss

Sacks et al. (2015) found that lost productivity accounted for costs of USD179.1 billion, with impaired productivity and premature mortality each representing about 40 percent of the total: in comparison health costs accounted for about 11 percent of the total. In Canada, alcohol contributed 38 percent of all substance-related workplace costs, in particular through premature mortality (Sorge et al., 2020). A European study conducted in 28 countries found that the total productivity loss associated with alcohol-related mortality accounted for EUR32.1 billion, which represented 0.215 percent of gross domestic product for those nations (Łyszczarz, 2019).

A3.3 Other alcohol-related costs

Sacks et al. (2015) reported that alcohol-related costs, including those to the criminal justice system and motor vehicle crashes, accounted for USD41.6 billion in the USA, with the criminal correction system costs being 38.2 percent (USD15.9 billion) of the total. Another study found that cost of motor vehicle accident damages in California was USD1.9 billion, while other property damage due to alcohol was USD1.78 billion (Miller et al., 2017). Furthermore, the lost quality of life from alcohol-related injury and impairment was estimated at USD91.2 billion. A Belgian study found that the direct costs of alcohol-related crimes was EUR363 million, with indirect costs of EUR39 million, and intangible costs of EUR3.6 billion (Lievens et al., 2017). An earlier study in Belgium (Lievens et al., 2015) found that direct alcohol-related costs for crime were estimated between EUR197.1 million and EUR252.1 million, while indirect costs were between EUR138.0 million and EUR151.3 million. Finally, the intangible costs due to interpersonal violence accounted for EUR144.8 million. In the same study, alcohol-related costs for traffic accidents accounted for EUR75.0 million in direct costs with EUR97.7 million from indirect costs, while intangible costs accounted for EUR568.4 million.

A3.4 Limited populations or conditions

We identified nine studies in eligible countries that used social cost methods but which were conducted on limited populations or a sub-set in a domain. For example: cancers attributable to alcohol (e.g. stomach, colorectal, liver) (Krueger et al., 2016); workplace absenteeism (Roche et al., 2016); and, costs due to foetal alcohol spectrum disorder (Easton et al., 2016; Ericson et al., 2017; Popova et al., 2016). These are summarised in Supplementary Tables S3 and S4. Supplementary Tables S5 and S6 report the costs adjusted to USD 2018 including purchasing power parity (where required) for studies conducted in ineligible countries or with limited populations / conditions.

Table A1.2: Summary information for the eligible identified studies

Country	COI guide	1st author (year)	Internal costs	Source of alcohol consumption prevalence / Method of estimation	Summary of findings / Costs estimated	Main themes
Belgium	Followed	Lievens (2017)	Not included	Data: Belgian Health Interview Survey (2013) and published studies	Total direct costs associated with alcohol in 2013: EUR 1,290 million Health: EUR 927 million; Crime: EUR 363 million Total indirect costs associated with alcohol in 2013: EUR 778 million Health: EUR 739 million: Crime: EUR 39 million Total intangible costs associated with alcohol in 2013: EUR 175.329 billion Health: EUR 171.710 billion Crime: EUR 3.619 billion	Total costs associated with alcohol
Belgium	Mentioned	Verhaeghe (2017)	Not included	Data sources: Belgian Health Interview Survey (2013)	Direct costs related to alcohol consumption: EUR 906.1 million Indirect costs related to alcohol consumption: EUR 642.6 million Intangible costs: EUR 6.3 billion	General social costs: inpatient/outpatient care, pharmaceuticals, prevention, disability, and premature mortality

Country	COI guide	1st author (year)	Internal costs	Source of alcohol consumption prevalence / Method of estimation	Summary of findings / Costs estimated	Main themes
Belgium	Followed	Lievens (2015)	Private costs included	Data: Belgian Health Interview Survey 2013	Alcohol-related costs for health: Hospitalisation: EUR 245 744 850 Inpatient care: EUR 761 781 690 Outpatient care: EUR 139 737 031 Social work services: EUR 60 445 Pharmaceuticals: EUR 2 016 596 Prevention: EUR 529 234 Direct costs: EUR 902 108 900 Indirect costs: EUR 642 525 039 Alcohol-related costs for crime: Direct costs: EUR 197,143,110 – 252,098,807 Indirect costs: EUR 138,029,141 – 151,333,313 Intangible costs (interpersonal violence): EUR 144,752,000 Alcohol-related costs for traffic: Total direct costs: EUR 74,951,876 Total indirect costs: EUR 97,688,279 Intangible costs (non-financial welfare costs): EUR 568,400,000	Hospitalisations, crime, traffic
Canada	No	Sherk (2020)	Not included	Data: Canadian Substance Use Costs and Harms model: alcohol revenue data from Statistics Canada's CANSIM database	Total Government revenue in 2014: CAD 10.9 billion Total societal costs due to alcohol consumption in 2014: CAD 14.6 billion Total deficit: CAD 3.7 billion.	General societal costs
Canada	Followed	Sorge (2020)	Not included	Data: Extracted from three Canadian national surveys.	Alcohol responsible productivity related costs accounting for CAD $5.916 billion	Workplace productivity loss

Country	COI guide	1st author (year)	Internal costs	Source of alcohol consumption prevalence / Method of estimation	Summary of findings / Costs estimated	Main themes
European Union	No	Lyszczarz (2019)	Not included	Data: Global Burden of Disease Study 2016	Total productivity losses associated with alcohol-related mortality in 28 European countries (Romania, Poland, Hungary, Slovakia, Czechia, Bulgaria, Lithuania, Estonia, Latvia, Ireland, Denmark, Finland, United Kingdom, Sweden, Portugal, Croatia, Spain, Slovenia, Cyprus, Italy, Greece, Malta, Luxembourg, Germany, Austria, France, Belgium, Netherlands): EUR 32.1 billion.	Productivity losses
France	Mentioned	Kopp (2017)	Not included	Data source: Published studies and reports	In 2010, alcohol societal costs were estimated to reach EUR 118 billion. Alcohol societal costs per daily user were EUR 23,612. Every year, the net public expenditure spent on alcohol is EUR 3 billion, while taxes generated by alcohol are EUR 3.2 billion which accounts for half of the corresponding alcohol health care costs (EUR 7.7billion).	Social cost
Germany	No	Effertz (2017)	Not included	Data source: German Statutory Health Insurance	EUR 39.3 billion are spent yearly in Germany due to hazardous alcohol consumption with a loss of 7 years in life expectancy.	Direct indirect and tangible costs
USA	No	Trangenstein (2020)	Not included	Data: Behavioural Risk Factor Surveillance System	Costs due to alcohol consumption in 2013 in Baltimore: USD 582.3 million	General social costs: health care, productivity, crime
USA	Mentioned	Miller (2017)	Not included	Data: Published alcohol-attributable studies	Total costs of alcohol in California in 2010: USD 128.724 billion Tangible costs: USD 37.529 billion Medical: USD 8.331 billion Wage work: USD 17.335 billion Household work: USD 6.819 billion Public services: USD 1.328 billion Property damage: USD 1.791 billion Motor vehicles: USD 1.925 billion Intangible costs: Quality of life: USD 91.195 billion	General costs (medical, wage, household, public services, property damage, motor vehicles, quality of life)

Country	COI guide	1st author (year)	Internal costs	Source of alcohol consumption prevalence / Method of estimation	Summary of findings / Costs estimated	Main themes
USA	No	Sacks (2015)	Not included	Data source: alcohol-attributable fractions from studies were extracted to analyse the proportion of direct and indirect costs in 2006 and were projected to 2010	Excessive alcohol consumption cost USD 249.026 billion in 2010, which is equivalent to nearly USD 2.05 per drink. Health care costs accounted for USD 28.379 billion, lost productivity (e.g. impaired productivity at work, absenteeism) for USD 179.085 billion, and Other costs (e.g. criminal justice, motor vehicle crashes) for USD 41.563 billion.	Category of costs: Health care: Special care for abuse / dependence, hospitalisation, ambulatory care, nursing home, drugs / services, FASD, prevention and research, training, health insurance administration. Lost productivity: impaired productivity at work / at home / while in specialty care / while in hospital, absenteeism, mortality, incarceration of perpetrators, victims of crime, FASD, Other: victim of property damage, criminal justice (corrections / alcohol-related crimes / violent and property crimes / private legal), motor vehicle crashes, FASD (special education).

CAD = Canadian dollar: EUR = Euro: FAS = Foetal alcohol syndrome: FASD = Foetal alcohol spectrum disorder: USA = United States of America: USD = United States dollar

Table A1.3: Summary of the aims, approaches and factors for the eligible identified studies

Country	Reference	Aim of the study	Approach	Sources of costs & factors included	Year/s costed
			International Studies		
Belgium	Lievens (2017)	To estimate the tangible and intangible costs associated with substance misuse in Belgium.	Prevalence	Direct (inpatient and outpatient care, social work services, drugs, prevention, criminal justice (investigation, prosecution, sentencing, sentence execution, prevention, property loss, tax refund for burglary prevention, anticipation to theft), indirect (disability, productivity loss due to premature mortality), and intangible costs (DALYs due to diseases, injuries, road crashes, interpersonal violence).	2012
Belgium	Verhaeghe (2017)	To quantify the current health-related social costs of drinking in Belgium.	Prevalence Human capital	Direct (inpatient and outpatient care, pharmaceuticals, prevention), Indirect (human capital approach – productivity loss due to premature mortality and disability) Intangible (DALYs)	2012
Belgium	Lievens (2015)	To assess the social costs of legal and illegal drugs in Belgium in terms of health care, crime, traffic, and integrated projects.	Prevalence Human capital was used to estimate productivity losses.	Health: Direct (inpatient, outpatient, pharmaceuticals, prevention, research coordination), indirect (disability, lost productivity from premature mortality), and intangible costs (DALYs) Crime: Direct (investigation, prosecution, sentencing, sentence execution, coordination, civil service/fire department research, property loss, prevention), indirect (productivity loss, anticipation to theft), intangible costs (DALYs) Traffic: Direct (Health-related costs: inpatient care, prevention, research; Crime related costs: investigation, sentencing, sentence execution), indirect (productivity loss), and intangible costs (DALYs)	2012
Canada	Sherk (2020)	To compare the societal costs to the Canadian government revenue from alcohol.	Prevalence	Direct costs (health care, economic loss of production, criminal justice and other)	2014

Country	Reference	Aim of the study	Approach	Sources of costs & factors included	Year/s costed
Canada	Sorge (2020)	To estimate the economic impact of substance use on workplace productivity loss in Canada.	Prevalence	Indirect costs (productivity loss due to premature deaths, presenteeism / absenteeism, and long-term disability)	2007-2014
European Union	Lyszczarz (2019)	To estimate the production losses of alcohol-attributable mortality in 28 countries in the European Union.	Prevalence Top-down Societal perspective Human capital method	Indirect costs (productivity losses)	2016
France	Kopp (2017)	To estimate the societal costs of alcohol and drug use in France, in terms of quality of life loss, years of life lost, productivity loss, and public expenditure.	Prevalence	Direct (cost of care), indirect (mortality, morbidity, years of life lost, the value of life and productivity loss due to mortality), and intangible costs (loss in quality of life)	2010
Germany	Effertz (2017)	To estimate the impact of hazardous alcohol consumption on life years lost, direct and indirect health expenditures, and pain and suffering in Germany.	Prevalence	Direct (healthcare expenditures, accidents), indirect (rehabilitation, absenteeism, early retirement, lost productivity, mortality), and intangible costs (pain and suffering)	2008-2012
USA	Trangenstein (2020)	To provide an update of the estimates of the economic burden to the National Health Service of poor diet, physical inactivity, smoking, alcohol, and overweight / obesity.	Prevalence	Direct costs (healthcare expenditure) and indirect costs (productivity loss, other effects on society such as the criminal justice system, fire, education property damage, correctional housing)	2013
USA	Miller (2017)	To estimate the economic and social costs related to substance use in California.	Prevalence Incidence	Tangible (lifetime medical costs including injury costs and acute medical care, property damage and loss due to road crashes and crime, public cost services (e.g. police), productivity losses, household work losses, driving crash costs (e.g. insurance claims, travel delays) and intangible (impaired quality of life due to mortality and injuries) costs	2010
USA	Sacks (2015)	To update the current state and national estimate of alcohol use cost in the USA, to implement prevention strategies.	Incidence	Direct (healthcare expenditure) and indirect costs (productivity loss, other)	2010

DALYs = disability adjusted life years: USA = United States of America

Table A1.4: Conversion of costs to 2018 USD including purchasing power parity adjustment as required

Reference	Reference year	Cost area	Original currency / cost	2018 USD
Lievens (2017)	2013	Total direct costs	EUR 1.3 (billion)	1.1 (billion)
		Health	EUR 927 (million)	780 (million)
		Crime	EUR 363 (million)	306 (million)
		Indirect costs	EUR 778 (million)	655 (million)
		Health	EUR 739 (million)	622 (million)
		Crime	EUR 39 (million)	33 (million)
		Total intangible costs	EUR 175.3 (billion)	147.6 (billion)
		Health	EUR 171.7 (billion)	144.6 (billion)
		Crime	EUR 3.6 (billion)	3.1 (billion)
Verhaeghe (2017)	2012	Direct costs	EUR 906.1 (million)	774 (million)
		Indirect costs	EUR 642.6 (million)	549 (million)
		Intangible costs	EUR 6.3 (billion)	5.4 (billion)
Lievens (2015)	2012	Total hospitalisation costs	EUR 245 744 850	210 (million)
		Total inpatient care	EUR 761 781 690	651(million)
		Total outpatient care	EUR 139 737 031	119 (million)
		Total social work services	EUR 60 445	0.051 (million)
		Total pharmaceuticals	EUR 2 016 596	2 (million)
		Total prevention	EUR 529 234	0.5 (million)
		Total direct costs	EUR 902 108 900	771 (million)
		Total indirect costs	EUR 642 525 039	549 (million)
		Total direct costs	EUR 197-252 million	168-215 (million)
		Total indirect costs	EUR 138-151 million	118-129 (million)
		Intangible costs (interpersonal violence)	EUR 144 752 000	124 (million)
		Total direct costs	EUR 74 951 876	64 (million)
		Total indirect costs	EUR 97 688 279	83 (million)
		Intangible costs (non-financial welfare costs)	EUR 568 400 000	486 (million)
Sherk (2020)	2014	Total Government revenue	CAD 10.9 billion	11.3 (billion)
		Total societal costs	CAD 14.6 billion	15.1 (billion)
		Total deficit	CAD 3.7 billion	3.8 (billion)

Reference	Reference year	Cost area	Original currency / cost	2018 USD
Sorge (2020)	2014	Alcohol responsible productivity related costs	CAD 5.916 billion	7.4 (billion)
Lyszczarz (2019)	2016	Productivity losses	EUR 32.1 billion	23.0 (billion)
Kopp (2017)	2010	Alcohol societal costs	EUR 118 billion	106 (billion)
		Alcohol societal costs per daily user	EUR 23,612	0.02 (million)
		Net public expenditure spent on alcohol	EUR 3 billion	2.7 (billion)
		Taxes generated by alcohol	EUR 3.2 billion	2.9 (billion)
		Half of the corresponding alcohol healthcare costs	EUR 7.7 billion	6.9 (billion)
Effertz (2017)	2008	Direct indirect and tangible costs	EUR 39.3 billion	44.7 (billion)
Trangenstein (2020)	2013	DALYs from homicides and victim of crime	USD 582.3 million	613 (million)
Miller (2017)	2010	Total costs of alcohol	USD 128.7 billion	144.7 (billion)
		Tangible costs	USD 37.5 billion	42.2 (billion)
		Medical	USD 8 3 billion	9.4 (billion)
		Wage work	USD 17.3 billion	19.5 (billion)
		Household work	USD 6.8 billion	7.7 (billion)
		Public services	USD 1.3 billion	1.5 (billion)
		Property damage	USD 1.8 billion	2.0 (billion)
		Motor vehicles	USD 1.9 billion	2.2 (billion)
		Intangible costs		
		Quality of life	USD 91.3 billion	102.5 (billion)
Sacks (2015)	2010	Excessive alcohol consumption cost	USD 249.0 billion	280.0 (billion)
		per drink	USD 2.05	2.3
		Health care costs	USD 28.4 billion	31.9 (billion)
		Lost productivity	USD 179.1 billion	201.3 (billion)
		Other costs	USD 41.6 billion	46.7(billion)

A4 Conclusions

This rapid review highlights that alcohol consumption and related harms cause significant social costs to many societies with substantial monetary impacts on health care, criminal justice, and workplace systems. Importantly in the context of this report, no relevant current (in the defined time period) or comprehensive studies were found for Australia, although reported in the supplementary tables were Australian data on the costs due to workplace absenteeism (Roche et al., 2016). Studies consistently identified that the monetary costs associated with alcohol use were substantial. However, comparisons between and even within countries was problematic due to wide variability in methods applied to estimate both epidemiological and economic components of social cost studies. There was wide variability for instance, in data sources, whether comorbidities were assessed and types of costs included (e.g. direct, indirect, and intangible), as well as potential differences between countries in underlying cost structures and norms for alcohol consumption.

Moreover, while some studies in the rapid review focused on prevalence-based approaches, others relied on incidence-based, demographic or human-capital approaches. Again, these key methodological differences make comparison across studies problematic. Indeed, a lack of consensus regarding appropriate approaches to estimating social costs of substance use has been identified as a shortcoming of the field (Vella et al., 2019). A comprehensive assessment of study quality was also beyond the scope of this rapid review. However, Table A1.2 describes studies which explicitly followed a standards guideline or mentioned a guideline in their methods section: 6 of 11 studies reported or followed either a national or an international guideline.

No comprehensive assessment of the costs and harms due to alcohol consumption by others was found. Elements of these costs were included, for example for premature mortality due to homicide (Lievens et al., 2017) and harms to the unborn foetus from in-utero exposure (Sacks et al., 2015). However, Australian findings, pre-dating the 2015 cut-off, document that these costs are likely to be in the billions of dollars (Laslett et al., 2010).

In sum, there is a great deal of variability in the scientific literature on social costs of alcohol use and this hinders comparisons between studies, regions and over time. Nevertheless, it is clear that alcohol consumption continues to cause considerable tangible and intangible costs to many societies. Greater efforts are required to curb the entirely preventable disease, injury and social harms that underpin these costs.

A5 Recommendations

i.) Due to the paucity of recent Australian studies, future studies should identify the social and economic impact of alcohol consumption and related harms among the Australian population.
ii.) There is a paucity of data evaluating alcohol's harms to (and from) others, including reduced quality of life, injuries and mental health problems experienced by adults and children.
iii.) There are few data on the prevalence of FASD in Australia or the life-long costs.
iv.) Widespread uptake of existing international guidelines for estimating social costs of alcohol would improve comparability among studies.

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Supplementary tables

Table S1: Summary information for ineligible international studies

Country	1st author (year)	Internal costs	Source of alcohol consumption prevalence / Method of estimation	Summary of findings / Costs estimated	Main themes
Brazil	Coutinho (2016)	Not included	Data source: Relative risk estimates were obtained from three meta-analyses; the risk consumption rates were obtained by the Brazilian National Cancer Institute	The attributable costs by alcohol-related disease were as follows: Breast cancer: USD 1.6 million; Oropharyngeal cancer: USD 2.7 million; Laryngeal cancer: USD 645.0 thousand; Oesophageal cancer: USD 753.6 thousand; Liver cancer: USD 92.8 thousand; Hypertension: USD 1 million; Cirrhosis: USD 1.2 million; Chronic pancreatitis: USD 42.9 thousand. Total costs: USD 8.2 million	Cancer: (breast, oropharyngeal, laryngeal, oesophageal, liver); hypertension; cirrhosis; and, chronic pancreatitis
Indonesia	Kristina (2018)	Not included	Data: Published studies and reports, as well as the Indonesia Universal Health Coverage	Treatment costs for alcohol-related cancers were as follows: Colorectum: USD 116,083; Oesophageal: USD 43,820; Larynx: USD 9,824; Liver: USD 93,253; Pharynx: USD 11,033; Pancreas: USD 5,613; Lung: USD 44,836; Stomach: USD 2,942. Total costs: USD 416,227.	Alcohol-related cancers

Country	1st author (year)	Internal costs	Source of alcohol consumption prevalence / Method of estimation	Summary of findings / Costs estimated	Main themes
Sri Lanka	Ranaweera (2018)	Yes, for lost workplace income due to premature mortality and absentee-ism	Data source: projections of cancer incidence in 2015 were based on data from the National Cancer Registry 2009 and compared to the Globocan 2012 IARC data; clinic visits, mortality, and hospital admissions in 2015 were based on the Annual Health Bulletin; other sources of information were based on the Department of Census and Statistics, as well as various governmental and non-governmental surveys and reports. Method of estimation: human capital approach	Total direct and indirect costs of alcohol-related cancers in 2015: USD 72.15 million (the cost of the lip/oral cavity/pharynx cancers accounted for 85% of the alcohol-related cancers, with USD 61.14 million). Total direct and indirect costs of alcohol-related conditions other than cancers in 2015: USD 814.16 million (the cost of road traffic injuries accounted for 30.8% of the overall cost of conditions other than cancers, with USD 251 million). Total economic costs of alcohol in 2015: USD 885.85 million. Total direct costs of alcohol in 2015: USD 388.35 million. Total indirect costs of alcohol in 2015: USD 497.49 million.	8 types of cancer: breast; colorectal; larynx; lip / oral / cavity / pharynx; liver; oesophagus; pancreas; and, stomach cancers 19 non-communicable diseases: acute and chronic pancreatitis, alcohol use disorders, alcoholic gastritis and duodenitis, alcoholic liver disease, cerebrovascular disease, cholelithiasis / cholecystitis, diabetes mellitus, epilepsy, fire injuries/ burning, hypertension, ischemic heart disease, lower respiratory tract infection, other liver diseases, poisoning, road injuries, self-harm, supraventricular cardiac arrhythmia, tuberculosis, uncoded / undiagnosed
Thailand	Komonpaisarn (2016)	Not included	Data source: the Cigarette Smoking and Alcoholic Drinking Behaviour Survey 2011; various epidemiological studies; the National Health Security Office in 2011	In 2011, the total alcohol-related health care costs among Universal Health Coverage beneficiaries was TBH 2.2 billion (outpatient services: THB 1.4 billion and inpatient services: THB 800 million).	Healthcare costs

Country	1st author (year)	Internal costs	Source of alcohol consumption prevalence / Method of estimation	Summary of findings / Costs estimated	Main themes
Uruguay	Lanzilotta (2018)	Not included	Data: Prevalence approach: Attributable fractions from Public Health England (2015).	Total net cost of abusive alcohol consumption: USD 256 982 570. Direct net cost of abusive alcohol consumption: USD 46 731 764. Indirect net cost of abusive alcohol consumption: USD 210 250 806.	General social costs: medical, enforcement, material, the judicial system, public, private, other, premature mortality, lost productivity. Note: cost reported in local currency Uruguayan Peso with author's conversion to USD

TBH = Thai Baht

Table S2: Summary of the aims, approaches and factors for the ineligible international reports

Country	Reference	Aim of the study	Approach	Sources of costs & factors included	Year/s costed
Brazil	Coutinho (2016)	To estimate the direct inpatient and outpatient costs attributable to alcohol consumption in Brazil.	Prevalence	Direct costs (healthcare expenditures)	2008-2010
Indonesia	Kristina (2018)	To estimate the burden and treatment costs related to alcohol in Indonesia.	Prevalence	Direct costs (treatment costs)	2016
Sri Lanka	Ranaweera (2018)	To estimate the costs of alcohol in Sri Lanka in 2015.	Prevalence	Direct (outpatient and inpatient healthcare expenditure) and indirect (loss of productivity due to mortality and absenteeism from work). Only included costs arising from illness and injury	2015
Thailand	Komonpaisarn (2016)	To estimate the inpatient and outpatient healthcare costs of alcohol consumption in Thailand.	Prevalence	Direct costs (outpatient and inpatient healthcare expenditures)	2011
Uruguay	Lanzilotta (2018)	To estimate the social costs of abusive alcohol consumption in Uruguay in 2015.	Prevalence Top-down	Direct (medical, law and enforcement, material, social services, prevention, and research), indirect (premature mortality, absenteeism, permanent and transitory retirement, FASD, incarceration)	2015

FASD = Foetal alcohol spectrum disorder

Table S3: Summary information for studies using social cost approach in limited populations or restricted cost domains

Country	COI guide	1st author (year)	Internal costs	Source of alcohol consumption prevalence / Method of estimation	Summary of findings / Costs estimated	Main themes
					Australian studies	
Australia	No	Roche (2016)	Not included	Data: National Drug Strategy Household Survey (2013)	Self-reported absence due to alcohol use: Total costs = AUD 451,920,700. Amount of any injury/illness due to alcohol use: Total cost AUD 2,022,322,758.	Absenteeism at work
					International Studies	
Canada	No	Krueger (2016)	Not included	Data source: Published meta-analyses, as well as the Canadian Community Health Survey (2005)	Total economic burden of cancers attributable to alcohol: Men: CAD 1,279 million; Women: CAD 412 million. Total: CAD 1,691 million.	Cancers: Lip / oral / cavity / pharynx / larynx, oesophagus, stomach, colorectal, liver, pancreas, trachea / bronchus / lung, breast, corpus uteri, ovary, prostate, kidney, urinary bladder
Canada	Yes	Popova (2016)	Not included	Data: Used costing mode developed in previous study (Popova et al., 2015)	Total costs associated with FASD: nearly CAD 1.8 billion (lower estimate: CAD 1.3 billion – upper estimate: CAD 2.3 billion) The three main contributors to the FASD cost were: Productivity loss due to disability and premature mortality between CAD 532 million and CAD 1,2 billion; Corrections (law enforcement system): CAD 378.3 million; and, Health care: between CAD 128.5 and CAD 226.3 million.	FASD
Canada	No	Krueger et al., (2017)	Not included	Data source: Published studies, as well as the Canadian Community Health Survey (2013)	Total economic burden associated with alcohol in 2013: Men: CAD 22.818 billion; Women: CAD 16.728 billion; and, Total: CAD 39.546 billion.	Economic benefits from 1% relative annual risk reduction in alcohol: cumulative reduction in alcohol burden from 2013 to 2036 of USD 11 billion

Country	COI guide	1st author (year)	Internal costs	Source of alcohol consumption prevalence / Method of estimation	Summary of findings / Costs estimated	Main themes
France	Yes	Cortaredona (2017)	Not included	Data: French Échantillon Généraliste de Bénéficiaires database: prevalence from Long-Term Illness registry & hospital discharge database	Total costs associated with alcohol use disorders for people without comorbidities: EUR = 2323 (EUR 1924-2722).	General healthcare costs
Germany	Mentioned	Manthey (2016)	Not included	Data: German Alcohol Dependence in Primary & Specialist Care in Europe study	Total direct costs were EUR 783 higher among people with alcohol dependence compared to other patients. Total indirect costs were EUR 1,051 higher among people with alcohol dependence compared to other patients. Total economic burden associated with alcohol dependence (difference in cost between people with and without alcohol dependence) was EUR 1,836.	Direct and indirect general costs
New Zealand	Mentioned	Easton (2016)	Not included	Data: NA	Loss of productivity due to FASD: NZD 49 million to NZD 200 million, which accounts for 0.03% to 0.09% of the annual GDP in New Zealand.	Foetal Alcohol Spectrum Disorder (FASD)
Sweden	Yes	Ericson (2017)	Not included	Data source: published and cost-data studies in Sweden	Annual societal costs of FAS per child (EUR 76,000) and per adult (EUR 110,000), accounting for EUR 1.6 billion per year. The annual additional cost of FAS was estimated at EUR 1.4 billion.	FAS

AUD = Australian dollar: CAD = Canadian dollar: EUR = Euro: FAS = foetal alcohol syndrome: FASD = Foetal alcohol spectrum disorder: NZD = New Zealand dollar

Table S4: Summary of the aims, approaches and factors for studies using social cost approach in limited populations or restricted cost domains

Country	Reference	Aim of the study	Approach	Sources of costs & factors included	Year/s costed
			Australian Studies		
Australia	Roche (2016)	To estimate the costs of alcohol and drug-related absenteeism in Australia.	Prevalence	Indirect costs (absenteeism in terms of working days and illnesses/injuries due to alcohol and drug use)	2013
			International Studies		
Canada	Krueger (2017)	To estimate the economic burden attributable to alcohol, tobacco smoking, excess weight, and physical inactivity by gender in Canada.	Prevalence and incidence	Direct (hospital treatment, clinician services, other health care professionals (excluding dentists), drugs, health research, other), and indirect costs (short/long-term disability and premature mortality).	2013-2036
Canada	Krueger (2016)	To estimate the burden of cancer attributable to alcohol, tobacco smoking, excess weight, and physical inactivity.	Prevalence	Direct (hospital treatment, clinician services, other health care professionals (excluding dentists), drugs, health research, other), and indirect costs (short/long-term disability and premature mortality).	2013-2036
Canada	Popova (2016)	To estimate the overall burden and costs associated with foetal alcohol spectrum disorder (FASD) in Canada.	Prevalence	Direct (healthcare cost, speech pathologist interventions, medications, inpatient and outpatient care, psychiatric care, emergency department attendance, screening, diagnosis, addiction treatment, law enforcement, care of youth and children, housing problems, long-term care, special education, research, and prevention) and indirect (mortality and disability) costs.	2013
France	Cortaredona (2017)	To estimate the costs associated with chronic diseases in France.	Prevalence Bottom-up	Direct (healthcare: primary care, consultations, pharmaceuticals, medical procedures and tests, health devices, emergency care, hospital care).	2014
Germany	Manthey (2016)	To analyse the economic burden associated with alcohol dependence among primary health care patients in Germany using a bottom-up approach.	Prevalence. Bottom-up	Direct (hospital attendances, general practice visits, home care, drugs, alcohol services) and indirect costs (productivity loss).	2014

Country	Reference	Aim of the study	Approach	Sources of costs & factors included	Year/s costed
New Zealand	Easton (2016)	To estimate the productivity loss (morbidity and premature mortality) of patients with FASD in New Zealand.	Demographic approach: counterfactual scenario – nobody with FASD	Indirect costs (productivity loss due to morbidity and premature mortality).	2013
Sweden	Ericson (2017)	To estimate the yearly costs of Foetal Alcohol Syndrome (FAS) to society in Sweden.	Prevalence	Direct (societal support, special education, comorbidities, AOD use) and indirect costs (informal caring, impaired working capacity).	2014

AOD = Alcohol or other drug: FAS = Foetal Alcohol Syndrome: FASD = Foetal alcohol spectrum disorder:

Table S5: Conversion of costs to 2018 USD including purchasing power parity adjustment as required – ineligible countries

Reference	Reference year	Cost area	Original currency / cost	2018 USD
Coutinho et al.,	2008-10	Breast cancer	USD 1.6 million	1.8 (million)
		Oropharyngeal cancer	USD 2.7 million	3.0 (million)
		Laryngeal cancer	USD 645.0 thousand	725 (thousand)
		Oesophageal cancer	USD 753.6 thousand	847 (thousand)
		Liver cancer	USD 92.8 thousand	104 (thousand)
		Hypertension	USD 1 million	1.1 (million)
		Cirrhosis	USD 1.2 million	1.3 (million)
		Chronic pancreatitis	USD 42.9 thousand	48 (thousand)
		Total costs	USD 8.2 million	9.2 (million)
Kristina et al., 2018	2016	Colorectum	USD 116 083.37	119 thousand)
		Esophageal	USD 43 820.60	45 (thousand)
		Larynx	USD 98 24.93	100 (thousand)
		Liver	USD 93 253.29	95 thousand)
		Pharynx	USD 11 033.69	11 (thousand)
		Pancreas	USD 5,613.22	5,733
		Lung	USD 44 836.84	45 (thousand)
		Stomach	USD 2 942.28	3,005
		Total	USD 416 227.34	43 (thousand)
Ranaweera et al., 2018	2015	Total direct and indirect costs of alcohol-related cancers	USD 72.15 million	75 (million)
		cost of the lip/oral cavity/pharynx cancers	USD 61.14 million	63 (million)
		Total direct and indirect costs of alcohol-related conditions (non-cancer)	USD 814.16 million	842 (million)
		Cost of road traffic injuries	USD 251 million	260 (million)
		Total economic costs of alcohol	USD 885.85 million	916 (million)
		Total direct costs of alcohol	USD 388.35 million.	402 (million)
		Total indirect costs of alcohol	USD 497.49 million	515 (million)

Reference	Reference year	Cost area	Original currency / cost	2018 USD
Komonpaisarn et al., 2016	2011	Alcohol-related healthcare costs	TBH 2.2 billion	29.7 (billion)
		Outpatient services	THB 1.4 billion	18.9 (billion)
		Inpatient services	THB 800 million	10.8 (billion)
Lanzilotta et al., 2018	2015	Total net cost	USD 256 982 570	266 (million)
		Direct net cost	USD 46 731 764	48 (million)
		Indirect net cost	USD 210 250 806	218 (million)

Table S6: Conversion of costs to 2018 USD including purchasing power parity adjustment as required – limited populations or restricted cost domains

Reference	Reference year	Cost area	Original currency / cost	2018 USD (multiplier)
Roche et al., 2016	2013	Cost (self-reported absence)	AUD 451,920,700	369 (million)
		Cost (injury/illness)	AUD 2,022,322,758	1 6 (billion)
Krueger et al., 2016	2013	Men	CAD 1,279 million	1.6 (billion)
		Women	CAD 412 million	0.5 (billion)
		Total	CAD 1,691 million	2.1 (billion)
Popova et al., 2015, 2016	2013	Total costs associated with FASD	CAD 1.8 billion	2.3 (billion)
		lower estimate	CAD 1.3 billion	1.6 (billion)
		upper estimate	CAD 2.3 billion	2.9 (billion)
		Productivity loss	CAD 532 million	0.7 (billion)
			CAD 1.2 billion	1.5 (billion)
		Corrections	CAD 378.3 million	0.7 (billion)
		Health care	CAD 128.5- 226.3 million	162-285 (million)
Krueger et al., 2017	2013	Men	CAD 22,818 million	29 million)
		Women	CAD 16,728 million	21.1 (billion)
		Total cumulative reduction in alcohol burden	CAD 11 billion	14 (billion)
Cortaredona et al., 2017	2014	Total costs	EUR 2323 (EUR 1924-2722)	1924.4(1594-2255)
Manthey et al., 2016	2014	Total direct costs	EUR 783	649
		Total indirect costs	EUR 1,051	871
		Total economic burden associated with alcohol dependence	EUR 1,836	1521
Easton et al., 2016	2013	Loss of productivity due to FASD	NZD 49 - NZD 200 million	72 - 295 (million)
Ericson et al., 2016	2014	Annual societal costs of FAS per child	EUR 76,000	62,960
		per adult	EUR 110,000	91,126
		per year	EUR 1.6 billion	1.3 (billion)
		Annual additional cost of FAS	EUR 1.4 billion	1.2 (billion)

APPENDIX CHAPTER 3: DEATHS AND HOSPITAL SEPARATIONS

Appendix 3.1

Table A3.1: Conditions included by category group

Condition	ICD10 codes[x] (Primary)	ICD10 codes (External)	Attributability	Relative risk source
Cancers				
Oral cavity & pharynx cancer	C01-C06.9; C09-C10.9; C12-C14.9		Partial	Bagnardi et al. (2015); Marron et al. (2010)
Oesophageal cancer	C15		Partial	Bagnardi et al. (2015); Marron et al. (2010)
Stomach cancer*	C16		Partial	Bagnardi et al. (2015)
Colorectal cancer	C18-C20		Partial	Bagnardi et al. (2015); Schütze et al. (2011)
Liver cancer	C22		Partial	Bagnardi et al. (2015); Schütze et al. (2011)
Pancreatic cancer	C25		Partial	Bagnardi et al. (2015); Schütze et al. (2011)
Laryngeal cancer	C32		Partial	Bagnardi et al. (2015); Marron et al. (2010)
Breast cancer (female)	C50		Partial	Bagnardi et al. (2015); Schütze et al. (2011)
Cardiovascular diseases				
Hypertension	I10-I15.9		Partial	Roerecke et al. (2018)
Ischaemic heart disease	I20-I25.9		Partial	Males: Zhao et al. (2017); Roerecke & Rehm (2010, 2011) Females: Roerecke & Rehm (2010, 2011, 2012)
Alcoholic cardiomyopathy	I42.6		100%	N/A
Atrial fibrillation & cardiac arrhythmia	I47.1; I47.9; I48		Partial	Samokhvalov et al. (2010c); Larsson et al. (2014)
Haemorrhagic stroke	I60-I62.9; I69.0-I69.2		Partial	Patra et al. (2010); Larsson et al. (2016)
Ischaemic stroke	G45; I63; I65-I67.9; I69.3		Partial	Patra et al. (2010); Larsson et al. (2016)
Unspecified stroke	I64, I64.4,		Partial	Patra et al.

	I64.8			(2010); Larsson et al. (2016)
Oesophageal varices	I85; I98.20; I98.21		Partial	Rehm et al (2010; 2017b)
Communicable diseases				
Tuberculosis	A15.0-A19.9		Partial	Imtiaz et al. (2017)
HIV	B20.0-B29.9; Z21		Partial	Rehm et al. (2017a)
Lower respiratory tract infections	J09.0-J22.9		Partial	Samokhvalov et al. (2010a)
Digestive diseases				
Alcoholic gastritis	K29.2		100%	N/A
Liver cirrhosis	K74.3-K74.6; K76.0; K76.9		Partial	Rehm et al (2010; 2017b)
Alcoholic liver disease	K70		100%	N/A
Acute pancreatitis	K85		Partial	Samokhvalov et al. (2015)
Chronic pancreatitis	K86.1		Partial	Samokhvalov et al. (2015)
Alcohol-induced pancreatitis	K86.0		100%	N/A
Endocrine diseases				
Diabetes mellitus, Type 2	E11		Partial	Knott et al. (2015); Baliunas et al. (2009)
Alcohol-induced pseudo-Cushing's syndrome	E24.4		100%	N/A
Neuropsychiatric conditions				
Alcohol abuse	F10.0-F10.1		100%	N/A
Alcohol dependence syndrome	F10.2		100%	N/A
Alcoholic psychosis	F10.3-F10.9		100%	N/A
Degeneration of nervous system due to alcohol	G31.2		100%	N/A
Epilepsy	G40; G41		Partial	Samokhvalov et al. (2010b)
Alcoholic polyneuropathy	G62.1		100%	N/A
Alcoholic myopathy	G72.1		100%	N/A
Intentional injuries				
Intentional self-harm*		X60.0-X64.9; X66-X84.9; Y87	Partial	English et al. (1995)
Intentional self-poisoning by alcohol		X65	100%	N/A
Assault		X85-X89.9; Y00-Y09.9; Y87.1	Partial	Corrao et al. (1999)
Assault (Age 0-14)*		X85-X89.9; Y00-Y09.9; Y87.1	Partial	English et al. (1995)
Unintentional injuries				
Road traffic crashes (Pedestrian)*		V12.3-V12.9; V13.3-V13.9; V14.3-V14.9; V19.4-V19.6; V19.9; V20.3-V20.9; V21.3-	Partial	Ridolfo and Stevenson

		V21.9; V22.3-V22.9; V23.3-V23.9; V24.3-V24.9; V25.3-V25.9; V26.3-V26.9; V27.3-V27.9; V28.3-V28.9; V29.4-V29.9; V30.4-V30.9; V31.4-V31.9; V32.4-V32.9; V33.4-V33.9; V34.4-V34.9; V35.4-V35.9; V36.4-V36.9; V37.4-V37.9; V38.4-V38.9; V39.4-V39.9; V40.4-V40.9; V41.4-V41.9; V42.4-V42.9; V43.4-V43.9; V44.4-V44.9; V45.4-V45.9; V46.4-V46.9; V47.4-V47.9; V48.4-V48.9; V49.4-V49.9; V50.4-V50.9; V51.4-V51.9; V52.4-V52.9;V53.4-V53.9;V54.4-V54.9;V55.4-V55.9;V56.4-V56.9;V57.4-V57.9;V58.4-V58.9;V59.4-V59.9;V60.4-V60.9;V61.4-V61.9;V62.4-V62.9;V63.4-V63.9;V64.4-V64.9;V65.4-V65.9;V66.4-V66.9; V67.4-V67.9;V68.4-V68.9;V69.4-V69.9;V70.4-V70.9;V71.4-V71.9;V72.4-V72.9;V73.4-V73.9;V74.4-V74.9;V75.4-V75.9;V76.4-V76.9;V77.4-V77.9;V78.4-V78.9;V79.4-V79.9;V80.3-V80.5; V81.1; V82.1; V82.9; V83.0-V83.3;V84.0-V84.3;V85.0-V85.3;V86.0-V86.3;V87.0-V87.9; V89.2; V89.3; V89.9		(2001)
Road traffic crashes (Non-pedestrian)*		V02.1-V02.9; V03.1-V03.9; V04.1-V04.9; V09.2-V09.3; V06.1	Partial	Ridolfo and Stevenson (2001)
Falls		W00-W19.9	Partial	Corrao et al. (1999)
Drowning		W65-W74.9	Partial	Corrao et al. (1999)
Fires		X00-X09.9	Partial	Corrao et al. (1999)
Accidental poisoning by alcohol	T51.0; T51.1; T51.9	X45; Y15	100%	N/A
Other unintentional injuries (aspiration, occupational machine injuries)		W78; W79; W24-W31.9; W45; W49; W60	Partial	Corrao et al. (1999)

[x] ICD10 codes and ranges not identical to those specified in InterMAHP guide.

* Conditions where we reverted to the more traditional method of calculating alcohol-attributable fractions from relative risks. Otherwise, InterMAHP v2.1 was used.

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Table A3.2: Central, low and high bound estimate alcohol-attributable fractions for mortality by age group, sex, and condition

			Central			Low			High		
			15-34 years	35-64 years	65+ years	15-34 years	35-64 years	65+ years	15-34 years	35-64 years	65+ years
Cancers	Breast cancer	F	0.088	0.114	0.079	0.088	0.114	0.079	0.088	0.114	0.079
	Colorectal cancer	M	0.125	0.202	0.195	0.125	0.202	0.195	0.125	0.202	0.195
		F	0.026	0.036	0.028	0.026	0.036	0.028	0.026	0.036	0.028
	Larnygeal cancer	M	0.207	0.298	0.205	0.207	0.298	0.205	0.207	0.298	0.205
		F	0.127	0.166	0.127	0.127	0.166	0.127	0.127	0.166	0.127
	Liver cancer	M	0.107	0.165	0.141	0.107	0.165	0.141	0.107	0.165	0.141
		F	0.101	0.155	0.197	0.101	0.155	0.197	0.101	0.155	0.197
	Oesophageal cancer	M	0.403	0.518	0.393	0.403	0.518	0.393	0.403	0.518	0.393
		F	0.280	0.340	0.262	0.280	0.340	0.262	0.280	0.340	0.262
	Oral cavity & pharynx cancer	M	0.362	0.493	0.345	0.362	0.493	0.345	0.362	0.493	0.345
		F	0.221	0.280	0.203	0.221	0.280	0.203	0.221	0.280	0.203
	Pancreatic cancer	M	0.043	0.077	0.085	0.043	0.077	0.085	0.043	0.077	0.085
		F	0.021	0.030	0.029	0.021	0.030	0.029	0.021	0.030	0.029
	Stomach cancer	M	0.015	0.020	0.015	0.015	0.020	0.015	0.015	0.020	0.015
		F	0.018	0.019	0.011	0.018	0.019	0.011	0.018	0.019	0.011
Cardiovascular diseases	Alcoholic cardiomyopathy	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Atrial fibrillation & cardiac arrhythmia	M	0.081	0.123	0.077	0.081	0.123	0.077	0.081	0.123	0.077
		F	0.048	0.062	0.043	0.048	0.062	0.043	0.048	0.062	0.043
	Haemorrhagic stroke	M	0.107	0.165	0.127	0.107	0.165	0.127	0.107	0.165	0.127
		F	0.140	0.187	0.152	0.140	0.187	0.152	0.140	0.187	0.152
	Hypertension	M	0.152	0.207	0.154	0.152	0.207	0.154	0.152	0.207	0.154
		F	0.047	0.068	0.038	0.047	0.068	0.038	0.047	0.068	0.038
	Ischaemic heart disease	M	0.037	0.060	0.056	-0.026	-0.004	-0.038	0.035	0.079	0.073
		F	0.007	0.031	0.035	0.007	0.031	0.035	0.054	0.091	0.096
	Ischaemic stroke	M	-0.036	-0.036	-0.069	-0.036	-0.036	-0.069	0.020	0.041	0.032
		F	-0.137	-0.195	-0.206	-0.137	-0.195	-0.206	0.014	0.025	0.009
	Oesophageal varices	M	0.508	0.670	0.526	0.508	0.670	0.526	0.508	0.670	0.526
		F	0.609	0.678	0.618	0.609	0.678	0.618	0.609	0.678	0.618
	Unspecified stroke	M	-0.036	-0.036	-0.069	-0.036	-0.036	-0.069	0.020	0.041	0.032
		F	-0.137	-0.195	-0.206	-0.137	-0.195	-0.206	0.014	0.025	0.009
Communicable diseases	HIV	M	0.021	0.042	0.015	0.021	0.042	0.015	0.021	0.042	0.015
		F	0.011	0.017	0.006	0.011	0.017	0.006	0.011	0.017	0.006
	Lower respiratory tract infections	M	0.066	0.100	0.063	0.066	0.100	0.063	0.066	0.100	0.063
		F	0.039	0.051	0.034	0.039	0.051	0.034	0.039	0.051	0.034
	Tuberculosis	M	0.287	0.411	0.266	0.287	0.411	0.266	0.287	0.411	0.266
		F	0.163	0.210	0.139	0.163	0.210	0.139	0.163	0.210	0.139
Digestive diseases	Acute pancreatitis	M	0.219	0.329	0.269	0.219	0.329	0.269	0.219	0.329	0.269
		F	0.005	0.062	0.104	0.005	0.062	0.104	0.093	0.161	0.183
	Alcoholic gastritis	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcoholic Liver cirrhosis	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

			Central			Low			High		
			15-34 years	35-64 years	65+ years	15-34 years	35-64 years	65+ years	15-34 years	35-64 years	65+ years
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcohol-induced pancreatitis	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Chronic pancreatitis	M	0.305	0.439	0.336	0.305	0.439	0.336	0.305	0.439	0.336
		F	0.196	0.266	0.255	0.196	0.266	0.255	0.196	0.266	0.255
	Liver cirrhosis	M	0.508	0.670	0.526	0.508	0.670	0.526	0.508	0.670	0.526
		F	0.609	0.678	0.618	0.609	0.678	0.618	0.609	0.678	0.618
Endocrine diseases	Alcohol-induced pseudo-Cushing's syndrome	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Diabetes mellitus	M	0.013	0.025	0.027	0.013	0.025	0.027	0.013	0.026	0.027
		F	-0.171	-0.209	-0.145	-0.171	-0.209	-0.145	0.007	0.014	0.024
Neuropsychiatric conditions	Alcohol abuse	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcohol dependence	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcoholic myopathy	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcoholic polyneuropathy	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcoholic psychoses	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Degeneration of nervous system due to alcohol	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Epilepsy	M	0.185	0.272	0.172	0.185	0.272	0.172	0.185	0.272	0.172
		F	0.107	0.138	0.092	0.107	0.138	0.092	0.107	0.138	0.092
Intentional injuries	Assault	M	0.190	0.212	0.108	0.190	0.212	0.108	0.190	0.212	0.108
		F	0.145	0.118	0.049	0.145	0.118	0.049	0.145	0.118	0.049
	Intentional self-harm	M	0.130	0.110	0.040	0.130	0.110	0.040	0.130	0.110	0.040
		F	0.110	0.090	0.050	0.110	0.090	0.050	0.110	0.090	0.050
	Intentional self-poisoning by alcohol	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	0.145	0.118	0.049	0.145	0.118	0.049	0.145	0.118	0.049
Unintentional injuries	Accidental poisoning by alcohol	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Drowning	M	0.154	0.179	0.093	0.154	0.179	0.093	0.154	0.179	0.093
		F	0.113	0.097	0.044	0.113	0.097	0.044	0.113	0.097	0.044
	Falls	M	0.154	0.179	0.093	0.154	0.179	0.093	0.154	0.179	0.093
		F	0.113	0.097	0.044	0.113	0.097	0.044	0.113	0.097	0.044
	Fires	M	0.154	0.179	0.093	0.154	0.179	0.093	0.154	0.179	0.093
		F	0.113	0.097	0.044	0.113	0.097	0.044	0.113	0.097	0.044
	Other unintentional injuries	M	0.308	0.357	0.187	0.308	0.357	0.187	0.308	0.357	0.187
		F	0.227	0.194	0.088	0.227	0.194	0.088	0.227	0.194	0.088
	MVC non-pedestrians	M	0.240	0.170	0.095	0.240	0.170	0.095	0.240	0.170	0.095
		F	0.125	0.075	0.025	0.125	0.075	0.025	0.125	0.075	0.025
	MVC pedestrians	M	0.400	0.345	0.230	0.400	0.345	0.230	0.400	0.345	0.230

			Central			Low			High		
			15-34 years	35-64 years	65+ years	15-34 years	35-64 years	65+ years	15-34 years	35-64 years	65+ years
		F	0.190	0.120	0.030	0.190	0.120	0.030	0.190	0.120	0.030

F = female: M = male: MVC = motor vehicle collision. Not shown: Assault for 0-14 year olds.

Table A3.3: Central, low and high bound estimate alcohol-attributable fractions for morbidity by age group, sex, and condition

			Central			Low			High		
			15-34 years	35-64 years	65+ years	15-34 years	35-64 years	65+ years	15-34 years	35-64 years	65+ years
Cancers	Breast cancer	F	0.088	0.114	0.079	0.088	0.114	0.079	0.088	0.114	0.079
	Colorectal cancer	M	0.125	0.202	0.195	0.125	0.202	0.195	0.125	0.202	0.195
		F	0.026	0.036	0.028	0.026	0.036	0.028	0.026	0.036	0.028
	Larnygeal cancer	M	0.207	0.298	0.205	0.207	0.298	0.205	0.207	0.298	0.205
		F	0.127	0.166	0.127	0.127	0.166	0.127	0.127	0.166	0.127
	Liver cancer	M	0.107	0.165	0.141	0.107	0.165	0.141	0.107	0.165	0.141
		F	0.101	0.155	0.197	0.101	0.155	0.197	0.101	0.155	0.197
	Oesophageal cancer	M	0.403	0.518	0.393	0.403	0.518	0.393	0.403	0.518	0.393
		F	0.280	0.340	0.262	0.280	0.340	0.262	0.280	0.340	0.262
	Oral cavity & pharynx cancer	M	0.362	0.493	0.345	0.362	0.493	0.345	0.362	0.493	0.345
		F	0.221	0.280	0.203	0.221	0.280	0.203	0.221	0.280	0.203
	Pancreatic cancer	M	0.043	0.077	0.085	0.043	0.077	0.085	0.043	0.077	0.085
		F	0.021	0.030	0.029	0.021	0.030	0.029	0.021	0.030	0.029
	Stomach cancer	M	0.015	0.020	0.015	0.015	0.020	0.015	0.015	0.020	0.015
		F	0.018	0.019	0.011	0.018	0.019	0.011	0.018	0.019	0.011
Cardiovascular diseases	Alcoholic cardiomyopathy	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Atrial fibrillation & cardiac arrhythmia	M	0.081	0.123	0.077	0.081	0.123	0.077	0.081	0.123	0.077
		F	0.048	0.062	0.043	0.048	0.062	0.043	0.048	0.062	0.043
	Haemorrhagic stroke	M	0.119	0.183	0.137	0.119	0.183	0.137	0.119	0.183	0.137
		F	-0.175	-0.183	-0.140	-0.175	-0.183	-0.140	0.034	0.062	0.070
	Hypertension	M	0.152	0.207	0.154	0.152	0.207	0.154	0.152	0.207	0.154
		F	0.047	0.068	0.038	0.047	0.068	0.038	0.047	0.068	0.038
	Ischaemic heart disease	M	0.025	0.035	0.011	-0.107	-0.168	-0.176	0.000	0.000	0.000
		F	-0.193	-0.288	-0.264	-0.193	-0.288	-0.264	0.008	0.014	0.011
	Ischaemic stroke	M	-0.038	-0.041	-0.071	-0.038	-0.041	-0.071	0.018	0.036	0.027
		F	-0.069	-0.098	-0.099	-0.069	-0.098	-0.099	0.005	0.008	0.003
	Oesophageal varices	M	0.301	0.438	0.375	0.301	0.438	0.375	0.301	0.438	0.375
		F	0.473	0.550	0.515	0.473	0.550	0.515	0.473	0.550	0.515
	Unspecified stroke	M	-0.038	-0.041	-0.071	-0.038	-0.041	-0.071	0.018	0.036	0.027
		F	-0.069	-0.098	-0.099	-0.069	-0.098	-0.099	0.005	0.008	0.003
Communicable diseases	HIV	M	0.021	0.042	0.015	0.021	0.042	0.015	0.021	0.042	0.015
		F	0.011	0.017	0.006	0.011	0.017	0.006	0.011	0.017	0.006
	Lower respiratory tract infections	M	0.066	0.100	0.063	0.066	0.100	0.063	0.066	0.100	0.063
		F	0.039	0.051	0.034	0.039	0.051	0.034	0.039	0.051	0.034
	Tuberculosis	M	0.287	0.411	0.266	0.287	0.411	0.266	0.287	0.411	0.266
		F	0.163	0.210	0.139	0.163	0.210	0.139	0.163	0.210	0.139
Digestive diseases	Acute pancreatitis	M	0.219	0.329	0.269	0.219	0.329	0.269	0.219	0.329	0.269
		F	0.005	0.062	0.104	0.005	0.062	0.104	0.093	0.161	0.183
	Alcoholic gastritis	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcoholic liver cirrhosis	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

			Central			Low			High		
			15-34 years	35-64 years	65+ years	15-34 years	35-64 years	65+ years	15-34 years	35-64 years	65+ years
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcohol-induced pancreatitis	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Chronic pancreatitis	M	0.305	0.439	0.336	0.305	0.439	0.336	0.305	0.439	0.336
		F	0.196	0.266	0.255	0.196	0.266	0.255	0.196	0.266	0.255
	Liver cirrhosis	M	0.301	0.438	0.375	0.301	0.438	0.375	0.301	0.438	0.375
		F	0.473	0.550	0.515	0.473	0.550	0.515	0.473	0.550	0.515
Endocrine diseases	Alcohol-induced pseudo-Cushing's syndrome	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Diabetes mellitus	M	0.013	0.025	0.027	0.013	0.025	0.027	0.013	0.026	0.027
		F	-0.171	-0.209	-0.145	-0.171	-0.209	-0.145	0.007	0.014	0.024
Neuropsychiatric conditions	Alcohol abuse	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcohol dependence	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcoholic myopathy	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcoholic polyneuropathy	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Alcoholic psychoses	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Degeneration of nervous system due to alcohol	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Epilepsy	M	0.185	0.272	0.172	0.185	0.272	0.172	0.185	0.272	0.172
		F	0.107	0.138	0.092	0.107	0.138	0.092	0.107	0.138	0.092
Intentional injuries	Assault	M	0.190	0.212	0.108	0.190	0.212	0.108	0.190	0.212	0.108
		F	0.145	0.118	0.049	0.145	0.118	0.049	0.145	0.118	0.049
	Intentional self-harm	M	0.130	0.110	0.040	0.130	0.110	0.040	0.130	0.110	0.040
		F	0.110	0.090	0.050	0.110	0.090	0.050	0.110	0.090	0.050
	Intentional self-poisoning by alcohol	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Unintentional injuries	Accidental poisoning by alcohol	M	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		F	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Drowning	M	0.154	0.179	0.093	0.154	0.179	0.093	0.154	0.179	0.093
		F	0.113	0.097	0.044	0.113	0.097	0.044	0.113	0.097	0.044
	Falls	M	0.154	0.179	0.093	0.154	0.179	0.093	0.154	0.179	0.093
		F	0.113	0.097	0.044	0.113	0.097	0.044	0.113	0.097	0.044
	Fires	M	0.154	0.179	0.093	0.154	0.179	0.093	0.154	0.179	0.093
		F	0.113	0.097	0.044	0.113	0.097	0.044	0.113	0.097	0.044
	Other unintentional injuries	M	0.308	0.357	0.187	0.308	0.357	0.187	0.308	0.357	0.187
		F	0.227	0.194	0.088	0.227	0.194	0.088	0.227	0.194	0.088
	MVC non-pedestrians	M	0.240	0.170	0.095	0.240	0.170	0.095	0.240	0.170	0.095
		F	0.125	0.075	0.025	0.125	0.075	0.025	0.125	0.075	0.025
	MVC pedestrians	M	0.400	0.345	0.230	0.400	0.345	0.230	0.400	0.345	0.230
		F	0.190	0.120	0.030	0.190	0.120	0.030	0.190	0.120	0.030

F = female: M = male: MVC = motor vehicle collision: Not shown: Assault for 0-14 year olds.

APPENDIX CHAPTER 4: PRIMARY CARE & NON-ADMITTED PATIENT HEALTH CARE COSTS

Appendix 4.1

Table A4.1: Areas of expenditure included and excluded in the disease expenditure analysis

Area of expenditure	Inclusions	Exclusions
Hospitals	Cost of services for: • Admitted patients in public, private, and psychiatric hospitals • Public emergency departments • Public outpatient clinics	Costs for: • Highly Specialised Drugs
Referred and unreferred medical services	Cost of services provided by, or on behalf of, registered medical practitioners that are fundedby: • Medicare Benefits Schedule (MBS) • MBS co-payments and other out-of-hospital payments • Department of Veterans' Affairs	Costs for: • Residential aged care • Health administration, health aids and appliances,and patient transport (ambulance) • Private health insurance funds • Australian Government premium rebates allocated to medical services • Compulsory motor vehicle third-party insurance • Non-MBS medical services (such as provision of vaccines for overseas travel)
Benefit paid pharmaceuticals and all other medications	Costs for: • Pharmaceutical Benefits Scheme (PBS) • Repatriation Pharmaceutical BenefitsScheme (RPBS) • Under co-payment prescriptions (those pharmaceuticals listed in the PBS and RPBS, the total costs of which are equal to or less than the statutory patient contribution for the class of patient concerned) • Highly Specialised Drugs	Costs for: • Over-the-counter drugs (including pain medications, sexual health products, vitamins and herbs) • Private prescriptions (pharmaceuticals dispensed through private prescriptions that do not fulfil the criteria for payment or benefit under the PBS or RPBS).
Dental	Costs • Dental services funded through the MBS • Self-funded dental services	Nil
Other health practitionersand community health services	Costs for services funded through the MBS	Costs for self-funded services as categories of expenditure for allied health practitioners are aggregated
Public health	Nil	Excluded because not possible to allocate to specific diseases
Capital expenditure	Nil	Excluded because not possible to allocate to specific diseases

Indirect costs	Nil	Costs include: • Loss of productivity • Travel costs of patients • Costs incurred by carers and family • Informal community care costs • Costs relating to lost quantity and quality of life • Community non-health services costs (for example, home help, Meals on Wheels)

Source: Disease Expenditure Study: Overview of analysis and methodology (Australian Institute of Health and Welfare, 2019c)

Table A4.2: Impact of alcohol protective effects for ischemic heart disease under different risk-function assumptions

Cost area	2017/18 Cost ($) Zhao	2017/18 Cost ($) RR	2017/18 Cost ($) No Protect
Allied health and other services	68,012,528	68,209,481	70,634,399
General practitioner services	82,910,266	90,300,024	105,303,351
Medical imaging	52,636,565	54,524,452	57,093,799
Pathology	11,238,943	13,472,258	20,676,087
Pharmaceutical benefits scheme	81,356,484	104,490,885	144,829,916
Private hospital services	166,426,104	252,778,725	326,425,153
Public hospital admitted patient [a]	*513,733,630*	*587,173,389*	*700,369,694*
Public hospital emergency department	211,962,564	227,548,031	243,780,006
Public hospital outpatient	209,580,209	219,063,356	240,726,575
Specialist services	23,634,591	33,001,571	42,265,155
Dental expenditure	44,544,994	45,730,613	67,345,530
All areas	**952,303,246**	**1,109,119,396**	**1,319,079,970**

[a] Not included in the total as these are inpatient costs.
No protect = Ischemic heart disease "protective effects" from Zhao et al (2017) set to relative risk = 1.0.
RR = Ischemic heart disease protective effects estimates from Roerecke and Rehm (2010, 2011, 2012).
Zhao = Ischemic heart disease protective effects estimates from Zhao et al. (2017).

Table A4.3: Other alcohol-attributable ED presentations using the proportion of hospital separations as a proxy for ED presentations

Principal Diagnosis Chapter	Total hospital separations	Alcohol-attributable separations	% alcohol-attributable	Total ED presentations	Alcohol-attributable ED presentations	Codes used
F00–F99 – Mental and behavioural disorders	467,161	59,577	12.753	286,985	36,599	All 'F10' codes
I00–I99 – Diseases of the circulatory system	583,914	133	0.023	343,290	78	I42.6 - Alcoholic cardiomyopathy
K00–K93 – Diseases of the digestive system	1,068,250	11,742	1.099	428,141	4,706	K29.2, K70, K85.2 and K86.0
O00–O99 – Pregnancy, childbirth & puerperium	517,363	10	0.002	103,732	2	Q86.0 - FASD
Total		**71,462**			**41,385.41**	

Table A4.4: Summary of cost methods for alcohol plus comparison with tobacco

Domain	Alcohol			Tobacco		
	Central	Low	High	Central	Low	High
Ambulance	Mean	HCP	SDS	HCP	-	-
ED	Mean	DES	SDS	HCP	-	-
Non-admitted	Mean	HCP	DES	HCP	-	-
Unreferred primary	Mean	DES	HCP	SDS	-	-
Referred primary (e.g. imaging / allied / specialist)	Mean	DES	HCP	NE [a]	NE [a]	NE [a]
Community mental health	SDS	-	HCP	NE [a]	NE [a]	NE [a]
Specialist drug treatment	Mean	SDS	SDS	NE [a]	NE [a]	NE [a]
Pharmaceuticals	Mean	DES	HCP	SDS	-	HCP
Cessation mediations	NE	NE	NE	SDS	-	-
Dental services	DES	-	HCP	NE [a]	NE	NE
Residential / aged care	HCP	-	-	HCP	-	-
Informal care	SDS	SDS	SDS	SDS	SDS	SDS

[a] The Tobacco report estimated the costs for referral to specialists but not the cost for imaging and pathology, which were not available at the time (Whetton et al., 2019).
DES = Disease Expenditure study: HCP = Hospital cost proportion: NE = not estimated: SDS = specific data set.

Table A4.5: Full range of estimated values of informal care

	Central estimate	Low bound	High bound
Central (mean)	332,987,622	317,575,515	414,337,906
Low (Australian Bureau of Statistics method)	290,613,995 [a, d]	277,163,123 [b, e]	361,612,223 [c, f]
High (Deloitte Access Economic method)	375,361,248 [a, g]	357,987,907 [b, g]	467,063,589 [c, g]

Sources: (Deloitte Access Economics, 2015): (Australian Bureau of Statistics, 2021).
[a] alcohol attributed care 0.592%.
[b] alcohol attributed care 0.565%.
[c] alcohol attributed care 0.737%.
[d] number needing care 3,929.
[e] number needing care 3,747.
[f] number needing care 4,889.
[g] Deloitte estimated cost-base $63,355,683,761.

APPENDIX CHAPTER 5: WORKPLACE COSTS

Appendix 5.1: Safe Work Australia's incident approach methodology

Safe Work Australia's incidence approach assessed the number of people entering the compensation system during 2012/13 as a result of a work-related incident and the costs (both current and expected future costs) associated with those cases. To estimate total costs, the expected future lifetime cost of each new case was used to represent the cost of cases in the reference year that were already in the compensation system (Safe Work Australia, 2015).

Appendix 5.2: Safe Work Australia's cost estimation methodology

The cost estimation methodology utilised by Safe Work Australia (2015) was based on the concept of the 'human cost' of occupational injury with only costs associated with actual injuries including:

- Production costs – costs incurred in the short term until production is returned to pre-incident levels;
- Human capital costs – long run costs, such as loss of potential output, occurring after a restoration of pre-incident production levels;
- Medical costs – costs incurred by workers and the community though medical treatment of workers injured in work-related incidents;
- Administrative costs – costs incurred in administering compensation schemes, investigating incidents and legal costs;
- Transfer costs – deadweight losses associated with the administration of taxation and welfare payments; and,
- Other costs – costs not classified in other areas, such as the cost of carers and aids and modifications (Safe Work Australia, 2015).

APPENDIX CHAPTER 9: INTERNALITIES

Appendix A9.1

Table A9.1: Full range of estimated values of disability adjusted life years lost to alcohol dependence

Value of a statistical life year used as multiplier	Number of disability adjusted life years lost		
	Central estimate (67,053)	Low bound (49,700)	High bound (88,330)
Central ($309,157)	$20,730,614,727	$15,365,553,971	$27,308,586,347
Low ($47,269)	$3,169,534,354	$2,349,262,278	$4,175,250,166
High ($872,275)	$58,488,768,079	$43,351,937,916	$77,047,670,533

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