The Social Costs of Methamphetamine in Australia 2013/14

National Drug Research Institute, Curtin University

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Preventing harmful drug use in Australia

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THE SOCIAL COSTS OF METHAMPHETAMINE IN AUSTRALIA 2013/14

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CORRIGENDUM

In reviewing the methods used in the analysis of tobacco related costs, we decided that the measure of a daily wage for full-time workers would be more appropriate that the wage for all workers used in the methamphetamine analysis that is, the latter would be too low. To enable the comparison of costs between reports we have updated these values in the methamphetamine study for the costs of workplace absence due to methamphetamine consumption. Below we report the updated values for Tables 10.10, 10.12 and 10.13. In addition, the revised total for chapter 10b has added to the executive Summary Table 1, increasing the total by just over $18 million. The values in original report have not been modified, and we believe should still provide a better estimate with respect to methamphetamine users.

Table 10.10: Rates of drug related absenteeism among methamphetamine users and associated costs

Method 1: Self-reported absence due to drug use				
Illicit drug Use	**Estimated population**	**% Absent due to drug use**	**Total days absent due to drug use**	**Cost ($) [a]**
None (abstainers)	8,278,476	-	-	-
Methamphetamine	231,893 [b]	29.1%	124,880	83,486,117
Other drugs	1,348,801	5.4%	616,120	485,595,336

[a] Number of days lost due to drug use multiplied by $360.02 (2013 average daily wage plus 20% employer on-costs); [b] estimated number in the workplace (Pidd and Roche, 2015b)

To account for drug related absenteeism due to the non-medical use of the drugs detailed in Table 10.11 (see original text), the figure for methamphetamine is then adjusted down by a factor of 3.892. This gives a total of **$21.5 million.**

Table 10.12 reports on a second method of estimating the costs of workplace absenteeism. The same adjustment factor is applied to this total to give a value of **$92.0 million**

Table 10.12: Rates of drug related absenteeism among methamphetamine users and associated costs

Method 2: Illness/injury absence attributable to drug use				
Illicit drug use	**Mean days absent due to illness/injury**	**Mean difference [a]**	**Excess absence [b]**	**Cost ($) [c]**
None (abstainers)	8.77	-	-	-
Methamphetamine	13.06	4.29	994,444	58,019,728
Other drugs	10.61	1.84	2,486,055	895,029,521

[a] Mean days absent due to illness/injury for drug users minus mean days absent for abstainers
[b] Difference in mean absence multiplied by estimated population
[c] Excess absence multiplied by $360.02 (2013 average daily wage plus 20% employer on-costs)

These new values are then added to the Chapter 10 summary table (Table 10.13) as the low and high bound estimate: the mean is used as the central estimate.

Table 10.13: Summary Chapter 10B costs

Cost area	Central estimate ($000,000)	Low bound ($000,000)	High bound ($000,000)
Occupational injury	[a] 250.90	[c]	[d]
Absenteeism	[b] 56.73	21.45	92.00
Total	**307.63**	**272.35**	**342.90**

[a] $48.6 million employer costs + $202.3 million community costs ($558.4 employee costs listed as internalities); [b] mid-point of estimate range; [c] Low bound estimate – duplicated central estimate: [d] High bound estimate – duplicated central estimate

Below, the revised values for Chapter 10 were then added to the Executive Summary Table 1.

Summary Table 1: Summary of methamphetamine attributable costs

Domain	Best estimate ($000,000)
Prevention, harm reduction & treatment - Chapter 4	110.7
Health care (e.g. hospitals, GPs ambulance) - Chapter 5	200.1
Premature mortality - Chapter 6	781.8
Crime (includes police, courts, prisons & victims) - Chapter 7	3,244.5
Child maltreatment & protection - Chapter 8	260.4
Clandestine laboratories & production - Chapter 9	11.7
Road crash cost - Chapter 10A	125.2
Workplace accidents & productivity - Chapter 10B	307.63
Total	**5,042.03**

SUMMARY

Robert J Tait & Steve Allsop

Major Cost Areas

Australia has one of the highest documented rates of methamphetamine use in the world, with about 2.1% of the population aged 14 years and over reporting they have used methamphetamine in the past year. Recent changes in the purity and form of methamphetamine have resulted in a significant rise in public concern and media interest in the harms associated with the consumption of methamphetamine. As documented in this report, methamphetamine consumption is associated with a diverse range of harms and costs to individual drug users, their families and wider society.

The objective of this project was to estimate the cost of methamphetamine use to Australia for a specific year (2013/14) rather than the future costs arising from use in that year, due to limitations in the available data and the level of uncertainly concerning future outcomes. Thus, other than years of life lost due to premature mortality, the costs do not include costs for treating chronic health conditions or lower levels of productivity over the lifespan. The harms and costs of drug use are substantially increased for dependent drug users compared with other users (Moore, 2007). We based our analyses on an estimated 160,000 dependent methamphetamine users and 108,000 regular non-dependent users (Degenhardt et al., 2016a). There are also estimated to be 240,995 people in Australia who use methamphetamine occasionally (Australian Institute of Health and Welfare, 2014a). Finally, we excluded the private costs incurred by non-dependent methamphetamine users. However, the private costs or the "internalities" of dependent drug use were quantified but not added to the overall total.

The report identified a range of prevention, supply reduction, harm reduction and treatment initiatives targeting the use of methamphetamine. In 2013/14 school based programs were the major prevention approach, with no substantial general population programs being identified in that year. Supply reduction programs were evident at the local level, through jurisdiction level policing or initiatives such as ProjectStop, which aims to limit access to precursor chemicals through the purchase of some over-the-counter medicines. Nationally, there were initiatives to regulate the commercial supply of chemicals and products that could be used in clandestine laboratories. The major harm reduction initiatives were existing programs that aim to reduce harms from injecting drug use (e.g. needle and syringe programs) that also involve some users of methamphetamine. However, treatment programs, such as withdrawal management, counselling services and residential rehabilitation, were the largest cost items in this area. Chapter 4 provides costing for these items (also see Summary Table 1).

Considerable media attention has focused on the consequences of methamphetamine use in hospital emergency departments, especially relating to psychotic episodes. However, the largest cost area we identified was inpatient hospitalisations followed by treatment for blood borne viruses. In common with other areas of the report, identifying costs due to methamphetamine use is problematic. First, diagnostic codes identify *stimulant* use (in Australia this is predominantly methamphetamine) and, second, most diagnostic codes are disease specific rather than substance specific. It is therefore likely that the estimate of $200.1 million in hospital and other general treatment costs misses cases involving methamphetamine.

In addition to morbidity, we identified deaths in 2013/14 partly or wholly due to methamphetamine use. These cases were identified via the National Coronial Information System (NCIS). Forensic pathologists identified 116 cases where methamphetamine was a direct cause (e.g. drug toxicity) and a further 175 where it was a substance producing injury (e.g. multiple drug toxicity), where we allocated a fraction to the total cases. This gave a total of 170.2 deaths. However, it should be noted that not all cases in the NCIS for 2013/14 had been finalised, including cases still before the courts, which means that homicides are likely to be under-represented. We also noted that the number of deaths attributed to suicide (n=55.75) was markedly lower than would be expected based on the attributable fraction method (n=114.7) for suicide deaths in this population (Degenhardt et al., 2013) with the alternative AF based estimate used in the upper bound cost estimate. As discussed in Chapter 6, the cost of these premature deaths was estimated at $781.8 million – the second highest cost area.

The costs relating to the criminal justice system (police, justice and imprisonment) was the single largest contributor to costs in this study ($3,244.5 million): this represents about 65% of total costs. There is no source for state police costs for crimes associated with drug use. However, the Drug Use Monitoring in Australia (DUMA) surveys of police detainees are widely used (Coghlan et al., 2015) and these formed the basis of our allocation of the fraction of each category of offence to methamphetamine and, hence, the estimate of $836.9 million police costs due to the use of methamphetamine. As with the police costs, there are no summary court costs for relevant cases, so these were also approximated via the DUMA data, with a total cost of $97.4 million. There are further costs from public prosecution and legal aid services relating to the judicial arena. Notable omissions from the estimate are the costs relating to juvenile offenders, where data are too sparse to allow estimation, and Federal Police/Border Protection Services, where overall budgets were available but with no reliable method identified for allocating a proportion to methamphetamine-related activity.

The costs of correctional services was estimated from Australian Bureau of Statistics reports on the number of prisoners (2014c) combined with the cost of prisons (Steering Committee for the Review of Government Service Provision, 2015a) to give a cost per prisoner of $106,601. Further costs accrued through community corrections (Australian Bureau of Statistics, 2014b) and lost productivity of those imprisoned. Some small-scale, offsetting savings in terms of reduced government payments were identified. The resulting final estimate was $970.4 million. There is a further $1,255.3 million related to the costs to victims of personal or household crime attributable to methamphetamine use.

Data from the United States (US) that considered lifetime costs, identified child endangerment as one of the most critical impacts of methamphetamine use, with only premature deaths/intangible cost of dependence and judicial costs exceeding this issue (Nicosia et al., 2009). However, in constructing the Australian estimate, we relied on small, potentially idiosyncratic samples. Nevertheless, we estimate that approximately 6.5% (n=2657) of substantiated child protection cases arise from methamphetamine use, with costs of about $259.8 million in 2013/14. There were further costs arising from Child Death Review proceedings. This is an area that would clearly benefit from collaboration between researchers and government agencies to provide greater clarity on the harms to children from substance use by family members.

We did not identify any child protection cases arising from exposure to clandestine methamphetamine laboratories, although this has been identified as a particularly high-risk setting for young children (Messina and Jeter, 2012). However, information on clandestine laboratories, rather than child protection data, suggests that about 426 children would have been present in the laboratories detected in 2013/14. In addition to the hazards to these children, manufacturers ("cooks"), family members, neighbours, bystanders and emergency services are at risk of exposure to toxic chemicals and other harms, such as explosions and hazardous waste. The assessment and remediation of contaminated sites was thought to cost about $10 million.

In addition to health costs and premature mortality, those who use methamphetamine are more likely to be involved in other accident events, such as road traffic crashes. Extrapolating from the 1.86% of crash deaths in the NCIS attributed to methamphetamine, this figure was applied to data on compensation payments, hospital separations and property damage from crashes, to arrive at a figure of $125.2 million.

Accidents, injuries and poor health impact on work productivity. National datasets on workplace compensation and injuries were used to generate estimates on more severe injuries – those resulting in absence from work. Based on an odds ratio of 3.4 for occupational injury following drug use (Li et al., 2011) and Australian workplace drug testing information, from 374,500 injuries, costing $26,284 million, $809 million was attributed to methamphetamine. Those who use illicit drugs are also likely to have more days absent from work. Using data from the National Drug Strategy Household Survey (NDSHS) (Australian Institute of Health and Welfare, 2014a), absenteeism among methamphetamine users was thought to result in workplace costs of about $38.5 million. The total social cost in this area was $289.4 million, as $558.4 million in lost wages was deemed an internality (see Chapter 13).

Summary Table 1: Summary of methamphetamine attributable costs

Domain	**Best estimate ($000,000)**
Prevention, harm reduction & treatment - Chapter 4	110.7
Health care (e.g. hospitals, GPs ambulance) - Chapter 5	200.1
Premature mortality - Chapter 6	781.8
Crime (includes police, courts, prisons & victims) - Chapter 7	3,244.5
Child maltreatment & protection - Chapter 8	260.4
Clandestine laboratories & production - Chapter 9	11.7
Road crash cost - Chapter 10A	125.2
Workplace accidents & productivity - Chapter 10B	289.4
Total	[a] **5,023.8**

[a] Without rounding $5,023,795,786

Before commencing this analysis, we were aware of some of the unique costs that those living in regional, rural and remote areas of Australia encounter in addressing the harms of methamphetamine use. While some national data (e.g. NCIS) should be free of geographical biases, virtually all other data will be less comprehensive or subject to greater margins of error in these communities. Addressing this limitation was beyond the remit of this project. However, we did undertake qualitative work in two sites to draw attention to the unique challenges of those outside metropolitan settings, although there was not an attempt to quantify these findings (see Chapter 11).

Tentative Additional Costs

There is increasing interest in the harms incurred by people exposed to substance use by others, in particular alcohol (Laslett et al., 2015). However, this field is very much at a formative stage in relation to illicit drug use. Therefore, we acknowledge the speculative and exploratory nature of this aspect of the analysis. We focused only on potential harms to resident partners and children of dependent methamphetamine users. Using data from the NDSHS and the estimate of 160,000 people dependent on methamphetamine, a total of about 15,000 - 45,000 partners and 30,000 – 121,000 children are believed to be impacted. Extrapolating from research for persons with alcohol dependence (Laslett et al., 2010; Salize et al., 2013), the estimated harms incurred by partners and children were respectively assigned one third and one half of the harms that a dependent user incurs in terms of disability adjusted life years. Depending on the value assigned to each life year lost to disability, this gives an estimate of between \$137.4 million and \$2,568.2 million for partners and between \$366.1 million and \$9,710.9 million for children (with the greater range caused by the two alternative estimates of the number of affected children). We also acknowledge the potential for overlap with victim of crime costs and child protection costs in these figures; thus this exploratory analysis was not included in the overall cost (Summary Table 2).

The correct apportionment of "internalities" in social cost studies of alcohol and other drug use has been subject to considerable debate. We decided to enumerate these costs, but not to include them in the overall total. In the US, the intangible costs of drug dependence attributable to methamphetamine was more than half the total cost (US\$12,597 million out of US\$23,384 million (Nicosia et al., 2009)). We undertook two approaches to calculating these costs. The estimate based on the reduced quality of life for the dependent user produced a total of \$8,611.7 million – greater than all other costs combined. The estimate based on expenditure and other costs summed to \$2,173.1 million (Summary Table 2).

Summary Table 2: Summary of tentative estimates and "internalities" of methamphetamine use

Domain	**Estimated costs (\$000,000)**
Partners and children – harms to others - Chapter 12	[a] 503.4 - [b] 12,279.2
Internalities - Chapter 13	[c] 2,108.3 - [d] 8,611.7

[a] Implied Pharmaceutical Benefits Scheme threshold estimate (Community Affairs References Committee, 2015); *[b]* US value of a statistical life year estimate (US Department of Transportation, 2015); *[c]* Cost based approach; [d] Value of a statistical life year estimate (Abelson, 2008)

Limitations

In considering these figures there are a range of limitations that should be taken into account. Among illicit drug users, poly-drug use is the norm, which means that even with the most conscientious efforts to estimate costs for methamphetamine alone, this will inevitably include a proportion of costs from other drugs (including tobacco and alcohol). We drew our evidence from both research and administrative datasets covering national populations through to limited samples. Each dataset has caveats to its use and the validity of assumptions made about the specific data can be questioned. Thus, it is more appropriate to examine the findings and interrogate their robustness individually rather than as an overall total. In all areas of the analysis we encountered difficulties with limited or non-specific data; in some instances we were simply not able to assign a quantum to methamphetamine, even though it was obvious that there were some relevant costs.

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CHAPTER 1: INTRODUCTION

Rebecca McKetin, Robert J Tait & Steve Whetton

1.1 Background

Methamphetamine belongs to a family of drugs referred to as amphetamine-type stimulants (ATS), which also includes the stimulant drugs amphetamine and ecstasy. In Australia, methamphetamine is sold under various street names including "meth", "ice", "crystal", "shard", "crack" [1], "tina", "fire", "speed" and "base". It is a synthetic drug that is produced in clandestine laboratories, both within and outside Australia, from chemicals, some of which have legitimate purposes, including, for example, ingredients used in decongestant medications (i.e., ephedrine and pseudoephedrine). Methamphetamine (and amphetamine) has a long history as a drug used in combat and in the pharmaceutical industry prior to control under international drug conventions. Medicinal use of methamphetamine (e.g. treatment of narcolepsy), has been largely superseded by similar acting drugs with lower dependence liability and safer risk profiles, although illicit use continues.

Illicit methamphetamine use is a public health and social concern both in Australia and internationally and concern has recently grown in Australia and other parts of the world. Global seizures have shown marked increases, from 34 tons in 2009 to 88 tons in 2013 (United Nations Office on Drugs and Crime, 2015). Worldwide, between 13.9 million and 53.4 million people reportedly use methamphetamine, or its less potent chemical cousin, amphetamine (0.3-1.0% past year use for 15-64 year olds) (United Nations Office on Drugs and Crime, 2015), and an estimated 17.2 million people are dependent on these drugs (Degenhardt et al., 2014; United Nations Office on Drugs and Crime, 2014b). Overall, illicit drugs contribute 0.8% of the global burden of disease, with methamphetamine and amphetamine second only to opioids in terms of disease burden (Degenhardt et al., 2013). Of particular concern, between 1990 and 2010, the disability adjusted life years due to dependence on these drugs grew by 37% (Degenhardt et al., 2014).

Australia has one of the highest reported rates of methamphetamine use worldwide. Neighbouring the world's major supply hub for methamphetamine in Southeast and East Asia, has left Australia vulnerable to large scale shipments of high purity crystalline methamphetamine ('ice'), which, since 2010, have doubled in the region, estimated at 14 tons in 2013 (United Nations Office on Drugs and Crime, 2015). In line with this supply trend, the number of Australians reporting the use of crystalline methamphetamine has doubled in Australia since 2010, overtaking less pure forms of methamphetamine, and being associated with heavier patterns of use (Australian Institute of Health and Welfare, 2014a), more health and social problems (Degenhardt et al. in press) and double the number of dependent users (Degenhardt et al., 2016a). Almost half (48%) of people who use methamphetamine now take the drug at least monthly (Australian Institute of Health and Welfare, 2014a), prompting widespread concern about the impact of methamphetamine use on Australia, leading to the establishment of a National Ice Taskforce (Commonwealth of Australia, 2015).

Together these strong shifts in the Australian methamphetamine market, particularly the increase in the level of dependence on the drug, and the increased impact that this is having on health services, indicates a need to revisit previously formulated cost estimates, described below (section 1.1.2).

[1] Also used to refer to crack cocaine

1.1.1 An overview of methamphetamine use patterns and trends in Australia

Australia has a longstanding history of methamphetamine and amphetamine use, with concerns about amphetamine use dating back to the 1980s (Chesher, 1991). At this time, amphetamine was sold on the street as a low purity, domestically produced powder often referred to as 'speed' or 'goey'. Harms related to amphetamine use, quantified by a series of surveys in Australia during the early 1990s, showed that they were most evident amongst the minority of people who injected methamphetamine, with people who snorted or swallowed the drug having relatively infrequent use and a relatively lower likelihood of dependence and other harms (Hall et al., 1996).

In the late 1990s, due to a shift in clandestine drug manufacturing methods, the street supply of illicit amphetamine was supplanted by methamphetamine (McKetin et al., 2005a). Specifically, clandestine chemists shifted from manufacturing amphetamine from the precursor phenyl-2-propanone (P2P) to manufacturing methamphetamine more easily from one of the key ingredients of over-the-counter cold and flu medications (pseudoephedrine). This domestically produced methamphetamine was still marketed as a low purity powder (and even referred to as amphetamine or speed on the street), leaving most people unaware of the change in composition. Both drugs have very similar effects, although methamphetamine is psychomimetically more potent and has a higher dependence liability.

This shift in domestic production was closely followed by importation of methamphetamine from Southeast Asia. Unlike domestically produced methamphetamine, imports of methamphetamine included high purity crystalline methamphetamine, which vaporised when heated, allowing it to be smoked. The first documented evidence of crystalline methamphetamine use in Australia occurred in 1999, and the first significant border detection occurred in 2001 (Topp et al., 2002). The emergence of methamphetamine in Australia was preceded by longstanding use in Japan (where the drug was first synthesised), and epidemics in East Asia and North America from the early 1990s. In these countries, the harms associated with crystalline methamphetamine were well appreciated but they were yet to be realised in Australia.

By 2006 Australia was in the midst of its first touted 'ice epidemic' [2]. Imports of crystalline methamphetamine complemented domestic production of methamphetamine (still sold largely as a powder, although increasing recognised as containing methamphetamine). This first wave of crystalline methamphetamine use was followed by a stabilisation of the prevalence of methamphetamine use, and a lull in methamphetamine-related problems, evident by 2009/10.

The re-emergence of the methamphetamine problem that we have seen in recent years has attracted extensive media attention. Initially there were limited data to substantiate claims of increased use, and the 2013 National Drug Strategy Household Survey (NDSHS) did not show any increase in past year methamphetamine use relative to previous years (Australian Institute of Health and Welfare, 2014a). However, a subsequent more detailed analysis of the NDSHS data found an increase in the number of frequent methamphetamine users, an increase in the use of crystalline methamphetamine, and an increase in number of new methamphetamine users (i.e. taken up use in the past three years) relative to previous years. These new methamphetamine users tended to be younger and had a preference for using crystalline methamphetamine (Australian Institute of Health and Welfare, 2015c).

[2] We acknowledge there is contention about the use of the term 'epidemic'.

Combined national data on purity of methamphetamine with State data on methamphetamine-related problems showed associated substantial increases between 2010 and 2014. Specifically, the number of methamphetamine-related hospital admissions, arrests and treatment episodes all doubled during this period, and most superseded levels seen at the peak of the previous wave of use observed in 2006 (Degenhardt et al., in press).

This increase in methamphetamine-related problems was not due to an increase in the number of people who had used methamphetamine at a population level, but an increase in the purity of the drug, particularly a shift to the use of the more pure crystalline methamphetamine, and the increase in smoking methamphetamine associated with this formulation (Degenhardt et al., 2016b). This shift in the drug market was associated with more frequent methamphetamine use and an increase in the number of Australians dependent on methamphetamine, which rose from an estimated 73,000 in 2003 to an estimated 160,000 in 2013/14 (Degenhardt et al., 2016a).

The increase in methamphetamine-related harm seen with the emergence of crystalline methamphetamine in Australia is consistent with evidence from past research, in Australia and internationally. The use of crystalline methamphetamine use is associated with double the odds of dependence on methamphetamine relative to the powder form of the drug. Also, smoking crystalline methamphetamine has been associated not only with elevated risk of dependence relative to other non-injecting routes of administration, but methamphetamine smokers report similar rates of harm to that seen amongst people who inject the drug (Cho, 1990; Matsumoto et al., 2002; McKetin et al., 2006a; Topp et al., 2002).

Smoking is also a less stigmatised route of administration than injecting, making it accessible to a larger pool of potential and current stimulant users, and subsequently increasing their risk of developing dependence and problems from their drug use. Evidence of this transition can be seen in the demographic characteristics of methamphetamine treatment entrants, with methamphetamine smokers being younger, more educated, and less involved in opiate use, than their injecting counterparts (McKetin et al., 2008).

1.1.2 Previous cost assessments

The extent of methamphetamine's economic impact is unclear, as are details on how this has translated into costs to users, their families and society as a whole. The most comprehensive cost estimates for methamphetamine to-date derived from the US. This key report found that the average cost per methamphetamine user, including social costs and intangible costs, was $26,872 for each person who had used methamphetamine in the past year, or $74,408 for each dependent user, with an estimated total economic burden of around $US23,384 million [3] per year (range $US16,237 to $US48,281 million). If the intangible costs are not included, this cost is lower but still substantial ($US12,395 and $US34,322 per person for past year methamphetamine use and dependent use respectively)(Nicosia et al., 2009).

In Australia, Collins and Lapsley provided cost estimates for illicit drug use in 2004/05 totalling $8,200 million, which incorporated psychostimulant use but did not provide specific estimates for the cost of methamphetamine or other psychostimulant drugs (Collins and Lapsley, 2008). In 2007, Moore provided social cost estimates for methamphetamine use specifically (health, crime and road accidents), which came to $3,730 million per annum ($3,272 million for dependent use and $459

[3] Unless indicated otherwise, all figures in dollars are for Australian dollars

million for non-dependent use), or $44,665 per dependent user and $926 per non-dependent user (Moore, 2007). However, these estimates rely heavily on data that pre-dates the recent increases in crystalline methamphetamine consumption, including estimates of the number of dependent methamphetamine users from 2003. As noted earlier, the number of dependent methamphetamine users in Australia is estimated to have more than doubled since this time (Degenhardt et al., 2016a).

Recent increases in Australian use of crystalline methamphetamine, particularly the sharp increase in harms and increased rates of dependent use, have motivated an updated estimate of the overall social cost of methamphetamine use. The current report considers costs arising in relation to: prevention, interventions, health services, premature mortality, the criminal justice system, child endangerment, remediation of production sites and workplace productivity.

1.2 Social Cost Studies

The broad framework of the study is to estimate the social costs of methamphetamine use (studies of this type are also sometimes referred to as "cost of illness" or "burden of disease" studies). These seek to identify the net costs arising from drug use to society, excluding any costs or benefits, such as sought after effects, which are internalised by the user themselves. The alternative approach, of seeking to identify the full range of benefits and costs accruing to both users and society, was regarded as not suitable for this policy area. First, because methamphetamine is an illegal drug, private benefits arising from the use of methamphetamine should not necessarily be considered as an offset against any social costs arising from its use. Second, because there are few data on the private benefits from consumption, and third, because of its status as an illegal product, data on many aspects of its use are not necessarily available. Studies estimating the social cost of a particular drug or activity need the following four sets of information:

- A decision on what costs are to be included in the study;
- Estimates on the prevalence of use, ideally by level of potential harm;
- Evidence on the nature of harms that are wholly or partially caused by the drug and the share of that harm that can be attributed to the drug; and,
- The unit cost of the harms.

The costs eligible for inclusion in this study can be broadly summarised as: costs relating to supply reduction; prevention and treatment costs; other healthcare costs; criminal justice costs; productivity costs; other tangible costs (e.g. road traffic accidents, child welfare, clandestine laboratory remediation); and, other intangible costs (e.g. the intangible costs of premature mortality; and, pain and suffering for people harmed by others' methamphetamine use).

The reason economic studies typically focus on social costs and exclude private costs (e.g. costs to the drug user) is that the standard assumption in economic analysis is that an individual's consumption represent his/her own rational decisions, having weighed up his/her available resources and the costs and benefits that would arise from that set of consumption choices. Thus, there is no economic rationale for public policy intervention to address costs that are internalised. Instead, the rationale for policy intervention should be based on the costs that are borne by other members of society as these are not typically taken into account by the consumer in weighing up the costs and benefits of their consumption. For example, expenditure by an individual on alcohol, or the costs of a hangover the next morning, does not necessarily create a rationale for regulating alcohol consumption, but it more clearly does if that translates to costs to others (e.g. work impairment, driving impairment). However, the risks to others from alcohol attributable road crashes and assaults, or the costs imposed on taxpayers from alcohol attributed hospital separations, or costs that might be associated with poor work performance due to a hangover, do provide a potential rationale to intervene.

Some studies address the issue of drug dependence and private costs by expanding the definition of social costs to include private costs arising from drug dependence, or include these costs separately under the heading of 'internalities'. More controversially, a few studies (including Collins and Lapsley (2008)) expand the definition of social costs to include not just costs due to drug dependence but also any costs to the user that were not foreseen due to imperfect information on the nature and scale of harms.

In this study, social costs will be defined narrowly to include only those harms that impact on society more broadly (e.g. excluding costs to the user). However, we will also seek to estimate those costs to the user caused by methamphetamine dependence, with these costs being reported under the heading 'internalities'. For example, in the case of treatment, Medicare rebates are included as social costs but any co-payment is listed an internalised cost.

CHAPTER 2: METHODOLOGY

Steve Whetton & Robert J Tait

This chapter provides a summary of the methodology used in the study, specifies caveats to the extent of the coverage and introduces key limitations impacting on the analyses.

2.1 Sources of Cost

There are a number of ways methamphetamine use could potentially impose costs on broader society. These include, but are not limited to:

- Prevention, harm reduction and treatment programs and supply reduction initiatives;
- Cases of morbidity attributable to methamphetamine (which impose healthcare costs on society through both increased rates of hospital separations as well as other healthcare costs borne by society; reduced economic output through absenteeism; and reduced contribution to household labour; and, to the extent that the morbidity affects someone other than the user, intangible costs of illness and injury);
- Crime attributable to methamphetamine use (which increases police costs, court system costs, and correction system costs; imposes tangible and intangible costs on the victims of the crime; and reduces economic output due to the reduction in the labour force due to detention and lower employment probabilities of convicted offenders);
- Productivity costs (such as reduced economic output and costs to business of recruiting replacement members of staff);
- Road crashes attributable to methamphetamine use (which increases mortality and morbidity with the range of associated costs, as well as imposing costs due to property damage and the cost of emergency services response (excluding ambulance data which are included in health care));
- Child abuse and neglect attributable to methamphetamine use (this imposes a substantial intangible cost on the victims, increases child protection system costs including out of home care, and imposes hospital and other medical costs);
- Cost of cleaning up properties used for clandestine methamphetamine laboratories (including removing hazardous waste);
- Premature deaths attributable to methamphetamine, as well as the intangible costs of death; and,
- Intangible costs of drug dependence to the individual’s family members (particularly to those residing in the same household).

Intangible costs of drug dependence to the drug consumer and other internalities will be reported separately from the social costs (see section 2.4 for detailed description).

An important task of the research was to identify and assess the quality of sources of data on the scale of harm attributable to methamphetamine use, and to value the unit costs of the various forms of harm. In many cases, data limitations mean that it is not possible to quantify a specific form of harm attributable to methamphetamine.

2.1.2 Approaches to estimating costs

There are two ways costs incurred over a long period of time (such as long term care to treat an illness or injury) can be incorporated into a social cost calculation:

(a) Valuing the present value (PV) of the lifetime costs of harms that occur in the study year (e.g. the stream of future treatment cost for an injury incurred in 2014 would be discounted back to current values and summed) (see Appendix 1). This approach can also be implemented by using a 'capitalised' value of future costs, such as the value of a statistical life or the average value of compensation payments for an injury; or,

(b) Valuing the costs incurred in the study year from the current 'stock' of harms, regardless of the year in which they occurred (e.g. treatment costs for methamphetamine attributable cases of Hepatitis C in 2014 would be summed, regardless of whether the initial infection occurred in 2014 or 1994).

Each approach has advantages and disadvantages. The first approach (valuing lifetime costs of harms incurred in the study year) is preferred where the objective of the social cost calculation is to support analysis of the potential impact of policy change (e.g. incorporating avoided costs into a cost benefit analysis of a new treatment for dependence). It is also preferred if the prevalence of the substance in question has changed over the past 30 years. The second approach is preferred if the objective is to identify the resources required to address harms caused by the substance in the study year (for example, if the focus of the study is on the costs to government), or if the stream of lifetime costs is uncertain (if, for example, data on how long an average individual would survive after receiving the injury is unclear).

Regardless of which approach is theoretically preferred, data availability can necessitate the use of one or other of the approaches for particular costs. In some cases, data only exist regarding when an individual has presented for treatment, not when the condition was first acquired. For example, whilst high quality data on hospital separations for Hepatitis C are available, it is not known when the individual first contracted the disease, requiring a 'stock' based approach to be used. Conversely, there are other costs, such as premature mortality attributable to a substance, for which good estimates of the current 'stock' of past harms are not available.

In this study, whilst approaches based on the lifetime cost of harms incurred in 2013/14 would have been preferred, data availability meant that several cost items were valued based on the existing 'stock' of the harm in 2013/14. This means that care needs to be taken if the values are used to assess potentially avoidable costs, such as in a cost benefit analysis of a treatment or other intervention.

Appropriate data were available to use approaches based on the present value of lifetime costs of harms incurred in 2013/14 for the methamphetamine attributable costs of:

- Long-term care and quality adjusted life years (QALYs) lost due to strokes;
- Premature mortality, including the Value of a Statistical Life, lost productivity in the workplace and home, and avoided health care costs; and,
- Long-term care, lost productivity in the workplace and home, and QALYs lost as a result of road crashes.

However, to permit easy comparison of costs across different sectors, we used the 'stock' approach as the basis of the main estimate in each case and used the present value data (where available) to inform the estimation of the upper bound of the costs.

Approaches based on the costs of the 'stock' of harms present in 2013/14 were used to calculate the methamphetamine attributable costs of:

- Blood borne viruses;
- Imprisonment; and,
- Out of home care costs for children taken into care.

2.2 Other Elements of Approach

The study took a prevalence rather than an incidence approach. The prevalence approach is considered more appropriate for determining the current economic cost of disease and covers both new and pre-existing disease in the year under assessment. The incidence approach is more appropriate when the objective is to determine the impact of a disease in the future and only evaluates new cases (World Health Organization, 2009). In addition, the study uses average rather than marginal costs.

The choice of year is dictated by the availability of key data on prevalence of use (particularly dependent use), hospital separations, mortality, etc., whilst being as close to the present as possible. It is recognised that some data are not available for any given study year and so, where necessary, we identified robust approaches to extrapolate such data to the study year. Furthermore, in some cases, such as reduced economic output due to premature mortality, those costs will be the Net Present Value (NPV) over a number of years of costs stemming from an adverse outcome in the study year. On this basis, the financial year 2013/14 offers the best balance of being as near as possible to the present, whilst having good data availability.

Whilst the study is on the costs of methamphetamine, we recognise that in some cases data on harms, or on aetiological fractions, are only available for amphetamine or even stimulants as a broad category (see section 2.7 "Limitations" for more details). Given that a small percentage of cases will be due to other amphetamine-type stimulants, our estimate for methamphetamine will overestimate the costs.

For most forms of harm (e.g. crime, child abuse/neglect) included in this study, joint causation by two or more drugs is a significant issue. One of the objectives of the project was to develop a robust approach to dealing with this situation to ensure that the estimated costs of drug-related problems are comparable with one-another and do not "double count" some of the same costs (or ignore the jointly caused costs). This posed significant challenges and debate, and often the solutions were less than perfect. Importantly, it further raises questions as to whether, given the pervasive nature of poly-drug use, the social cost of methamphetamine needs to be considered in unison with frequently co-used drugs or is even feasible under current conditions (i.e. available data, knowledge).

The level of analysis is the individual, so any costs to the families/households of the users is in-scope as a social cost. There are a few areas of cost where it is not possible to isolate the costs to users from the costs as a whole, for example with road crash costs, in which case we include the total cost.

Finally, in terms of the definition of social cost, the core estimates of the study define social costs relatively narrowly, excluding all costs borne solely by the user except for the costs arising from premature mortality (on the basis that this is not anticipated by users), or where it is not possible to distinguish costs to the user from costs to others. However, the study also assesses, where feasible, the costs to users arising from dependence (e.g. the internalities) with these costs presented separately.

2.3 Approach to Economic Analysis

Whilst the general case for excluding private costs and benefits is established, there is considerable debate on how to treat costs incurred by users with drug dependence, as the individual might not necessarily meet the criteria of a rational, fully informed consumer with time consistent preferences and therefore is not necessarily best analysed as a purely private cost. A good survey of the literature on this issue is included in Cawley and Ruhm (2011), and the discussion in this section draws on their work (see Appendix 1 for further details).

The assumptions underlying the "rational addiction hypothesis", which was first set out in Becker and Murphy (1988), is supported by a considerable body of empirical work (c.f. (Becker et al., 2008; Chaloupka, 1991)). Two of the implications of the hypothesis are controversial, namely that dependent users' current consumption is optimal for them, and that dependent consumers will be *more* responsive to permanent increases in price than non-dependent users. So in a rational framework, ***none*** of the costs to the user are included as social cost or externalities.

Other economists believe that some of the critical underpinning assumptions of the hypothesis are not fulfilled. The evidence that casts doubt on critical assumptions of the rational addiction hypothesis is that consumers generally:

- Underestimate the probability that their particular consumption paths will lead to dependence, or either hold incomplete information on the potential health impacts of consuming the drug in question;
- Underestimate the potential impacts on themselves (Gruber and Köszegi, 2001; Kenkel, 1991; Khwaja et al., 2007; Smith et al., 2008; US Department of Health and Human Services, 1994);
- Have time inconsistent preferences (Angeletos et al., 2001; Gruber and Köszegi, 2001; Laibson, 2001); and,
- Engage in optimisation behaviours that can be characterised by "bounded rationality", that is using "rules of thumb" to make decisions or optimising using an incomplete information set (Akerlof, 1991; Suranovic et al., 1999).

If any of the departures from rational, fully informed consumers listed above apply, it can no longer be asserted that current consumption levels of the "addictive good" will maximise the lifetime utility of use to the dependent user. As such, the costs arising from dependence can justify public policy responses to reduce consumption, whether by decreasing availability, increasing price, or providing information to users and potential users. As the costs to a dependent user are not strictly social costs, in that they are borne by the users themselves, they are often referred to as "internalities", costs to the user that were not factored into the consumption decision.

2.4 "Internalities" or Private Costs in Social Cost Studies

One approach often used is to include costs to consumers related to dependent use but to disregard costs incurred by non-dependent users as the four departures described above from a rational utility maximising consumer are likely to be greatest in the presence of drug dependence. In some cases, an attempt is made to identify the level of consumption, and therefore harm, that these consumers would face if they were not dependent (see, for example, the Productivity Commission's inquiry into the social costs of gambling in Australia (Productivity Commission, 1991)). In other cases, all costs borne by dependent users are treated as internalities.

More controversially, the evidence that few individuals understand the long-term health impacts of their drug consumption decisions (imperfect information) or they do not perceive the subjective relevance, combined with the fact that we know from behavioural economics that time-consistent preferences are relatively uncommon, creates an arguable case that health impacts that either have a long lead time (e.g. liver cancer from alcohol consumption) or for which the link between consumption and the health impact is not widely known, should be treated as ***social*** costs as they have not been taken into account in the consumption decision. This was the approach taken in Collins and Lapsley (2008).

Our conclusion is the weight of evidence is such that costs to the dependent user should be included in the analysis, as it is unlikely that they have been fully integrated into the decision making process of the dependent user. As these costs are not, strictly speaking, social costs, they will be reported separately (see Chapter 13).

2.5 Causal Factors and Potentially Causal Factors

There are a number of health conditions for which there is evidence that methamphetamine use can be a causal factor. Some of these conditions, by definition, can only be caused by amphetamine, methamphetamine or other stimulant use (Ritter et al., 2015b; World Health Organization, 1992) such as amphetamine intoxication (see Appendix 1 for a listing). There are also other conditions for which methamphetamine use is one of several (or many) potentially causative factors (e.g. Hepatitis C, also see Appendix 1 for a listing).

A key issue for the social cost analysis is how to identify the proportion of mortality and morbidity from these conditions partially attributable to methamphetamine use. There are three widely used approaches to attributing a portion of partially caused conditions to the substance in question: using attributable fractions; identifying “excess” cases of the condition in question; or, using expert judgement to determine direct attribution of cases to the substance.

In most cases, the preferred approach is to assess the causal relationship on a condition by condition basis, using what are called aetiological fractions (e.g. the proportion of deaths or cases of the condition caused by methamphetamine), derived using indirect methods (see Appendix 1 for details). Aetiological fractions derived using indirect methods require two sets of information: the relative risk, derived from analysis of case control or cohort studies, of developing the condition of interest (or dying from a particular cause) for those who consume methamphetamine, and the proportion of the population by age category and gender who consume methamphetamine, based upon self-report surveys of consumption. This approach has been used in attributing partially caused hospital separations to methamphetamine in this report.

Where data limitations mean harms arising from a particular drug cannot be estimated though aetiological fractions, an alternative approach is to undertake statistical analysis comparing the mortality and morbidity rates of a population of users of the drug(s) in question with the rates observed in a control population who have similar demographic and socio-economic characteristics but do not consume the drug. Any *excess* mortality or morbidity after other factors have been controlled for can be attributed to the drug use. This approach has an important limitation in that it will not capture harm to non-users (e.g. victims of assaults or road crashes caused by a user of the drug), and it is likely to significantly understate harms with long lead times (such as cancer) or long average delays to diagnosis (e.g. blood borne diseases or STDs). In this study, this approach has been used to allocate general practice (GP) and emergency department (ED) costs to methamphetamine.

Where data limitations preclude the use of either aetiological fractions or calculation of “excess” morbidity, an alternative is to make a direct attribution on a case by case basis of the contribution of a drug or alcohol to the condition or injury (e.g. a study could analyse hospital admissions data to identify the proportion of psychotic episodes where amphetamine-type stimulants were diagnosed as the cause). Direct attribution has important limitations including 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. As such it is generally the least preferred of the three main approaches to attribution, although the reliability of direct attribution increases with the degree of expertise of the person making the attribution and the time available to make the determination [4].

However, the use of aetiological fractions relies on the assumption that the relationship between consumption patterns and harm is stable. Where there are a large number of cases, any random variation in causation between risk factors should be minimised by the size of the sample. However, with low frequency events, such as premature mortality, this may not be the case and random variations between the influences of various causal factors can alter the “true” attribution for that year. For this reason, our analysis of methamphetamine attributable mortality was based on the direct attribution of forensic pathologists as recorded in coronial data.

2.6 Limitations

2.6.1 Amphetamine *versus* methamphetamine

In this study, by default we use the term methamphetamine. Methamphetamine is part of the broader category of stimulants and is in the class of amphetamine-type stimulants. Police and customs data typically do not report whether seizures are methamphetamine or other amphetamine-type stimulants, but an analysis of 4963 samples from drug seizures in Victoria (1997 to 2002) found that 97.5% were methamphetamine (McKetin et al., 2005a). The RAND analysis included an adjustment factor (0.931) to correct for the presence of other forms of amphetamine-type stimulants, for example in attributions from hospital diagnostic codes that do not specify methamphetamine (Nicosia et al., 2009). Given the low prevalence of other amphetamine-type stimulants in Australia, no adjustment for other amphetamine use was undertaken in this report.

2.6.2 Poly-drug use

Polysubstance use is ubiquitous among users of methamphetamine, especially the consumption of tobacco, alcohol and cannabis but also illicit benzodiazepines and opioids (McKetin et al., 2013a; Quinn et al., 2015). The challenges this issue creates is likely to arise in virtually all areas of this report, including health care, child welfare and crime/justice costs. Poly-drug use is a particular complication in attributions of mortality (see Chapter 6) with a review finding that death was due to combined toxicity with opiates (82%), benzodiazepines (42%) and antidepressants (24%) (Kaye et al., 2008). Therefore, except for instances where the attributable fraction is 1, attribution of harms to a particular substance will carry a measure of uncertainly and, in some cases, require crude estimates of the apportionment of costs.

[4] We acknowledge there may be cases were experts are reluctant to make attributions to avoid labelling a person as a drug user or an event as drug caused.

2.6.3 Economic analysis for single drug categories

One of the objectives for the study was to develop a robust methodology that could be implemented with other categories of drug in the future. We have endeavoured to complete this with respect to methamphetamine. However, based on the available data, we believe that this should not be extended to other illicit drugs in contrast to drugs such as tobacco and alcohol where there are more substantial data and less extensive poly-drug use. In particular, the issue of polysubstance use means the impact of a single drug is unlikely to be able to be identified. Even if a cohort of "single" drug users was identified, the outcomes for such a cohort would not generalise to the larger group of polysubstance users.

2.6.4 Generalising from a sample

Even where substantial representative datasets, such as the National Drug Strategy Household Survey, exist, there is the potential that those with significant substance use disorders will be under-represented in the sample, if for no other reason than that the sample frame is the household (Australian Institute of Health and Welfare, 2014a). Therefore, by definition, the homeless and those in hostels are not sampled. Even state based samples, such as the analysis of Victorian ambulance records (Lloyd et al., 2014), are potentially open to questions concerning differences between jurisdictions in consumption patterns. Many of the data in this field are derived from small or idiosyncratic samples which have clear limitations in generalising to national estimates. In Australia, differences between urban and rural/remote settings will have a major impact on costs, for example in the ability to access services or costs of providing services. We have highlighted these limitations where applicable in each chapter.

2.6.5 Range of costs

Where data are available, we present our best estimate of costs together with a high and low range. However, data limitations mean that this is not possible in all instances; in these cases we use the central estimate to replace the missing boundary(s). Conversely, where data are available to estimate the range but without a clear central estimate, we use the mid-point as the estimate (e.g. see Chapter 5, Table 5.6).

2.6.6 Systematic review

As a prelude to conducting this estimation, we systematically reviewed the literature on social cost studies published since the RAND review (Nicosia et al., 2009) (see Appendix 1) both to identify new studies and new areas on which the use of methamphetamine impinged. The only new area that was identified was the impact of clandestine laboratories on neighbouring house prices (Congdon-Hohman, 2013). However, we were unable to identify any relevant data to translate this to an Australian context.

2.7 Included and Excluded Costs

The issue of excluded costs, especially where data are missing, is discussed in detail in Chapter 14. However, it is important to acknowledge this project does not capture all costs associated with the use of methamphetamine; there are areas where we are aware there are costs but have been unable to locate appropriate data on which to base estimates. For example, costs to individuals living in rural and remote parts of Australia are included in our estimates, where these data appear in standard datasets. However, excluded from the study are the unique costs to individuals living in rural and remote areas as the extent and quality of available data are generally poor compared to metropolitan and regional areas. Nevertheless, the project included a sentinel investigation to identify those costs and harms that particularly impinge on those in regional and remote Australia.

Similarly, there are no approved maintenance pharmacotherapies for methamphetamine users and medications used in withdrawal management are not unique to methamphetamine (e.g. short course of sedative-hypnotic medications, anti-depressant medications) (Jenner and Lee, 2008). Therefore, although some people will receive pharmaceutical interventions, we have not been able to identify evidence of any costs in this area.

No estimate has been made of the “opportunity costs” in this area. For example, interventions to reduce the diversion of precursor chemicals used in the manufacture of methamphetamine have an impact on the legitimate users of those chemicals. This applies at the individual level, with increased burden in accessing over-the-counter medications containing pseudoephedrine and at the commercial level in regulating access by chemicals.

CHAPTER 3: PREVALENCE OF METHAMPHETAMINE USE

Rebecca McKetin & Steve Whetton

3.1 Prevalence and Definitions of Methamphetamine Use

The prevalence of methamphetamine use is a critical input into many of the calculations of methamphetamine attributable harm. Methamphetamine attributable harm varies with how frequently the drug is used, the context of the use, whether someone is dependent on the drug and, particularly, whether it is injected. Therefore, in some cases, the prevalence of interest is any use over the past year (i.e., approximating all current users). In other cases, it is only dependent users that are relevant in calculating the scale of harm. Finally, there are forms of harm for which the causal factor is not methamphetamine *per se*, but rather injection of the drug (e.g., transmission of blood borne viruses).

The National Drug Strategy Household Survey (NDSHS) is an important source of data on the prevalence of methamphetamine use (and indeed substance use more broadly). The NDSHS is a triennial national survey of alcohol, tobacco and illicit substance use in Australia that also collects information on overall wellbeing and demographics. The survey uses a multi-stage probabilistic sampling framework to obtain a representative sample of Australians. In 2013, the NDSHS surveyed 23,855 individuals aged 14 and over in Australia. Based on this survey, 2.1% of Australians aged 14 years or older reported they had used methamphetamine in the past year (Australian Institute of Health and Welfare, 2014a). The majority of those captured took methamphetamine less than monthly (69%), while 17% took it about monthly, and 14% took the drug either weekly or more often.

Whilst household surveys like the NDSHS provide accurate prevalence data on legal and more prevalent illicit substances, they are less accurate measures of heavy or problematic substance use, particularly for highly stigmatised forms of substance use (e.g. injecting drug use) (Hickman et al., 2002). National surveys capture too few of these population groups to provide precise prevalence estimates. Also, these populations are under-represented in household surveys because (a) a proportion of heavy substance users will be institutionalised or homeless (cf. residing in households); (b) stigma and concerns about illegality of substance use can lead to under-reporting; and, (c) heavy/problematic substance use tends to cluster in specific geographic regions, whereas the sampling framework used for national household surveys assumes a uniform distribution of substance use across geographic regions (McKetin et al., 2005b). In the case of methamphetamine, under-reporting of use has been seen in the Australian NDSHS, and this is more apparent for methamphetamine than for other drug types, a phenomenon that has been attributed to increased media attention stigmatising use (Chalmers et al., 2016).

To address this limitation, indirect prevalence estimation methods have been developed to derive alternative prevalence estimates for problematic drug use (Hickman et al., 2002). One such method that has been applied in Australia is the benchmark-multiplier method, which utilises routinely collected data on drug-related contacts through services (e.g., drug treatment admissions, hospital admissions for drug use, drug arrests). A multiplier is applied to these routine data to estimate the number of problematic drug users. This method was applied to estimate the number of dependent methamphetamine users in Australia in 2003 (McKetin et al., 2005b). Degenhardt et al. recently replicated this approach to estimate that there were 268,000 regular methamphetamine users (at least monthly use) aged 15-54 years in Australia in 2013/14, of whom 160,000 were dependent on methamphetamine (Degenhardt et al., 2016a). Regular use was defined as at least monthly use. The key limitation of these estimates is that they are based on multipliers derived from a community-based survey of methamphetamine users in Sydney in 2003/4. Applying these multipliers to estimate the number of methamphetamine users in Australia assumes similar average rates of access to treatment and hospital at a national level, and also that there have been no marked changes in access to these health services since 2003. It also assumes the community survey on which the multipliers were based is representative of methamphetamine users in the community, which is impossible to verify. Although these estimates have limitations, they are the best available estimates of the number of dependent methamphetamine users in Australia.

In our costing exercise, we drew together data from these two sets of estimates, namely the NDSHS and the indirect prevalence estimates derived by Degenhardt et al. 2016. These were used to derive estimates for three levels of past year methamphetamine use that could be used in the subsequent costing exercises. Specifically, we used the Degenhardt et al. (2016a) estimates for the prevalence of dependent use and regular use (i.e., at least monthly, but non-dependent). We used the NDSHS for the prevalence of less frequent methamphetamine use (< monthly use in the past year), which we label "occasional use". See Box 3.1 for specific definitions of each category. Although these categories were intended to be mutually exclusive, each was derived using a different method, and therefore we suggest caution in summing categories to provide a total estimate of past year prevalence.

Box 3.1 Definitions of methamphetamine use

Occasional use: Occasional use was defined as using methamphetamine less than monthly in the past year. Estimates were derived from the 2013 NDSHS using self-reported frequency of methamphetamine use in the past year, and included participants who reported using once or twice a year or every few months. The age range for the estimates was restricted to 15-54 years to match the Degenhardt et al. (2016a) estimates, amounting to 240,995 occasional users (see Table 3.1).

Regular non-dependent use: This category reflected at least monthly use in the past year, but not meeting criteria for dependence on methamphetamine. Estimates were taken from Degenhardt et al. for the number of regular methamphetamine users in Australia (Degenhardt et al., 2016a). Degenhardt et al. estimated that there were 268,000 regular methamphetamine users (95% CI 187,000 to 385,000) aged 15 to 45 years in Australia in 2013/14. This included a sub-set of dependent users (160,000, 95% CI, 110,000 to 232,000) who were subtracted from the total number of regular users to obtain an estimate of the number of people who used methamphetamine but who were not dependent on the drug. That is 268,000 minus 160,000, or 108,000.

Dependent methamphetamine use: The estimated number of dependent methamphetamine users was taken from Degenhardt and colleagues, that is 160,000 (2016a). The definition of dependence used for these estimates was a score of 4+ on the Severity of Dependence Scale, which is equivalent to a DSM-IV diagnosis made using the Composite Diagnostic Interview (Topp and Mattick, 1997).

The prevalence rates and estimated number of individuals for each of these categories is presented in Table 3.1 disaggregated by age group. Age break-downs for the regular non-dependent use and dependent use categories are based on the age distribution reported for dependent use in 2012/13 in Degenhardt et al. (2016a). As noted earlier, for some forms of harm (e.g., blood borne virus transmission), the prevalence of interest is the number of people who inject methamphetamine. The number of people who inject methamphetamine has been calculated in Chapter 5 to estimate the number of methamphetamine users with blood borne viruses.

Table 3.1: Estimated past year prevalence of methamphetamine use and number of methamphetamine users in 2013/14 by frequency of use over the past year [a]

Frequency	Source	15-24	25-34	35-44	45-54	Total 15-54
Prevalence (%) [b]						
Dependent use	1	1.40	1.84	1.10	0.32	1.24
Regular non-dependent use	1	0.96	1.26	0.76	0.22	0.85
Occasional use	2	2.21	3.33	1.51	0.55	1.91
Estimated number of people [b]						
Dependent use	1	48,000	63,158	37,895	10,947	160,000
Regular non-dependent use	1	32,400	42,632	25,579	7,389	108,000
Occasional use	2	68,643	105,717	49,929	16,707	240,995

Sources: 1 (Degenhardt et al., 2016a); 2 (Australian Institute of Health and Welfare, 2014a). Note: a There were a small number of respondents to the NDSHS aged >54 who reported having used methamphetamine in the past year, they are excluded from our prevalence estimate as we have restricted the analysis to those aged 15-54 to match Degenhardt et al. 2016a.

b These categories are not intended to be summed to provide an estimate of past year prevalence.

3.2 Limitations and Recommendations for Further Research

Estimating the prevalence of illicit drug use is highly problematic due to the unknown parameters of this population and problems with under-reporting illicit behaviour. As we have outlined, the NDSHS, although considered a gold standard for measuring the prevalence of drug use, suffers under-reporting problems for methamphetamine use, and population level surveys more generally tend to under-estimate the prevalence of problematic drug use. The alternative estimates we use for regular and dependent methamphetamine users were based on indirect prevalence estimation methods, which are thought to provide a more accurate estimate of the population size for problematic drug use. However, they too have their limitations. We combined these indirect prevalence estimates for regular and dependent use, with estimates for occasional methamphetamine use from the NDSHS. In doing this we derived prevalence estimates for three categories of methamphetamine use (occasional, regular but not dependent, and dependent) which could be used in the subsequent costing exercises.

It should be appreciated that in each case there is a considerable margin of error surrounding the prevalence estimate. For example, the 95% confidence limit around the estimated 160,000 dependent methamphetamine users is 110,000 to 232,000. Although this estimate of dependent use may seem high, it only equates to around 1% of the population aged 15-54 years, with the total number of regular and dependent users combined being around 2%. This is plausible when compared to the NDSHS estimates for younger adults in Australia (past year prevalence ranges from 3.1 to 5.8% for 20-40 year olds). In summary, while these estimates are imprecise, they are the best estimates available in Australia, and they provide a defensible basis for the calculation of the subsequent costing exercises.

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CHAPTER 4: PREVENTION, HARM REDUCTION & TREATMENTS

Marian Shanahan & Robert J Tait

4.1 Background – Prevention

Prevention programs can be classified into two groups: primary programs that aim to prevent the uptake of drug use; and, secondary programs that aim to prevent the transition to more problematic drug use. Primary prevention programs are largely delivered through schools, with secondary programs either delivered in schools or to broader community targets. In 2009-2010 it was estimated that Australia spent $156.8 million on preventing illicit drug use, with $79.2 million (50.5%) of this on school based programs (Ritter et al., 2013).

In 2002, the average secondary student in Victoria received 10 hours and the average primary student 12 hours of drug specific education per year in government schools (Auditor General Victoria, 2003). However, the report noted that 34% of students attended non-government schools, and that data were lacking on the quality and quantity of drug education that these students received. Ritter and colleagues estimated that the number of hours of *illicit* drug education represented 25% of all drug education in those in year 8 and below and 50% in those in year 9 and over (Ritter et al., 2013). These hours comprise 0.2% of total student time and hence the cost was estimated at 0.2% of recurrent expenditure, or $79.2 million for the financial year 2009/10, assuming that the cost of providing teaching on illicit drugs is approximately typical in terms of cost per hour.

4.1.1 Cost of school prevention programs

Federal and other government recurrent expenditure on government schools in 2013-14 was approximately $38,500 million plus $11,900 million on non-government schools (total $50,415 million) (Steering Committee for the Review of Government Service Provision, 2016). Applying the same proportion as above (0.2%), illicit drug education was estimated at $100.8 million. In secondary schools, this funding will cover education about a range of drugs, including heroin, amphetamine-type stimulants, hallucinogens, cocaine and ecstasy, and in primary school illicit drug education will typically cover steroids and cannabis (Auditor General Victoria, 2003). Therefore, it would be more conservative to estimate the costs associated with just secondary school students when considering costs associated with methamphetamine even though this will build on knowledge developed in primary school.

Table 4.1: Estimated hours of illicit drug education and costs for secondary students in 2013-14

	Student numbers [1]	Hours (000)	Illicit drug hours	Cost per student [2]	Total cost (000)	Cost illicit drug education
Government	900,023	1,080,028	4,522,616	$18,327	$16,494,721	$69,071,646
Non-Government	609,560	731,472	3,063,039	$9,327 [3]	$5,685,366	$23,807470
Total	**1,509,583**	**1,811,500**	**7,585,655**		**$22,180,087**	**$92,879,117**

[1] Table 1 (Australian Bureau of Statistics, 2015d); [2] Tables 4A.12 & 4A.15 (Steering Committee for the Review of Government Service Provision, 2016); [3] Non-Government schools: cost for any student, not just per secondary school student

In 2013 there were 0.9 million (full time equivalent) secondary students in government schools and 0.6 million in non-government schools (Table 4.1). The costs associated with these were respectively

$18,327 per student and $9,327 [5] per student, giving a total of $22,200 million. The total school hours based on a 6 hour day and 40 weeks per year is 1,811 million hours. Drug education hours per year (mid-point 10.05, range 7.1 to 13.0 hours) were obtained from the Auditor General's report and multiplied by the number of students per year (Australian Bureau of Statistics, 2015d) and the 50% estimate applied to obtain illicit drug education hours (Table 4.1). The 7.6 million hours on illicit drugs equate to 0.42% of total hours and hence a total cost for secondary illicit drug education of $92.9 million.

The Auditor General's report identified five classes of drugs typically addressed by secondary school programs, if "ecstasy" is regarded as a separate class to amphetamine (the remainder being heroin, cocaine and hallucinogens) (Auditor General Victoria, 2003). We were unable to locate the time allocated to each drug and have thus assumed that these are approximately equal. On this basis, the cost of methamphetamine prevention activities in schools is estimated at **$18.6 million**.

4.1.2 Cost of general population prevention programs

In 2009-2010, Western Australia spent $7.0 million on general alcohol and other drug prevention programs and Victoria spent $27.3 million (Ritter et al., 2013). These included direct costs arising from prevention programs and activities, staff salaries and overheads, and equated to $4.12 per person in WA and $4.88 in Victoria. Using an assumption that 50% would be spent on illicit drug programs and extrapolating from these figures to the national population, an estimated $55.78 million was spent by state and territory governments. This figure was subsequently reduced to $53.67 million on the basis of confidential information supplied to the Ritter research team by a third State (Ritter et al., 2013). At the federal level, $18.9 million was spent on prevention via the National Illicit Drug Strategy. In addition, an estimated $5.0 million was spent on specific Indigenous programs under the Closing the Gap strategy. Therefore, in 2019/10, an estimated $77.6 million was spent on general illicit drug programs (Ritter et al., 2013).

In 2013-2014, Western Australia spent $5.70 per head of population aged 14 and above on prevention programs, primarily on the *Alcohol Think Again* and *Drug Aware* program (Western Australian Drug and Alcohol Office, 2014). With a population of 2.06 million people aged 14 or older in June 2013 (Australian Bureau of Statistics, 2013a), this totals to $11.8 million. There were no data available on the split between alcohol and other drugs or on the proportion spent on methamphetamine.

The annual report for the Victorian Department of Health in 2013/14 reported that $26.4 million was spent on drug prevention and control (Victorian Department of Health, 2014). However, this item included a range of activities that would not normally be classed as "prevention", such as licences and permits issued to health services and treatment permits issued to medical practitioners.

The Australian population aged 14 or older at June 2013 was 19.0 million (with 4.1 million aged less than 14 years). Applying the WA costs of $5.70 per head to this figure totals to $108.6 million in state expenditure on alcohol and illicit drug prevention. Based on the method of Ritter and colleagues, we allocated 50% of the costs to illicit drug use: $54.3 million. As with the education data, the costs distribution across to specific substances was not specified. Therefore, as a crude approximation, but in line with the education figures, we have allocated one fifth of the costs to methamphetamine: **$10.9 million.**

[5] Cost for any student, not just secondary students

4.1.3 Cost of limiting precursor supply: ProjectStop

In 2004, law enforcement agencies estimated that around 90% of pseudoephedrine used in illicit laboratories in Australia was sourced from community pharmacies (Miller, 2009; Ransley et al., 2011). While precursors are also illegally imported, at that time they were predominantly being obtained from local sources through the diversion of legal products, bought or stolen from pharmacies. In response to this increasing local production in Australia of methamphetamine using precursor chemicals, ephedrine and pseudoephedrine, all Australian governments agreed in 2005 to restrict the availability and sale of therapeutic products containing pseudoephedrine (Ransley et al., 2011). Also in 2005, in response to the increased detection of clandestine laboratories, the Queensland Branch of the Pharmacy Guild initiated and funded a method of controlling the sale of pseudoephedrine sourced from community pharmacies, titled ProjectStop.

ProjectStop is an online decision support tool for pharmacists to help assess requests for pseudoephedrine. It aimed to reduce diversion of pseudoephedrine-based medications into illicit drug manufacture through enhancing pharmacists' ability to identify suspicious requests for medications containing pseudoephedrine, and determine whether customers seeking to purchase pseudoephedrine products were legitimate or illegitimate (Miller, 2009).

Subsequently, in 2007 ProjectStop was made available nationally through a Federal government funded scheme in an attempt to reduce the diversion of pharmaceutical products containing pseudoephedrine to illicit drug manufacturing. In June 2014, 79.3% of approved community pharmacies were registered (Australian Crime Commission, 2015). GuildLink, a 100% subsidiary company of the Pharmacy Guild of Australia (PGoA), provides the national, online, real-time decision support system for ProjectStop, which enables pharmacists' management of pseudoephedrine based products. This technical and administrative support is provided free to pharmacies who are members of the PGoA and for a $300 fee to pharmacies who are not members. The ProjectStop decision support tool helps pharmacists assess requests for pseudoephedrine. Participating pharmacists request identification, record the information, and ascertain whether the identification number has reached a threshold number of records. If a sale is made, the pharmacist records the drug and date of purchase.

Police in the various jurisdictions access data from ProjectStop through an online portal. This provides an opportunity to monitor individual activities as well as respond to activities that trigger a warning. This access is provided free to police.

The cost to administer this national program is approximately **$380,000** per year (Miller, 2009); of this approximately $120,000 (2015 AUD) is recovered from non-member pharmacies. ProjectStop is mandatory for pharmacies in Qld, WA, NT and SA. Participation in NSW became mandatory in March 2016 (NSW Health, 2016). Pharmacies in other jurisdictions also participate voluntarily in ProjectStop.

These costs do not cover the time costs of the pharmacist participating in ProjectStop, as data was not available on the number of occasions pharmacists enter data into the register or review data in it. It is likely that the costs of precursor controls are significantly underestimated given these data limitations.

4.1.4 Cost of limiting precursor supply: Other

In addition to ProjectStop, there are other mechanisms that attempt to control access to precursor chemicals potentially diverted from legitimate production into the production of methamphetamine. The Australian Federal Police established the National Drug Precursor Risk Assessment capability to identify precursor chemicals used in manufacturing illicit drugs (funding $1.795 million over four years:

2013/14 $44,875) and the Enhanced National Intelligence Picture on Illicit Drugs ($5.864 million over four years: 2013/14 $1,466,000) to monitor illicit drugs market including precursor chemicals (Senate Standing Committee on Legal and Constitutional Affairs, 2011). Given the uncertainly of the distribution of these costs, they are used as part of the upper bound estimate only ($1,510,875) plus the cost of ProjectStop (**$1,890,875**).

4.2 Prevention of BBV Transmission in People Who Inject Drugs

For more than 20 years, needle and syringe programs (NSP) have been at the forefront of preventing the spread of Human Immunodeficiency Virus (HIV) and other blood borne viruses (BBV), particularly hepatitis C (HCV), in Australia (Australian National Council on Drugs, 2013). NSP also provide a range of health and other services, including education and access to treatment programs for often highly marginalised people (Australian National Council on Drugs, 2013). In 2009, there were estimated to be more than 3500 NSP distributing more that 33 million syringes each year (Australian National Council on Drugs, 2013).

The controversy surrounding the introduction of NSP has resulted in detailed evaluations of their benefits being conducted in 2002 (Australian Government Department of Health and Ageing, 2002) and again in 2009 (Australian Government Department of Health and Ageing, 2009). The latter analysis estimated that the total costs of providing NSP from 2000 to 2009 was $243 million, with the 2007/08 budget being $26.4 million. Over the period 2000 to 2009, an estimated 32,050 new HIV infections and 96,667 HCV infections were prevented.

Patterns of drug use have changed since the last evaluation of NSP, with surveys indicating that fewer people report heroin as the last injected drug. By 2013, the proportion reporting heroin as the last drug injected had declined from 34% to 29% while methamphetamine increased from 24% to 29% (Chow et al., 2014). Nevertheless, the proportion reporting as HCV positive in 2013 remained higher among heroin/opioid injectors (59%-67%) than those who reported methamphetamine as their last injected drug (46%) (Iverson and Maher, 2013). In contrast, the prevalence of HIV positive status was higher in the methamphetamine cohort (3.9%) than those reporting heroin/opioids as their last injected drug (1.3-1.4%) (Iverson and Maher, 2013).

Since 2009, funding for NSP has been included in the broad banded Healthcare Specific Purpose Payment (Ritter et al., 2013). Therefore, it has not been possible to update the budget allocated to NSP from the Federal budget. Instead it is estimated on the basis of CPI increases since the 2007/08 budget, when $26.4 million was spent on NSP. Thus, in 2013/14 the CPI inflated budget was $31.6 million. From this we allocated 29% of costs to methamphetamine use based on the reported last drug injected (Chow et al., 2014), giving a total of **$9.2 million.** This assumes that reported use leads to equivalent costs. In the case of NSP this seems a reasonably plausible assumption.

There are a number of organisations and activities that fall under the rubric of harm reduction, such as the Sydney Medically Supervised Injecting Centre (SMSIC) and the Federal Hepatitis C Education and Prevention Initiative. In 2008, the costs for the SMSIC was estimated at $2.8 million. Similar to the NSP, this is estimated to have resulted in substantial savings ($658,000) (SAHA International, 2008). By 2013/14 the budget for the SMSIC had increased to $3.5 million (personal communication manager SMSIC). Applying the 29% estimate used above gives a total on methamphetamine users of **$1.02 million.**

There are also many other organisations working in the area of harm reduction, for example those in the umbrella group Australian Injecting and Illicit Drug Users League (AIVL), which represents drug users and seeks to reduce harms and promote the health of users. There are also groups focusing on blood borne viruses, such as the individual state based AIDS Councils and Hepatitis Australia. All of these would be expected to incur costs in providing services to methamphetamine users. However, given the great diversity of clients to whom these organisations provide services, and as there are not well-defined methods to allocate expenditure by drug type for these organisations, we have not attempted to quantify these costs.

4.3 Treatment for Methamphetamine Disorders

Although demand for treatment for methamphetamine and its uptake continues to increase (Australian Institute of Health and Welfare, 2015a) there are limited treatment options for methamphetamine dependence (Ciketic et al., 2015). In particular, the lack of approved pharmacotherapies for maintenance for those with dependence means that the focus of this section will be on psychotherapies. However, systematic, reliable costs of treatment either by treatment type (residential rehabilitation, detoxification, intensive outpatient, counselling), or by drug type are not routinely available for Australia.

Having said that, with a number of caveats itemised below, this section provides an estimate of the cost of treatment for methamphetamine disorders in *specialty treatment centres*. An estimate of the costs of treatment provided within an acute care inpatient setting is found in Chapter 5.

The data for estimating the cost of treatment related to methamphetamine disorders were obtained from a limited number of sources. The preferred method would have been to obtain actual costs of providing treatment or expenditures for the treatment for methamphetamine dependence. This turned out to be not feasible as treatment agencies are funded from a range of sources (State, Territory and the Commonwealth governments, philanthropy, personal payments, and private health insurance to name a few) and funders would not necessarily be aware of the internal allocations. While Ritter and colleagues have documented the funding flows for AOD these are not apportioned by drug type (Ritter et al., 2014; Ritter et al., 2015a). Simple apportioning of expenditures by distribution of primary drug of concern may not reflect actual expenditures due to differences in duration and mix of treatment types for each drug type.

In the absence of obtaining financial data directly from providers, an alternative method was used. First, the number of episodes where methamphetamine was the primary drug of concern was sourced from the Alcohol and Other Drug Treatment Services (AODTS) in Australia 2013/14 data (Australian Institute of Health and Welfare, 2015a). Agencies that provide publically funded services report to the AIHW. Reported data do not include services for: health promotion; primary accommodation; needle syringe programs; treatment only to admitted patients located in acute care or psychiatric hospitals; and, those private agencies that do not receive any public funding and those agencies providing only opioid pharmacotherapies.

It was estimated that for the year 2013/14, 97% of in-scope agencies submitted data (Australian Institute of Health and Welfare, 2015a). Data reported are episode based, which is defined as the period of time between initiation and closure of the file, which occurs when there has been no further contact between the client and treatment provider for three months, or when treatment is ceased. The duration of an episode may, or may not, reflect the actual time in treatment as some time may pass after the client has last visited before the file is closed, making the length of stay data problematic.

For this report, the actual unit record data were obtained from the AIHW (Australian Institute of Health and Welfare, 2015a). Two sets of costs are presented, first for those who report that their own primary drug of concern was methamphetamine, and secondly, the costs attributable to family members who are seeking advice or treatment due to the drug use of another person. Frequencies were obtained by treatment type, and by whether the treatment occurred in the community or in residential care (Table 4.2).

Table 4.2: Treatment episodes for methamphetamine (own use)

Type of treatment			**Frequency**	**Average duration in days**
Withdrawal	*All*		*3,242*	*17.74*
		Non residential	1,079	34.75
		Residential	2,163	9.25
Rehabilitation	*All*		*2,508*	*68.22*
		Non residential	679	72.63
		Residential	1829	66.59
Counselling			13,001	87.03
Support & case management only			2,728	75.50
Information & education only			1,294	17.26
Assessment only			5,511	19.84

Source: (Australian Institute of Health and Welfare, 2015a)

4.3.1 Costs of methamphetamine treatment

Costs by treatment type and episode were obtained from a range of sources (one state health department/personal contacts/previous research). A main estimate and a high and low estimate of costs are also presented where feasible (Table 4.3). Costs per episode of treatment (by treatment type) specifically for methamphetamine dependence were not available and, further, the cost by treatment type for any/all drug types were not widely available. The average costs were then multiplied by the relevant frequency of episodes of care. The low and high ranges involve multiplying the average costs by the 95% CI for the average length of stay. However, for the non-residential rehabilitation, where we had two very different costs, the CI were used in the low cost estimate.

The AODTS data also contain information on individuals who seek treatment or support for themselves as a consequence of another person's drug use. These data do not contain information on the drug of concern, therefore for the purposes of this study, as 17% of those seeking treatment for their own drug use indicated that methamphetamine was the primary drug of concern [6] (Australian Institute of Health and Welfare, 2015a), this same percentage was applied to the total of those who were seeking assistance due to others' drug use. The same average costs of treatment were applied.

[6] It was an additional drug of concern in 13% of episodes (Australian Institute of Health and Welfare, 2015a)

Table 4.3: Cost of treatment episodes – methamphetamine primary drug 2013/14 – own use

Treatment type		Cost per episode	Central estimate	Low bound	High bound
Withdrawal					
	Non residential	[a] $4,786	$7,818,499	$7,138,027	$8,498,971
	Residential	[a] $7,246	$10,352,421	$8,916,030	$11,788,811
Rehabilitation					
	Non residential	[a] $1,996/ [b] * $7,500	$5,092,500	$1,009,221	$5,641,230
	Residential	[a] $7,246	$13,253,044	$12,555,814	$13,950,274
Counselling		[a] $1,996	$25,952,336	$25,233,511	$26,671,162
Support & case management only		[c] $1,732	$4,724,430	$4,506,247	$4,942,613
Information & education only		[c] $365	$471,823	$374,312	$569,335
Assessment only		[c] $112	$615,797	$581,845	$649,749
Total			**$68,280,850**	**$60,315,006**	**$72,712,145**

Sources: [a] (Mental Health Commission, 2015); [b] Personal Communication (Personal communication TK, 2015), (Nov 2015); [c] (Ngui and Shanahan, 2010); * costs to fund an intensive methamphetamine outpatient program

Table 4.4: Estimating the costs of treatment for those seeking treatment due to others' methamphetamine use

Treatment type	All cases	17% of cases	Costs
Counselling*	6,287	1,069	$2,133,497
Support & case management only	719	122	$211,681
Information & education only	893	152	$55,354
Assessment only	553	94	$10,505
Other (includes pharmacotherapy) [1]	503	N/A	N/A
Total	**8,955**	**1522**	**$2,411,037**

[1] Pharmacotherapy costs are not included for those seeking treatment due to others drug use: Sources: (Mental Health Commission, 2015); (Personal communication TK, 2015); (Ngui and Shanahan, 2010); Note: * these data do not include visits to general practitioners or other health care provided in community mental health. These interventions are to some degree captured in Chapter 5. Sources: (Mental Health Commission, 2015); (Ngui and Shanahan, 2010).Unit costs from Table 4.3

Table 4.5: Total expenditure on treatment for methamphetamine at specialist treatment centres

Client	Central estimate	Low bound	High bound
Treatment for own use	$68,280,850	$60,315,006	$72,712,145
Treatment for others' use	$2,411,037	[a]	[b]
Total	**$70,691,887**	**$62,726,043**	**$75,123,182**

[a] Low bound estimate – duplicated central estimate: [b] High bound estimate – duplicated central estimate

Combining the two sets of costs for drug users and for others results in a total of **$70.7 million** expenditure on treatment where methamphetamine was the primary drug of concern in specialist treatment centres (see Table 4.5).

The unit costs used herein are primarily comprised of state / territory based funding. By way of comparison, see the Ritter et al. report on AOD (excluding tobacco) treatment funding estimates obtained directly from each of the jurisdictions and all other funding sources (but not apportioned into drug type as mentioned above) (Ritter et al., 2014). See Table 4.6.

If the 17% figure (percentage of episodes in the AODTS where methamphetamine is the primary drug of concern) is applied to the amount that is funded by states and territories ($499.6 million), the amount that would be attributed to methamphetamine is $84.9 million compared to $70.7 million from our estimates.

If Commonwealth AOD treatment grants and philanthropy (likely more closely reflecting the true of costs of treatment episodes) are included, the total is $715.2 million and 17% of this equates to **$112.3 million**. Simply taking 17% of the overall total in the Ritter et al. report, would likely overestimate the costs and possibly lead to double counting as, in this current research, inpatient admissions and GP contacts are included elsewhere in our report. Pharmaceutical Benefits Scheme (PBS) expenditures as reported by Ritter et al. will primarily be medications for treating alcohol and opioid dependence not for methamphetamine.

Table 4.6: Estimated total AOD treatment spending in Australia, 2012/2013 from Ritter et al.

Funder type	Amount	Percentage
State & Territory AOD treatment funding *	$499,561,630	39.6%
Public hospitals – admitted patients	$189,120,132	15.0%
Private hospitals – admitted patients	$141,417,520	11.2%
Commonwealth AOD treatment grants*	$130,281,000	10.3%
Pharmaceutical Benefits Scheme	$98,805,759	7.8%
Client contributions (fees and co-payments)	$85,341,283	6.8%
Primary care services – GPs	$53,650,750	4.3%
Allied health services	$32,151,907	2.5%
Philanthropy*	$31,000,000	2.5%
TOTAL	**$1,261,329,980**	**100%**

Source: (Ritter et al., 2014) Table 4.1; *these three items sum to $660,842,630

In summary, as shown in Table 4.7, our main estimates of the costs of treatment for methamphetamine are likely an underestimate of the true costs. The estimates derived from the Ritter et al., 2014 are included as the upper estimate.

Table 4.7: Summary Chapter 4 costs

Cost area	Central estimate (000,000)	Low bound (000,000)	High bound (000,000)
School prevention programs	$18.6	[a]	[b]
Population prevention programs	$10.9	[a]	[b]
Precursor control (ProjectStop)	$0.4	[a]	$1.9
Prevention blood borne viruses	$9.2	[a]	[b]
Supervised injecting centre	$1.0	[a]	[b]
Treatment	$70.7	$62.7	$114.7 [c]
Total	[c] **$110.7**	**$102.8**	[c] **$156.3**

[a] Low bound estimate – duplicated central estimate; [b] High bound estimate – duplicated central estimate; [c] Based on Commonwealth AOD treatment grants and philanthropy estimate above. Columns may not sum due to rounding

4.4 Limitations and Recommendations for Further Research

As highlighted above, there are several limitations to these estimates. Data estimating the cost of school programs draw on a single-state report from 2003 (Auditor General Victoria, 2003). Further, more than one third of students were not covered by the school data (i.e. those in non-government schools) so the cost and quality of the drug education programs that they received was unknown. In both the school-based and general population programs, there was no information regarding the breakdown of costs between drugs, meaning there is some uncertainty in attribution of costs specifically to methamphetamine. Also, the extent of population programs is likely to be highly variable. In 2013/2014, the Federal Government did not run any specific methamphetamine or general drugs advertising campaigns (exceeding the $250,000 reporting threshold) (Department of Finance, 2014), but the “National Drugs Campaign – Ice” in 2014/15 cost $8.9 million.

While estimates of the cost effectiveness of harm reduction programs such as NSP exist, little information is available on specific drugs as drivers of transmission either through sexual practices, injecting, contextual risks or other risk behaviours. In addition, the long latency before people enter treatment means that even if they are currently methamphetamine users, disease exposure may pre-date this use.

The limitations arise both from the data used to determine the frequency and type of episodes of treatment and the cost estimates. The use of the AODTS captures approximately 97% of in-scope agencies. However, there are a range of out-of-scope activities that would ideally be included but cannot. For example, the AODTS data do not include data from any agency that does not receive any public funding, such as privately funded counselling or privately funded centres providing inpatient rehabilitation or withdrawal management. Neither does it include an exhaustive estimate of contacts with general practitioners, although some visits are captured in Chapter 5.

Often clients will report multiple drugs of concern, and our decision to apply costs only to those cases where methamphetamine was the primary drug of concern means a significant component of costs may have been excluded (i.e. where additional drug of concern is methamphetamine for 13% of episodes (Australian Institute of Health and Welfare, 2015a)). This choice was deliberate and conservative to ensure that double counting would not occur if the costs related to other drugs were subsequently to be estimated. In addition, the amount of time spent and harms from other drugs of concern was unknown.

The availability of the cost of treatment data was very limited – many jurisdictions were not able to provide cost of treatment and those that did were not able to provide methamphetamine specific treatment costs. Therefore, the unit costs are limited to the average cost of treatment for all drugs of dependence, from a limited number of sources. Therefore, the estimates should be treated with some caution as external generalisability has not been conclusively demonstrated. Existing research on the costs of providing drug and alcohol treatment in Australia has primarily focused on treatments for heroin dependence, with little research assessing the actual costs of providing interventions for methamphetamine. [7]

Further, the length of stay information in the AODTS data is based on initiation and closure of the file, not on treatment provided. Thus, an episode is closed when there has been no further contact between the client and treatment provider for three months or when treatment is ceased, making these data unhelpful for estimating costs. Consequently, such an approach would over-estimate the costs of treatment.

As discussed above, not all "treatment" interventions are included in this section. Treatment costs for methamphetamine dependence/misuse are also included in Chapter 5 (inpatient, general practitioner, and mental health). Not included is treatment provided totally within the private sector. Finally, as in other sections of this report, while we refer to methamphetamine, it is understood that a small proportion of the actual costs may be related to other amphetamine-type stimulants.

It is not known how much time is spent by pharmacists recording information in the data system associated with ProjectStop, nor how much time is spent reviewing data in the system when considering an individual's request for a medication containing pseudoephedrine. As such, the cost of controlling precursors is likely to be underestimated.

[7] The 2007 study conducted by RAND assessing the costs related to methamphetamine also did not find specific costs for methamphetamine treatments. The RAND study relied on the available unit costs of treatment from the Drug Abuse Treatment Cost Analysis Program (DATCAP), Substance Abuse Treatment Cost Analysis Allocations Template (SATCAAT) and Alcohol and Drug Services Study (ADSS). Each of these is a data collection instrument that examines costs by treatment modality. They are widely used across the United States by researchers, policy makers and treatment providers with costs being available from more than 750 treatment agencies in 2007 (Nicosia et al., 2009).

CHAPTER 5: HEALTH CARE COSTS RELATED TO METHAMPHETAMINE USE

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5.1 Background

The costs of treatment for methamphetamine dependence provided within specialist treatment settings were included in the previous chapter. Such treatment can also be provided by a range of other providers including acute care hospital services, medical specialists and general practitioners, however, data precision often precludes separating such encounters from those encounters for other health problems where methamphetamine may also have played a role. Health service use related to methamphetamine goes beyond treatment for methamphetamine dependence and potentially includes a range of other illnesses and injuries.

Cost of illness studies, such as those of Collins and Lapsley, have typically utilised national data and aetiological fractions (AF) to estimate the quantum of health care resources utilised as a consequence of a specific behaviour, for example, smoking or the consumption of alcohol and illicit drugs (Collins and Lapsley, 2008). However, this previous work only assessed the morbidity and associated costs related to all illicit drugs combined, not for individual illicit drug types, other than for tobacco and alcohol. The use of the aetiological approach requires the 1) relative risk of an illness/disease being caused by the factor of interest, in our case, methamphetamine; 2) rate of the illness/disease in the population; and, 3) prevalence of methamphetamine use in the population. The limiting factor in using AF for methamphetamine is the lack of available solid medical and scientific information on the relative risks of methamphetamine in causing specific illnesses/diseases.

The Global Burden of Diseases (GBD), Injuries, and Risk Factors Study 2010 conducted a wide ranging literature review assessing the relative risk from various causes. As part of that study, the burden of illicit drug dependence for illicit drugs, including amphetamine-type stimulants, cocaine, opioids, and cannabis, were estimated for those causes where the level of evidence was sufficiently strong (Degenhardt et al., 2013). The authors indicated that for many hypothesised consequences of illicit drug use in general (or for specific drugs such as amphetamines) the level of evidence was too low or confounding effects had not been disentangled. The GBD studies did find that: dependence upon psychostimulants is a significant contributor to disease burden (Degenhardt et al., 2014); injecting drug use is a risk factor for hepatitis C, hepatitis B, HIV; and, amphetamine dependence is a risk factor for suicide. We have also identified relative risks due to methamphetamine for cardiomyopathy (Yeo et al., 2007) and for ischemic and haemorrhagic strokes (Petitti et al., 1998; Westover et al., 2007).

Researchers from RAND took a different approach to estimating health care costs related to methamphetamine. Treatment costs were estimated directly from the data for those cases where methamphetamine was the only drug or primary drug of concern. All such episodes of care were included whether they occurred at treatment facilities or as an inpatient at an acute care hospital (Nicosia et al., 2009). Additionally, through a literature review, they identified the IDC-9CM codes for a number of conditions (foetal dependence, drug-induced neuropathy, drug-induced mental health disorders, mental health and poisoning by psychostimulant drugs, skin infections, bacterial skin infections, other skin inflammation, and chronic skin ulcers) as being methamphetamine induced. When these conditions were identified through ICD-9-CM codes, and when methamphetamine dependence or "abuse" was mentioned, all costs of a hospitalisation were included (Nicosia et al., 2009).

Methamphetamine was also identified as a "contributing factor" to other illnesses. For those factors deemed to be "contributing", the RAND approach was to use the incremental cost for a given illness. They calculated the difference between the actual costs for those with "a non-primary mention of methamphetamine dependence or abuse" and those "having the illness and not having a mention of methamphetamine dependence or abuse". Only conditions where the literature suggested there was a rationale for methamphetamine contributing were included. Additionally, the RAND study extracted from a data management system the details of the methamphetamine-related suicide and suicide attempts and estimated their costs.

Given the limited number of valid AF fractions for methamphetamine, the current study uses a variety of approaches and datasets to estimate the health care costs related to methamphetamine. Further, it was not feasible to follow the RAND approach for estimating costs where methamphetamine might be a "contributing factor" as the cost per case data necessary to estimate the incremental costs related to methamphetamine are not available. Each method is described below.

Included are inpatient hospitalisations where: 1) methamphetamine is listed as the primary diagnosis; 2) a skin condition was the primary diagnoses with a mention of methamphetamine dependence or abuse in one of the subsequent diagnoses; 3) a selected mental illness was the primary diagnosis with a mention of methamphetamine dependence or abuse in one of the subsequent diagnoses; 4) cardiomyopathy and strokes, which were estimated on population data using available AF; and, 5) suicide attempts, which were estimated on population data using available AF. The methods and assumptions are discussed below. Also included are estimates of health care costs and treatment related to hepatitis C virus (HCV) and HIV/AIDs. Alternate methods and data sets are used to estimate expenditures in emergency departments, for general practitioners and on ambulances. It is expected that these are conservative estimates as there are a number of exclusions. For example, not included are costs related to other sexually transmitted diseases, hepatitis B virus, other illnesses related to injecting such as bacterial endocarditis, other cardiac diseases, and impact on new-borns.

5.2 Methamphetamine Attributable Hospital Admissions

Data from the National Hospital Morbidity Database (NHMD) were obtained from the Australian Institute of Health and Welfare (AIHW) for 2013/14. These data are a collection of electronic confidentialised summary records of patient separations from public and private hospitals in Australia. Data for all hospital separations have been supplied to the AIHW by all jurisdictions and territory health authorities with the exception of Tasmania, which only supplied separations where either the principal or an additional diagnosis was drug related.

The *International Classification of Diseases*, 10th revision (ICD-10-CM) (World Health Organization, 1992) was used to identify amphetamine-related separations. While some ICD codes are specific to a given substance, most ICD codes are disease specific. In addition to up to 32 diagnoses, each hospital record contains the relevant Australian Refined Diagnosis Related Group (AR-DRG). The AR-DRG grouper software utilises each patient's diagnoses, age, gender, and other relevant information to allocate the relevant AR-DRG for which there are case weights, which in turn are used to derive the cost per case (Independent Hospital Pricing Authority, 2016). The challenge, given the lack of AF for methamphetamine, was to ascertain which hospital separations were attributable to methamphetamine.

A summary of the inpatient hospital separations and costs attributable to methamphetamine is provided in Table 5.1. A full description of the methods and assumptions used to generate these estimates is provided immediately below the table.

Table 5.1: Summary of inpatient hospital separations and costs

Inpatient hospital separations	Frequency	Total Costs
Mental and behavioural disorders due to use of stimulants (excluding cocaine) & Poisoning by psychostimulants	7,832	$48,955,996
Mental health (not elsewhere included)	1,124	$22,605,614
Self-harm & suicide attempts	2,174	$13,321,105
Skin disorders	205	$1,281,145
Ischemic and haemorrhagic strokes	115	$2,912,031
Cardiomyopathy	49	$896,491
Total	**11,412**	**$89,972,382**

Source: (Australian Institute of Health and Welfare, 2014b)

5.2.1 Selecting cases by primary diagnosis (Mental and behavioural disorders due to use of stimulants (excluding cocaine) & Poisoning by psychostimulants)

The total cost of all separations where the primary diagnosis was one of the ICD-10-CM codes F15 to F15.99 were included (i.e. attributable fraction is equal to one). These ICD codes constitute the category of *Mental and behavioural disorders due to use of stimulants (excluding cocaine) & Poisoning by psychostimulants*. They are further classified into DRGs such as drug intoxication and withdrawal, drug use disorder and dependence, poisonings and toxic effects of drugs with or without requiring mechanical ventilation. As mentioned elsewhere (section 2.6.1), these ICD codes may also include a small proportion of those affected by amphetamine.

There were a total of 7,832 separations in the year 2013/14 with the total costs of **$48,955,996**. Appendix 2 provides a list of the DRGs, and their associated frequencies, case weights and costs.

In addition to those cases above, considerable literature exists highlighting various other mental health problems associated with methamphetamine, although no specific relative risk data for the causation of mental illness from methamphetamine were found. Recent literature has revealed that in NSW those diagnosed with schizophrenia who have a history of stimulant use have a significantly higher rate of mental health and other health service contacts over and above those who do not use simulants (Sara et al., 2014). Therefore, costs related to episodes in the inpatient hospital data where a mental health diagnoses existed alongside a diagnosis of methamphetamine were included. The included episodes had one of the following as a primary diagnosis: schizophrenia disorders, paranoia and acute psychotic disorders, or major affective disorder, and had a methamphetamine diagnosis as an additional diagnosis. Importantly, in an attempt to exclude polysubstance impact, any episode where there was a mention of another psychoactive drug was excluded. Once cases were identified the AR-DRG case weighted costs were applied, resulting in a total of **$22.6 million** (Table 5.2).

Table 5.2: Other mental health DRGs, cases and costs

DRG description	Total cases	Case weight	Total cost
Schizophrenia disorders + mhls	458	4.88	$11,408,704
Schizophrenia disorders - mhls	233	3.08	$3,663,754
Paranoia & acute psychiatric disorders + cscc/mhls	88	3.55	$1,592,964
Paranoia & acute psychiatric disorders cscc - mhls	59	2.22	$668,538
Major affective disorders age >69 / + cscc	45	5.77	$1,325,211
Major affective disorders age <70 - cscc	241	3.21	$3,946,443
Total	**1124**		**$22,605,614**

+/-cscc = with or without catastrophic or severe complications and or comorbidities; +/-mhls = with or without mental health legal status; Sources: (Australian Institute of Health and Welfare, 2014b); (Independent Hospital Pricing Authority, 2014)

5.2.2 Selecting cases: Self-harm/attempted suicide

Methamphetamine is a central nervous system stimulant generating potent sympathomimetic activity. Use of methamphetamine produced a dose-related increase in the risk of psychotic symptoms, including paranoid ideas and hallucinations, similar to those observed in paranoid schizophrenia (Glasner-Edwards and Mooney, 2014; Kuo et al., 2011; McKetin et al., 2013b; Sara et al., 2014). It is possible that such distressing psychotic symptoms, alone or in combination with frequently-observed mood changes, may contribute to the observed high rates of suicide and suicide attempts among long-term methamphetamine users (Degenhardt et al., 2013; Nicosia et al., 2009; Sara et al., 2014). The relative risk (95% CI) of suicide among those with psychostimulant use was 8.2 (3.8-16.9) (Ferrari et al., 2014).

To include the hospital costs related to suicide attempts or self-harm attributable to methamphetamine, the age-specific relative risks of suicide from the GBD study (Degenhardt et al., 2013) were obtained (Table 5.2) and aetiological fractions were calculated. Next, the potentially relevant cases of self-harm or suicide attempt in the inpatient population data (ICD-CM codes of X60-X84) were identified, resulting in a total of 26,799 cases amongst those 15 to 54 years of age (the age range for which a relative risk existed). The AF were applied to the relevant age group, resulting in 2,174 separations. The average costs were then applied, resulting in a total cost of **$13.3 million.**

Table 5.3: Self-harm/suicide attempt: Relative risks and costs resulting in 2174 separations

Suicide attempt/ self-harm	ICD-CM codes	RR	Attributable fraction by age group				Total
			15-24	25-34	35-44	45-54	
Attributable fraction by age group	X60-X84	8.2	0.092	0.117	0.074	0.022	8.2
		3.9	0.039	0.051	0.031	0.009	3.9
		16.9	0.182	0.226	0.149	0.048	16.9
Cases identified		Main	900	733	432	109	2174
		Low	383	315	182	44	927
		High	1789	1419	876	234	4317
Costs ($)		**Main**					**13,321,105**
		Low					5,682,240
		High					26,465,251

Sources: (Ferrari et al., 2014) (Australian Institute of Health and Welfare, 2014b); (Independent Hospital Pricing Authority, 2014)

5.2.3 Selecting cases: Skin conditions

Methamphetamine use is associated with skin-picking behaviours. Skin picking, characterised by the repetitive and compulsive picking of skin, leading to tissue damage, may develop as a result of methamphetamine use or as a side effect of treatment for ADHD (Grant et al., 2012), particularly when an individual has engaged in continuous use over a period of days ("tweaking") (Lee et al., 2005). Such skin picking may lead to abscesses, as can injecting drugs, particularly in those who have poor hygiene and poor nutrition. Following the methods of Nicosia and colleagues at RAND (2009), those hospital separations with a DRG indicating a skin infection, bacterial skin infection, other skin inflammation, or a chronic skin ulcer as a primary diagnosis, and where one of the subsequent diagnoses was methamphetamine-related (i.e. mental and behavioural disorders due to use of stimulants or poisoning by psychostimulants) were included. Those hospitalisations with mentions of other illicit drugs or alcohol use were excluded.

All hospital costs for included cases were included, giving an estimated total cost of **$1.3 million**.

5.2.4 Selecting cases related to cardiomyopathy and strokes

In addition to separations where methamphetamine was the principal reason for hospitalisation (as per the first diagnostic code listed), other separations where there is evidence that methamphetamine may be a major contributing cause for the hospitalisation were considered. The literature suggests that the cardiovascular effects of methamphetamine include both acute and chronic damage. Three studies identified the relative risk of cardiomyopathy and strokes due to methamphetamine (Petitti et al., 1998; Westover et al., 2007; Yeo et al., 2007). The attributable fractions were calculated, using the relative risk and dependent population, and then applied to the relevant population data. The published odds ratios were converted to relative risks using the approach outlined by Grant and described in detail in Chapters 7 and 10 (Grant, 2014). The definitions of methamphetamine users in the three studies that form the basis for our calculation of methamphetamine attributable strokes and cardiomyopathy most closely match the cohort of regular users (dependent and non-dependent) from Degenhardt et al. (2016a) and this was used in the calculation of attributable fractions.

Once cases were identified, the relevant AR-DRGs case weights and costs were once again applied (See Tables 5.4-5.6). For cardiomyopathy and haemorrhagic or ischaemic stroke the total cost was **$3.8 million**.

Table 5.4: Strokes and cardiomyopathy: Relative risk and attributable fractions

					Attributable fraction			
Condition	**Source**	**ICD-10 codes**		**RR**	**15-24**	**25-34**	**35-44**	**45-54**
Cardio-myopathy	1	I42	Main	3.68	0.059	0.077	0.048	0.014
			95% CI lower	1.80	0.018	0.024	0.015	0.004
			95% CI higher	7.70	0.136	0.172	0.111	0.035
Ischaemic stroke	2, 3	I63; I64; I65; I66; I69.3; I69.4	upper bound	3.8	0.062	0.080	0.050	0.062
			lower bound	1.04	0.001	0.001	0.001	<0.001
Haemorrhagic stroke	2, 3	I60; I61; I62; I69.0; I69.1; I69.2	upper bound	4.94	0.085	0.109	0.068	0.021
			lower bound	3.8	0.062	0.080	0.050	0.015

Sources: 1. (Yeo et al., 2007); 2. (Petitti et al., 1998); 3. (Westover et al., 2007); 4. (Degenhardt et al., 2013)

Table 5.5: Strokes and cardiomyopathy: Frequency of cases attributable to methamphetamine by age group

Condition	**15-24**	**25-34**	**35-44**	**45-54**	**Total cases**
Cardiomyopathy main bound	6.0	13.6	18.8	10.1	48.6
Cardiomyopathy lower bound	<5	4.3	5.8	<5	15.0
Cardiomyopathy upper bound	13.8	30.5	43.9	24.8	113.0
Ischemic stroke upper bound	4.6	20.1	36.0	26.3	87.1
Ischemic stroke lower bound	<5	<5	<5	<5	<5
Haemorrhagic Stroke upper bound	6.5	23.3	31.9	20.2	81.8
Ischemic Stroke lower bound	4.7	17.1	23.1	14.4	59.3

Source: (Australian Institute of Health and Welfare, 2014b); Table 5.2

Table 5.6: Costs related to cardiomyopathy and stroke

Condition	Central estimate	Low bound	High bound
Cardiomyopathy	$896,491	$276,509	$2,085,911
Ischemic Stroke	* $820,296	$24,221	$1,616,370
Haemorrhagic Stroke	* $2,091,735	$1,758,710	$2,424,761
Total	**$3,808,522**	**$2,059,440**	**$6,127,042**

* In the absence of other information, the mid-point between the upper and lower bounds were used.
Sources: (Australian Institute of Health and Welfare, 2014b); (Independent Hospital Pricing Authority, 2014)

5.3 Blood Borne Viruses (HIV/AIDS and hepatitis C)

Injecting drug use, regardless of the substance involved, is a risk factor for infection with blood borne viruses unless safe injecting techniques are followed. However, methamphetamine use appears to confer additional hazards. There is increasing evidence that methamphetamine has profound and negative impact on host immunity (Salamanca et al., 2015). Additionally, methamphetamine has been shown to inhibit immune responses in the liver, facilitating hepatitis C Virus (HCV) replication as well as having a negative impact on treatment efficacy (Ye et al., 2008). Combining this with altered judgement, sharing of drug injecting paraphernalia, increased sexual risk taking and reduced inhibitions, those using methamphetamine, especially injectors, are at a high risk of acquiring blood borne viruses such as human immunodeficiency virus (HIV) and HCV (Colfax et al., 2010; Colfax et al., 2004). Among the cohort of men who have sex with men, those who inject drugs (predominantly methamphetamine rather than heroin) differ in risk taking behaviours from those who do not inject. Those who inject are more likely to use drugs for sex, engage in more esoteric sexual practices and have twice the odds of being HIV positive and seven times the odds of been HCV positive (Lea et al., 2013).

Given the similar modes of transmission, it is unsurprising that co-infection with HIV, HCV (and hepatitis B Virus) can occur (Australasian Society for HIV Medicine, 2010). About 10% of those testing positive for HIV will also be HCV positive (Amin et al., 2004; Australasian Society for HIV Medicine, 2010).

In previous studies, the costs related to HIV/AIDS and hepatitis have been attributable to drug use and hospital costs estimated through the use of the ICD codes and aetiological fractions (Collins and Lapsley, 2008). The feasibility of replicating this approach is challenged by the fact that again there are no specific AF for methamphetamine and blood borne viruses. Plus a considerable proportion of the treatment for both HIV and HCV occurs at primary care or specialist treatment in the community.

The methodology used here is a more direct approach of estimating the costs, using available published data on treatment and other health care costs for both HCV and HIV/AIDS alongside estimates of the relevant population. Here, rather than using only hospital admissions and DRGs, we estimate the annual costs of treatment and other health care utilisation both in and out of the hospital for the cohort of individuals who have acquired HCV or HIV that can be attributable to injecting methamphetamine. Due to lack of comparable data, this does not include costs attributable to those who acquire the BBV through activities other than injecting.

5.3.1 Estimating the size of the population with HIV/AIDs and hepatitis C

For the purposes of estimating the costs related to HIV/AIDs and HCV, the number of dependent and regular but not dependent methamphetamine users estimated by Degenhardt et al. 2016 was used (2016a). The number who use regularly (at least monthly) equates to 268,000, while the number estimated to be dependent was 160,000. This latter number was subtracted from the number of regular users for an estimate of regular but not dependent users (108,000) (Degenhardt et al., 2016a).

Unlike heroin use in Australia, injection as a route of administration for methamphetamine is not always the usual route of administration and, furthermore, injecting as a usual/or most recent route of administration can vary by frequency of use. Of those entering treatment where methamphetamine was reported as the primary drug of concern, 43.6% of those having injected in the previous 12 months reported injecting as their usual route of administration whereas 14.4% (95% CI 12.0% to 19.5%) of those who use monthly or weekly reported injecting as the usual route of administration (Australian Institute of Health and Welfare, 2015a).

Having determined the potential number of dependent and the number of regular but not dependent users who are injecting methamphetamine, the next step was to estimate the number who have blood borne viruses by multiplying the HIV prevalence (2.4%) and the rate of HCV prevalence (48%) amongst injecting drug users who reported methamphetamine as last drug injected (The Kirby Institute, 2014) by the number of estimated persons who inject methamphetamine (See Table 5.7). It is acknowledged that using the “last drug injected” may not correspond to how HIV/HCV were actually acquired (i.e., it may have been acquired through previous injecting of heroin or other drugs, injecting of methamphetamine, or sexual transmission with or without methamphetamine). It is not feasible to ascertain precisely how or when these BBV viruses were obtained. Given previous periods of higher rates of use of methamphetamine and the long history of methamphetamine use in Australia (Chesher, 1991), it is not expected that the numbers will be a significant overestimate. Indeed, as those who have injected methamphetamine in the past but are no longer injecting methamphetamine are not included, these numbers may be a significant underestimate. Data to ascertain the actual numbers are not available.

Table 5.7: Estimating the numbers of persons who inject methamphetamine with HIV or HCV

Category of user	Dependent	Regular not dependent	Total
Number of methamphetamine users	160,000	108,000	268,000
Injecting as usual route of administration	43.6%	14.4%	
Number of methamphetamine users who have injected in past 12 months	69,760	15,552	85,312
Number of methamphetamine users who have HIV	1,953	435	2,388
Number of methamphetamine users who have HCV	33,485	7,465	40,950

Sources: (Degenhardt et al., 2016a); (The Kirby Institute, 2014)

5.3.2 Estimating the costs related to the treatment of and health care utilisation of those with HIV/AIDs

Costs were estimated for treatment for HIV/AIDs and for other health care services for those with HIV/AIDs. Treatment and its costs vary as a function of the status of the disease process. A measure of the immune system is the CD4 count, with a lower CD4 count indicating greater progression of the disease. It was not feasible to apportion treatment costs according to individuals based on their CD4 count. Therefore, a weighted average cost for treatment, based on the current distribution of CD4 counts (The Kirby Institute, 2014), and relevant costs of the annual average cost of medical care by CD4 count (Schneider et al., 2014) were calculated. These two data sources were used to calculate a weighted average cost: $4,520 (2014 AUD) per person per annum for health services (hospital, GP, and specialists).

In addition, anti-retroviral treatments are available, with approximately 61% of those who have HIV receiving treatment. The cost of medication was sourced from the HIV, Viral hepatitis and Sexually Transmissible Infections in Australia, Annual Surveillance Report, 2014; (Table 7.2.1) (The Kirby Institute, 2014). The average cost of medication was calculated at $16,715 per person per annum. The total estimate of treatment and other health care was **$30.0 million** for one year.

Table 5.8: Methamphetamine attributable HIV costs (treatment and health care) (2014$)

Category	**Data**
Number with HIV [a]	2388
Average cost per year for health care for person with HIV	$4520
Subtotal – Cost of health care	*$10,793,666*
% who receive antiretroviral treatment	61%
Number who receive antiretroviral treatment	1,457
Cost per year of anti-retroviral drugs	$13,211
Subtotal – Cost of anti-retroviral drugs	*$19,244,343*
Total	**$30,038,009**

Sources: Table 5.7; (Schneider et al., 2014); (The Kirby Institute, 2014); authors' calculations: [a] Estimate of injection acquired HIV

5.3.3 Estimating the costs related to the treatment of and health care utilisation of those with hepatitis C

The progression of HCV is categorised as stages 0-4 based on the severity of liver fibrosis. On average, in 2014, 2% of those in stages F0 to F4 accessed treatment for HCV in that year (NSW Ministry of Health, 2104). The average cost of treatment for HCV was $4,382 for a one time course of treatment.

Individuals with HCV may be in one of several stages of the disease from F0 to F4, or decompensated cirrhosis, liver cancer, or liver transplant eligible. As with costing HIV, we have no way of knowing the actual stages of the methamphetamine using population, but we do know the distribution over the whole hepatitis C population (The Kirby Institute, 2014) and this distribution was applied to the 40,950 persons estimated to have HCV. The costs for health care for each of the stages was sourced from Visconti and colleagues with costs updated to 2013/14 AUD (Visconti et al., 2013). The total cost for HCV related health care was **$23.2 million** (Table 5.9).

Table 5.9: Methamphetamine attributable costs of HCV treatment and health care for those who have hepatitis

Category	Data
Number with HCV [a]	40,950
Cost per one HCV treatment course	$4,382
Rate of treatment uptake	2%
Number who take up treatment	819
Costs of HCV treatment	*$3,588,837*
Health care for those with HCV	*$19,649,865*
Total	**$23,238,702**

Sources: Table 5.7; (Visconti et al., 2013); (The Kirby Institute, 2014); authors' calculations: [a] Estimate of injection acquired HCV

5.4 Emergency Presentations

5.4.1 Number of ED presentations

Previous assessments of the health care costs related to illicit drugs in Australia have tended not to include any of the costs related to emergency department (ED) presentations (i.e. accidents, overdoses, psychotic behaviours, chest pain). The RAND study estimated that approximately 13.1% of all health care costs related to methamphetamine occurred in the ED (Nicosia et al., 2009). With reports of increased methamphetamine-related ED presentations and data such as that from the Victorian ambulance service confirming a recent increase in callouts relating to methamphetamine use (Lloyd et al., 2014), it seemed prudent to attempt to capture these costs.

A paper by Gray and colleagues reported on a three month study conducted in Royal Perth Hospital with the use of a mandatory diagnostic prompt in the ED computerised data information system (Gray et al., 2007). They reported that 1.2% (n=156) of all presentations during that time were judged to be causally related to amphetamine use. Of interest, these patients were often (57.1%) determined to be habitual drug users, using amphetamine at least weekly; the presentations were typically of high acuity; many came by ambulance (32.1%) or were brought in by police (16.0%); and, 37.2% required a psychiatric evaluation. However, other diagnoses such as motor vehicle accident, seizures, chest pain, injury, and infection at injection sites were also reported. As these data came from one inner city hospital over a short period, they were not considered generalisable to the whole country.

A second report, a background paper on crystal methamphetamine prepared by NSW Health, described methamphetamine use among those ED presentations where a triage nurse identified one of the following: overdose; poisoning; acute alcohol problem; illicit drug or, a mental health problem (NSW Health, 2015). This study, which reported there were 2,982 such presentations in 2014 from 59 NSW hospitals, is limited in scope as a large proportion of hospitals are missing. Other presentations, such as cardiovascular, overdose, self-harm and accidents, were also not included in these data.

The current study turned to data from the MATES study, a longitudinal cohort of 501 methamphetamine users (for a description of the cohort see (McKetin et al., 2012). The relationship between methamphetamine use and emergency admissions was estimated using three one year panels of data from this cohort study, representing 1,205 observation points (i.e. 1,205 years of data). The relative rate of emergency presentations per person year was estimated using a random effects model with a random intercept for individuals (on repeats) for three levels of past year methamphetamine use (no use, 152 years; non-dependent use, 347 years; and, met DSM-IV criteria for dependence on methamphetamine, 706 years). The model was adjusted for other drug use in the past year, including frequency of cannabis use (0, < 5 days/week; 5+ days/week), alcohol use (0, < 5 days/week; 5+ days/week), any tobacco use, and the number of other drug classes used (heroin, other opioids, cocaine, ecstasy, hallucinogens, inhalants). A negative binomial regression model was used as it provided the best goodness of fit for the over-dispersed count of emergency presentations. DSM-IV dependence was assessed at each follow-up using the Composite International Diagnostic Interview (World Health Organization, 1993).

This model was used to derive marginal rates (and 95% confidence intervals) for presentations during periods of abstinence from methamphetamine, non-dependent use and dependent use respectively (Table 5.10). The difference between this rate for no use (i.e., 0.647 presentations per year per person) and each methamphetamine use category was taken as an estimate of the additional number of presentations that accrued to that category (i.e., 0.178 presentations per person year for non-dependent use, 0.307 presentations per person year for dependent use). These estimates and their confidence intervals are presented in Table 5.11. In these analyses it was assumed that the relationship between methamphetamine use and increased ED presentations reflected the number of presentations attributable to methamphetamine use where "no use" represents the baseline ED use, analogous to a population control.

Table 5.10: Emergency department presentation adjusted for other substance use*

Category of user	Rate ratio	95% confidence interval		P value	Predicted marginal incidence rates (ppy)	Difference relative to no use (ppy)
		Lower	Upper			
No use (reference)					0.647	0.000
Non-dependent use	1.27	0.91	1.78	0.152	0.825	0.178
Dependent use	1.47	1.06	2.05	0.020	0.954	0.307

* Past year cannabis use (no use, < 5 days/week; 5+ days/week); Alcohol use (no use, < 5 days/week; 5+ days/week), any tobacco use, & number of other drug classes used (cocaine, inhalants, hallucinogens, ecstasy, heroin, other opioids)

The rates in Table 5.11 are treated as attributable risk rates and are multiplied by population estimates of 108,000 regular users, and 160,000 dependent users (Degenhardt et al., 2016a). In doing this, it is assumed that non-dependent regular methamphetamine use is equivalent to the category of regular (but not dependent) methamphetamine use in the national prevalence estimates of methamphetamine use provided by Degenhardt and colleagues (2016a).

Table 5.11: Number of additional presentations at ED with 95% confidence intervals

Category of user	Main	Lower 95% CI	Upper 95% CI
Non-dependent regular users	0.178	0.020	0.335
Dependent users	0.307	0.183	0.431

Source: (McKetin et al., 2012)

Where feasible we have attempted to validate our data. Our estimate of 68,345 potential ED presentations attributable to methamphetamine (Table 5.12) is 1.0% of the total of 6.649 million ED presentations reported for Australia in 2014 (Independent Hospital Pricing Authority, 2016), which is similar to the 1.2% reported by Gray providing some confidence in our estimates (2007).

Table 5.12: Number of modelled potential additional ED presentations per year attributable to methamphetamine use

Category	Population	Number of ED presentations per year attributable to methamphetamine use		
		Main result	Lower 95% CI	Upper 95% CI
Non-dependent users	108,000	19,180	2,179	36,181
Dependent users	160,000	49,165	29,309	69,022
Total	**268,000**	**68,345**	**31,487**	**105,202**

Sources: (Degenhardt et al., 2016a; McKetin et al., 2012)

5.4.2 Costs of ED presentations

Having determined the number of presentations attributable to methamphetamine, the next step is to estimate the costs. We do not have any information on the reason for attending emergency, nor whether a given presentation led to a hospital admission, which is relevant as the inpatient cost weights applied to inpatient admissions elsewhere (see Table 5.2) include an ED cost component. Therefore, an average for admitted ED presentations of $956 (2013/14) and $443 (2013/14) for non-admitted ED presentations was used (Independent Hospital Pricing Authority, 2016).

Gray and colleagues reported that 39.7% of ED presentations determined to be due to ATS were subsequently admitted (Gray et al., 2007). The costs of these cases were not included in the overall totals to avoid potential double counting. The ED costs for non-admitted patients for presentations that were related to methamphetamine use was **$18.8 million**.

Table 5.13: Total cost of ED presentations with the 95% CI

Distribution	Main result	Lower 95% CI	Upper 95% CI
Admitted (39.7%)	$24,763,034	$11,408,496	$38,117,209
Not admitted (60.3%)	$18,759,472	$8,642,615	$28,876,055
Total	**$43,522,506**	**$20,051,111**	**$66,993,265**

Source: (Independent Hospital Pricing Authority, 2014); authors' calculations, Tables 5:11, 5:12

5.5 Community Mental Health Care

5.5.1 Number of mental health separations

While inpatient mental health admissions are included in the inpatient hospital data above (Table 5.1 and Section 5.1), community contacts within the mental health system are not. Data on the number of community mental health contacts where the ICD code was F15 to F15.99 (Mental and behavioural disorders due to use of stimulants (excluding cocaine)) were obtained from the Community Mental Health Care 2013/14 data (Mental Health Services in Australia, 2014). This accounted for 0.2% of the total, or 15,490 contacts. This is likely a conservative approach as it excludes cases where methamphetamine was a secondary diagnosis.

5.5.2 Costs of community mental health

The costs of community mental health expenditure data was sourced from AIHW website reporting mental health expenditure data (Australian Institute of Health and Welfare, 2014c). To estimate the proportion of Community Mental Health Care to apportion to methamphetamine, the 0.2% from above was multiplied by the reported total of $1,878 million for community mental services, resulting in an estimate of **$3.7 million.**

5.6 Ambulance Costs

As always, national data would be preferred but with respect to ambulance data and methamphetamine use, the only data located on the number of ambulance attendances for methamphetamine was for Victoria (Lloyd et al., 2014). This study reported that the total number of methamphetamine-related ambulance attendances in Victoria in 2012/13 was 1706. The reported methamphetamine attendances (1,706) was divided by the total ambulance attendances for Victoria for the same year (Steering Committee for the Review of Government Service Provision, 2015b). This proportion (0.23%) was multiplied by the total expenditure nationally on ambulances (Steering Committee for the Review of Government Service Provision, 2015b). The total expenditure was estimated at **$6.1 million**.

Table 5.14: Estimating ambulance costs

Category of call out	Source	Data
Ambulance call outs assessed to be methamphetamine-related	1	1706
Total ambulance call outs in Victoria in 2012/13	1	738,625
Percentage of Victorian call outs attributed to methamphetamine	1, 2	0.23%
Total expenditure nationally on ambulances	2	$2,641,944,478
Expenditure on ambulances attributable to methamphetamine		**$6,102,091**

Sources: 1 (Lloyd et al., 2014); 2 (Steering Committee for the Review of Government Service Provision, 2015b); author calculation

5.7 General Practitioner Visits

5.7.1 GP visits

The population data from the Medical Benefits Schedule statistics on GP visits does not provide information on the reason/diagnosis related to the visit. Therefore data on rates of contact with general practitioners (GPs) were based on a community survey of 310 regular (at least monthly) methamphetamine users recruited from Sydney (Kelly et al., 2005). Participants were asked “In the last 4 weeks, how many times have you visited GPs?” and then “How many of these times did you receive help for your methamphetamine use?” The number of visits for which the person received help for methamphetamine use was used as an estimate of the incidence rate for methamphetamine-related GP utilisation. Rates were derived for dependent use and non-dependent use separately (Table 5.16), where dependence was defined as a score of 4+ on the Severity of Dependence Scale. This criterion shows good concordance with a DSM-III diagnosis of dependence on the Composite International Diagnostic Interview (Topp and Mattick, 1997). These incidence rates were multiplied by the estimated number of regular and dependent methamphetamine users to obtain the total number of GP visits per month, and then multiplied by 12 to obtain the number per year (Table 5.15).

Table 5.15: Incidence rates* for GP visits for methamphetamine use by level of use

Category of user	Incidence rate per person month	Population size	No. of GP visits per year	95% confidence intervals	
				Lower	Upper
No use (intercept)					
Non-dependent use	0.04 (0.02-0.10)	108,000	56,759	20,830	123,541
Dependent use	0.32 (0.24-0.42)	160,000	621,503	469,477	807,073
Total			**678,262**	**490,306**	**930,614**

Sources: (Kelly et al., 2005) and authors' (RM) calculations; *Incidence rate and 95% confidence interval calculated using a Poisson distribution

5.7.2 Cost of GP visits

Having obtained the number of GP visits, it is necessary to attach a cost. Data were not available to ascertain the type and length of visits, therefore the average benefit paid ($41.64 (Medicare Australia, 2016)) per visit to the GP was used. This may well be an underestimate given the complexity of drug use and other illnesses. The total expenditure on GPs related to methamphetamine is estimated at **$28.2 million**.

Table 5:16: Expenditure on GPs attributable to methamphetamine use

Category	Main	Lower 95% CI	Upper 95% CI
2013/14 MBS payment	$28,242,830	$20,416,383	$38,750,767

Source: Tables 15:16, (Medicare Australia, 2016); MBS = Medicare Benefit Schedule

Table 5:17: Summary of methamphetamine attributable health care expenditures included

	Central estimate	Low bound	High bound	Refer to table
Inpatient hospitalisations	$89,972,382	[a]	[b]	5.1, 5.6
Emergency department	$18,759,472	$8,642,615	28,876,055	5.13
Community mental health	$3,756,707	[a]	[b]	
HIV/AIDs	$30,038,009	[a]	[b]	5.8
Hepatitis C	$23,238,702	[a]	[b]	5.9
General Practitioners	$28,242,830	$20,416,383	$38,750,767	5.16
Ambulance	$6,102,091	[a]	[b]	5.14
Total	**$200,110,193**	**$178,789,909**	**$236,976,672**	

[a] Low bound estimate – duplicated central estimate; [b] High bound estimate – duplicated central estimate

5.8 Limitations and Recommendations

Although considerable effort went into compiling these costs, as elsewhere there are a number of limitations to the analyses is this chapter. First and foremost, these data are an attempt to capture only the direct health care costs that occurred in 2013/14 and as such the long-term consequences (costs and impact on quality of life) are not included. Whether dependence, self-harm, strokes or HCV, most diagnoses will have ongoing health care requirements but these are not included in this research.

Importantly, any ongoing chronic health care needs from previous use among those no longer using methamphetamine will not be captured. This is not an unusual situation in such studies as this, including previous Collins and Lapsley studies, but it is worth noting.

There is considerable need for additional epidemiological research. There is some evidence, but not sufficient, that methamphetamine use can result in bacterial endocarditis, foetal dependence and withdrawal management, injuries (other than self-inflicted), hepatitis B, and other sexually transmitted illnesses that are not included in our figures. Another key area where evidence is lacking is the impact of methamphetamine on the cardiovascular system. Although there is good evidence of the scale and nature of the impact on risks of cardiomyopathy and strokes, evidence suggests that methamphetamine consumption can potentially cause a broader range of harms to the cardiovascular system, however the scale of these risks have not as yet been reliably quantified (Herbeck et al., 2015; Karch et al., 1999; Kaye et al., 2008; Kuo et al., 2011). Thus, to reliably quantify the health burden and related costs to the health care system, much more research is needed on understanding the causal pathways and attribution.

In several instances assumptions were required. For example, although they likely represent a negligible component of the illicit drug market, it was not feasible to separate hospitalisations from prescribed stimulants (dexamphetamine), ecstasy and amphetamine from methamphetamine-related hospitalisations. Another strong assumption was to exclude use of health care resources where poly-drug use was recorded unless methamphetamine was the most responsible drug. This is to ensure that double counting does not occur, should the cost of the other drugs (e.g. alcohol, heroin, cannabis, diazepam) be estimated.

The lack of data, both cost and epidemiological, meant that we often had to rely on only one study (cardiomyopathy, emergency and GP utilisation) or one jurisdiction (several drug treatment costs, ambulance) to generate the costs. Clearly, this is not ideal.

In conclusion, whilst there was a mix of methods and data sets used, every effort was made to be thorough, using the best evidence available to provide a defensible estimate of the costs to the health care system for 2013/14. However, we believe the total health care burden is likely underestimated.

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CHAPTER 6: PREMATURE MORTALITY

Sharlene Kaye & Steve Whetton

6.1 Methamphetamine Attributable Mortality

There is a growing body of evidence to suggest that methamphetamine users, dependent users in particular, are at an increased risk of mortality compared to the general population. In 2007, a cohort study of excess mortality among amphetamine users found that mortality among users was more than six times greater (standardised mortality ratio (SMR) 6.22) than the general population (Lejčková and Mravčík, 2007). Subsequent studies of methamphetamine-related mortality have likewise found elevated mortality among clinical samples of those with methamphetamine use disorders (e.g. SMR 4.7; (Callaghan et al., 2012); SMR 6.02 (Kuo et al., 2011)); and, a recent study of treated and untreated methamphetamine users reported high SMRs among both males (27.8) and females (21.3) (Herbeck et al., 2015).

Mortality related to the use of methamphetamine may be attributable to four broad causal categories: drug toxicity; disease; suicide; and, trauma.

6.1.1 Drug toxicity

Methamphetamine toxicity accounts for a large proportion of methamphetamine-related deaths, with previous autopsy studies finding more than half of methamphetamine-related fatalities were directly attributable to methamphetamine toxicity (Karch et al., 1999; Kaye et al., 2008).

Death caused by methamphetamine toxicity is not as well-defined as that caused by heroin toxicity or "overdose", where there is clear evidence of progressive respiratory depression, and can involve a number of mechanisms. The stimulatory effects of methamphetamine on the central and peripheral nervous systems, for example, can increase the risk of acute and potentially fatal cardiovascular complications. Cardiac arrhythmias, that typically cause sudden cardiac death, are well-documented indicators of methamphetamine toxicity. The use of methamphetamine has also been associated with acute myocardial infarction, coronary vasospasm and fatal acute aortic dissection (Kaye et al., 2007).

Cerebrovascular accidents, such as cerebral haemorrhage, stroke and ruptured cerebral aneurysm, are another well-recognised complication of methamphetamine use, with users at significantly elevated risk of stroke, haemorrhagic stroke in particular. Methamphetamine use not only increases odds of haemorrhagic stroke by almost fivefold (odds ratio (OR) 4.95), but is associated with almost three times the likelihood of death following haemorrhagic stroke (OR 2.63) (Westover et al., 2007).

Methamphetamine toxicity can also manifest as other potentially fatal events, such as seizures, hyperthermia, rhabdomyolysis (skeletal muscle breakdown resulting in the release of toxic muscle cell contents into the bloodstream) and associated renal failure, and respiratory failure (Darke et al., 2008; Karch, 2002).

There does not appear to be a clear dose-response for methamphetamine toxicity and the threshold over which potentially fatal reactions occur varies widely. Toxic reactions can occur irrespective of dose, frequency of use or route of administration, and have been reported with small amounts and on the first occasion of use. With long-term use, however, the risk associated with each episode substantially increases over time. Previous studies have consistently found that deaths due to methamphetamine toxicity typically occur among experienced drug users, aged in their mid-30s, reflecting the cumulative risk exposure due to repeated consumption (Darke et al., 2008).

The risk of drug toxicity is increased when methamphetamine is combined with alcohol, cocaine or opiates and, in cases of methamphetamine-related mortality, death is most commonly due to combined drug toxicity, reflecting the observation that poly-drug use is the norm among illicit drug users (Darke and Hall, 1995; McKetin et al., 2013a; Teesson et al., 2015). A review of 371 methamphetamine-related fatalities in Australia over a five-year period (2000-2005) revealed that the most common drugs present with methamphetamine in cases where death was due to combined toxicity were opiates (82%), benzodiazepines (42%) and antidepressants (24%) (Kaye et al., 2008).

6.1.2 Disease

Frequent, long-term use of methamphetamine can increase the risk of chronic and infectious disease, which may cause or contribute to mortality. Underlying disease is commonly found among cases of methamphetamine-related mortality (Karch et al., 1999; Kuo et al., 2011) and compared to the general population, death due to natural causes (i.e. chronic and infectious diseases) was markedly elevated among dependent methamphetamine users (SMR 3.4), with excess mortality due to disease typically attributable to cardiovascular (SMR 14.7) and hepatic diseases (SMR 6.0) (Kuo et al., 2011).

6.1.2.1 Cardiovascular pathology

The cardiotoxic properties of methamphetamine not only have the potential to cause acute cardiac events, as described above, they can also lead to the development of chronic cardiovascular pathology.

While hypertension is an acute effect of methamphetamine intoxication, continued methamphetamine use can lead to chronic hypertension which, in turn, can increase the risk of acute cardiovascular complications. Long-term methamphetamine use has also been strongly associated with the premature and accelerated development of coronary artery disease, with underlying cardiovascular disease found in a significant proportion of methamphetamine-related deaths (Herbeck et al., 2015; Karch et al., 1999; Kaye et al., 2008; Kuo et al., 2011). Accordingly, cardiomegaly (enlargement of the heart), a consequence of hypertension and/or coronary artery disease, is a common finding among methamphetamine users at autopsy (Karch et al., 1999; Kaye et al., 2008). Autopsy findings have also demonstrated the presence of cardiomyopathy in cases of methamphetamine-related death, most commonly dilated cardiomyopathy (Zhu et al., 2000). Isolated cases of hypertrophic cardiomyopathy have also been reported among deceased users. While there is little evidence to suggest that the use of methamphetamine causes hypertrophic cardiomyopathy, which is inherited in the majority of cases, it may exacerbate the condition when already present.

6.1.2.2 Blood-borne viral infections

Methamphetamine users who inject the drug are at increased risk, as are all injecting drug users, of blood-borne virus contraction and transmission. In particular, injecting drug use is associated with an elevated risk of the human immunodeficiency virus (HIV), the hepatitis C virus (HCV) and the hepatitis B virus (HBV) (Degenhardt et al., 2013).

These viruses can contribute to mortality among methamphetamine users through compromised immunity and the contraction of opportunistic infections (e.g. pneumonia) in the case of HIV, and from pathology secondary to HCV and HBV, such as liver cirrhosis and cancer. There is also evidence to suggest that the interaction of methamphetamine with anti-retroviral medications used to treat HIV may increase the risk of methamphetamine toxicity and mortality (Darke et al., 2007; Urbina and Jones, 2004).

Methamphetamine use can also increase the risk of BBV transmission through sexual risk behaviours. Methamphetamine use has been associated with elevated levels of sexual activity and risky sexual behaviours and, among men who have sex with men, an elevated incidence of HIV seroconversion (Darke et al., 2008).

6.1.2.3 Endocarditis

Injecting drug use may lead to endocarditis, an inflammation of the inside lining of the chambers and valves of the heart (endocardium) via the sharing of infected injecting equipment (Darke et al., 2007). Other risk factors are infection at injecting sites, an HIV infection and a past history of infective endocarditis. Endocarditis can be fatal and deaths due to endocarditis among methamphetamine injectors have been reported (Hiroshi et al., 2005; Takasaki et al., 2003).

6.1.3 Suicide

Suicide is a leading cause of death among regular illicit drug users and contributes significantly to the illicit drug health burden, contributing to at least 10% of overall mortality in the majority of studies (Darke et al., 2007). The mechanisms by which drug users typically commit suicide are intentional drug overdose, hanging, self-inflicted injury and carbon monoxide poisoning (Darke et al., 2007). It is important to note, however, that the majority of illicit drug overdoses among drug users are accidental. In cases of deliberate drug overdose, licit pharmaceutical drugs (e.g. benzodiazepines and antidepressants), rather than illicit drugs, are the most commonly implicated substances causing death (Darke et al., 2007).

Epidemiological research, such as the Global Burden of Disease Study 2010, has identified amphetamine dependence as a risk factor for suicide (Degenhardt et al., 2013), with a systematic review and meta-analysis of the literature up to 2010 yielding a pooled relative risk of suicide of 8.2 among those with amphetamine dependence (Ferrari et al., 2014). More recently, a study of mortality among a large cohort of methamphetamine-dependent individuals found that the SMR for suicide, which accounted for 32% of deaths, was 17.1 (Kuo et al., 2011).

6.1.4 Trauma

Mortality due to trauma occurs at a higher rate among illicit drug users than among the general population, with motor vehicle accidents (MVAs), other accidents (e.g. drowning, fatal falls from heights, sharp object injuries) and homicide the most common types of trauma involved in drug-related deaths (Darke et al., 2007). While there is an overall paucity of data on the prevalence and risk of trauma-related mortality among methamphetamine users specifically, a recent study of MVA fatalities amongst drug users found methamphetamine users were at an elevated risk of MVA-related mortality (SMR 2.6) (Callaghan et al., 2013).

6.2 Identification of Cases in the NCIS

Attribution of deaths to a particular substance or risk factor can be undertaken by either drawing on the cause of death data included in the coronial record or by applying attributable fractions derived from epidemiological research to the gross number of deaths by cause. In this study, we have used the data from the National Coronial Information System (NCIS) to identify attributable deaths, except in the case of homicide, as coronial investigations into deaths that are subject to criminal investigations and/or prosecutions are suspended until completion of the criminal case. As such, the majority of homicide cases in the target year are unlikely to have been finalised.

6.2.1 Case identification

Methamphetamine-related deaths occurring between 1 July 2013 and 30 June 2014 were identified from the NCIS.

The NCIS is a database of coronial information as provided by the coroners' courts in each Australian jurisdiction. The NCIS contains information on deaths occurring from 1 July 2000 that have been reported to an Australian coroner. A complete NCIS case file includes demographic information, a police narrative of circumstances, autopsy and toxicology reports and the coronial finding, which provides information as to whether death was accidental, suicide or homicide and confirms the cause of death. NCIS data, in the form of free text and coded data, are based on information contained within the coronial file. Cause of death, as determined by a forensic pathologist and noted on the autopsy and coroner's reports, is entered verbatim. Findings from police, autopsy and toxicology reports, as well as coronial findings, can also be obtained from attachments of the original reports where available.

In Australia, the criteria for reporting a death vary between jurisdictions. In general, a death is reportable to a coroner where: the person died unexpectedly and the cause of death is unknown; the person died in a violent and unnatural manner; the person died during or as a result of an anaesthetic; the person was "held in care" or in custody immediately before they died; a medical practitioner has been unable to issue a death certificate stating the cause of death; or, the identity of the decedent is unknown.

6.2.2 Search strategies

Fatalities attributable to the use of methamphetamine were identified via a combination of search strategies.

Cases where methamphetamine was deemed to be a cause of death involved keyword searches of the "Medical Cause of Death" fields in the NCIS database. The medical cause of death is defined by the NCIS as "the diagnosis or diagnoses relevant to the death of the deceased, based on the autopsy report". The medical cause of death is comprised of the following breakdown: ***direct cause*** (i.e. disease or condition leading directly to death); ***antecedent causes*** (morbid conditions, if any, giving rise to the direct cause of death); and, ***other significant conditions contributing to the death but not relating to the disease or condition causing it***. Cause of death is determined by a forensic pathologist on the basis of the circumstances of death, a comprehensive autopsy and toxicological analyses. The word stem "amphet" was used to identify all possible cases where the terms "methamphetamine", "amphetamine" or "amphetamines" were used by the pathologist determining the cause of death, as these terms are often used interchangeably by pathologists.

Searches for cases where methamphetamine was listed in the "Object or Substance Producing Injury" fields were also conducted. The object or substance producing injury is defined by the NCIS as "the objects, substances and phenomena which produce the injury or injuries causing death".

Cases identified from the results of the above search strategies were combined and checked for duplicates. Any duplicates identified were removed from the final sample.

6.2.3 Case selection

Deaths directly attributable to methamphetamine were defined as those in which methamphetamine was determined by the forensic pathologist conducting the autopsy to have been a medical cause of death.

Cases where methamphetamine was not listed as a medical cause of death, but was noted in the object or substance producing injury field, were retained and analysed separately to examine the role of methamphetamine.

6.3 Results of NCIS Analysis

We identified 116 cases where methamphetamine was determined to have been a medical cause of death (Table 6.1). Decedents were typically males in their late thirties and death was accidental in over three quarters of cases.

Methamphetamine was deemed by the forensic pathologist conducting the autopsy to be a direct cause of death in 68.10% of cases, an antecedent cause of death in 12.93% of cases and a significant contributing condition in 18.97% of cases. The most common cause of death was drug toxicity (38.79%), with more than half (57.78%) of such deaths involving multiple drug toxicity (i.e., toxicity due to a combination of methamphetamine and at least one other drug). Almost one quarter of deaths were due to drug toxicity in combination with underlying pathology, predominantly cardiovascular disease, with 32.14% of these cases involving multiple drug toxicity.

Table 6.1: Cases where methamphetamine is a medical cause of death (n=116)

Characteristic	**Data**	
Age mean (SD)	39.38	(9.02)
Age range years	19-64	
Gender % male (n)	78.45	(91)
Intent % (n) [a]		
Unintentional	77.27	(68)
Suicide	11.36	(10)
Undetermined/Unlikely to be known	9.09 (8)/2.27	(2)
Role of methamphetamine in cause of death % (n)		
Direct cause of death	68.10	(79)
Antecedent cause	12.93	(15)
Significant contributing condition	18.97	(22)
Cause of death % (n)		
Drug toxicity [b]	38.79	(45)
Drug toxicity + disease process [c]	24.14	(28)
Disease process	16.38	(19)
Suicide	8.62	(10)
Drug effect + disease process	6.03	(7)
Accidental injury/trauma	6.03	(7)

Source: National Coronial Information System: [a] n=88; [b] 57.78% multiple drug toxicity; [c] 32.14% multiple drug toxicity

A further 175 cases, where methamphetamine was listed as a substance producing injury but not as a medical cause of death, were identified, giving a total of 291 deaths. Of these fatalities, 168 were cases where methamphetamine and/or its metabolites were either detected in the decedent's blood via toxicological analysis or where the use of methamphetamine by the decedent was commented upon by the pathologist conducting the autopsy or the coroner. The causes of death in these cases were multiple drug (unspecified) toxicity (n=80), suicide (n=47), trauma sustained from collision involving a private or passenger vehicle (n=18), other types of traumatic injury (n=8), disease (n=9), drug toxicity with underlying disease (n=3), homicide (n=1), and in 2 cases, the cause of death could not be ascertained. The remaining seven cases identified were those where the decedent was a passenger or pedestrian in a MVA and the driver of the car causing the collision was affected by methamphetamine.

For the purpose of estimating costs associated with methamphetamine attributable mortality, the 80 cases where death was due to unspecified drug toxicity were excluded, as the role of methamphetamine was unclear.

The role of BBVs in methamphetamine-related deaths was unable to be examined using NCIS data. Post-mortem testing for HIV, HCV and other BBVs is not routinely conducted. Information on the presence of BBVs and the likelihood that they have contributed to death is typically only provided where there is information in the decedent's medical history that indicates the presence of BBVs or where there are pathological findings that give cause to conduct serological testing for such viruses.

6.4 Attributing Deaths to Methamphetamine for Cost Calculations

The number of deaths at least partially attributable to methamphetamine identified in section 6.3 need to be factored down for the cost analysis to reflect other potentially causal factors where they are noted on the coronial record. The rules used in assigning fraction were as follows:

- Where the cause of death was methamphetamine itself (e.g. intentional or unintentional methamphetamine poisoning), and where no other cause of death was noted, then the fraction assigned to methamphetamine was 1;
- Where the cause of death was a condition for which there is robust evidence of methamphetamine's causal role, and there is no other potentially causal factor (e.g. cardiomyopathy in a person aged under 45 with no other factors such as family history or mitral valve leakage listed) then the fraction assigned to methamphetamine was 1;
- Where the cause of death was a condition for which there is robust evidence of methamphetamine's causal role, but there were other potentially causal factors mentioned in the cause of death fields (e.g. intentional self-harm in the context of methamphetamine and alcohol use; multiple drug toxicity where methamphetamine was one of several substances listed) then the fraction used was 1/[number of potentially causal factors]; and,
- For those deaths where methamphetamine was not listed in the cause of death fields but was listed as an "object", a fraction of 1 was assigned where methamphetamine was a potentially causal factor based on epidemiological evidence (intentional self-harm, road crash where the driver was potentially intoxicated by methamphetamine, stroke) ***and*** no other potentially causal factor was identified in the data; and a fraction of 0 was assigned otherwise (i.e. the 80 cases of unspecified multi-drug toxicity identified in section 6.1 have not been treated as methamphetamine attributable).

Applying these fractions for methamphetamine attribution, the 291 deaths identified in Section 6.3 are adjusted down to 170.2 methamphetamine attributable deaths.

In addition to the deaths identified in Section 6.3, evidence suggested that a proportion of homicide deaths can be attributed to methamphetamine (Darke, 2010; McKetin et al., 2006b; Nicosia et al., 2009; Stretesky, 2009; Torok et al., 2008). As noted in Section 6.3, as of mid-2016, NCIS data cannot be used to quantify the degree of methamphetamine attribution for homicide as only 45 homicide cases are finalised in the NCIS database for 2013/14 (out of an estimated total of 242 homicide deaths, excluding deaths caused by dangerous driving, in 2013/14 (Australian Bureau of Statistics, 2015c)). In addition, the NCIS data does not report details of the motives or characteristics of the perpetrator (other than their relationship to the victim) and so would not necessarily identify cases where, for example, the perpetrator was intoxicated by methamphetamine or where the motive for the homicide was related to the perpetrator's involvement with methamphetamine.

As data on homicide deaths are not available in the NCIS database and attribution is therefore much less certain, homicide deaths attributable to methamphetamine have not been included in our central estimate of the costs of premature mortality. An estimate of the costs related to these deaths is, however, included in our upper bound estimate.

Instead, data on the number of deaths due to homicide (murder and manslaughter but excluding death caused by dangerous driving) were taken from the ABS publication "Recorded Crime – Victims" (Australian Bureau of Statistics, 2015c) and allocated by age and gender based on the age and gender of homicide victims in 2010/11 to 2011/12 reported in the Australian Institute of Criminology (AIC) homicide monitoring program report (Bryant and Cussen, 2015). In the absence of data on how methamphetamine attribution for homicide varied by the age of the victim, it was assumed that the rate applied evenly across the age range. [8]

Stretsky undertook a case controlled study of US murder perpetrators, which found that after adjusting for sociologic covariates and indicators of other substance use, the odds ratio for homicide amongst monthly methamphetamine users was 9.87 (Stretesky, 2009). Converting this to a relative risk using the approach outlined by Grant (Grant, 2014), and then to an attributable fraction using the estimated prevalence of at least monthly methamphetamine use in Australia (Degenhardt et al., 2016a), gives an attributable fraction of 0.115. If homicide is included, this gives an estimate of an additional 32.2 methamphetamine attributable deaths.

The data from the homicide monitoring program reports age within age groups rather than by single year of age. For those forms of cost or avoided cost where the age of the decedent influences the cost, deaths were assumed to occur at the mid-point age within the age group (rounded up to the nearest whole number) except for the 65+ age band for which all deaths were allocated to age 70.

The estimates derived from the NCIS data include 55.75 methamphetamine attributable cases of death due to suicide and intentional self-harm out of a total of 2,217 cases for those aged 15 to 54, and this is the number of suicide cases used in our central estimate of the costs of premature

[8] This is likely to be incorrect, as research suggests that the victims of violent crime committed by methamphetamine users are most likely to be drug-using acquaintances of the perpetrator, the partner of the perpetrator, or a non-drug-using acquaintance of the perpetrator (Torok et al., 2008) and, as such, would typically be of a not dissimilar age range to the population of methamphetamine users. If this were the case then our calculations would be likely to slightly understate the costs of methamphetamine attributable homicide.

mortality. Other research has suggested a greater causal role for methamphetamine in suicide and intentional self-harm. For example, in their work for the Global Burden of Disease study, Degenhardt and colleagues (2013) estimated that the relative risk for dependent methamphetamine use and mortality due to intentional self-harm was 8.2. Applying the estimated prevalence of dependent methamphetamine use (Degenhardt et al., 2016a) gives attributable fractions by age group that range from 0.022 for 45 to 54 year olds to 0.117 for 25 to 34 year olds (Table 6.2).

Table 6.2: Attribution of suicide and intentional self-harm to methamphetamine by age group

	15-24	25-34	35-44	45-54	Total 15-54
Methamphetamine attributable fraction [a]	0.092	0.117	0.074	0.022	
Total suicide/intentional self-harm deaths [b]	305	380	432	465	1,582
Total methamphetamine attributable deaths	28.0	44.4	32.0	10.2	114.7

Sources: [a] (Degenhardt et al., 2016a; Degenhardt et al., 2013), [b] National Coronial Information System, calculations by the authors

Applying these attributable fractions to the cases of death due to intentional self-harm in the NCIS database gives an estimate of 114.7 cases of methamphetamine attributable premature mortality, almost exactly twice the estimate derived from review of the cause of death and “object” data in the NCIS database. For the central analysis we have used the estimate derived from the NCIS cause of death data, with the estimates derived by the alternative AF based approach, used in calculating the upper bound costs.

Drawing together these data, our central estimate of methamphetamine attributable mortality is **170.2 cases**, with an upper bound estimate of 261.3 cases (with the inclusion of methamphetamine attributable homicide (32.2 cases), and the inclusion of 114.7 cases of methamphetamine attributable suicide/intentional self-harm by using the AF approach rather than the 55.75 cases identified through the analysis of NCIS data in our central estimate). It should be noted that the central estimate of deaths is likely to be an underestimate, as 18% of the 2013 NCIS cases and 33% of the 2014 cases remained open at the time the data analysis was undertaken, and as such could not be included in the analysis. The estimate of deaths also excludes 80 cases of unspecified multiple drug toxicity where methamphetamine was noted as a substance producing injury, but its role in the death was unclear.

6.5 Tangible Costs of Premature Mortality

There are two broad forms of social cost (as opposed to private cost) that arise as a result of premature mortality: tangible costs (the present value of lost expected lifetime labour in paid employment not captured by the substance user, 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), and the intangible cost of premature mortality (which are dealt with in Section 6.7). Productivity impacts are calculated per year for some period into the future and so require the number of deaths in the reference year to be converted into a years of life lost estimate, whereas intangible costs are calculated directly from the number of deaths that occur in the reference year.

No costs have been included 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.

As some users of the data may wish to use estimates relating solely to net costs in 2013/14 (rather than the present value of harm caused by methamphetamine in 2013/14 regardless of which year it occurs in), our base case only includes those costs actually incurred in 2013/14, with the full present value of harms that occurred in 2013/14 reported in the upper bound estimate.

This full present value of harms included in the upper bound includes estimated costs (or offsetting cost savings) to society that arise in each of the next 30 years as a result of a premature death that occurs in 2013/14. Estimates related to lifetime costs or savings are calculated as present values of future benefits or costs assessed over a 30 year horizon using a real discount rate of 7% as recommended in Australian Government guidance (Department of Finance and Administration, 2006; Department of the Prime Minister and Cabinet, 2016).

The years of life lost (YLLs) for each premature death were calculated using age and gender specific estimates for years of life remaining from the Australian Bureau of Statistics' life tables (2015b), although benefits or costs occurring more than 30 years beyond 2013/14 were not included in the analysis based on Australian Government recommendations noted above. Years of life lost were not discounted, with discounting of future values introduced though discounting the costs and offsetting savings arising from the YLLs.

6.5.1 Workplace costs of premature death

The workplace costs of a premature death are the present value of expected future economic output from the deceased individual (excluding the income that they would have received through wages, which is a private cost), together with the cost to employers of filling a job vacancy. Other workplace costs such as absenteeism, are addressed in Chapter 10.

Of those who died prematurely as a result of their own or some other person's methamphetamine consumption, the actual employment rate, and industry of employment for those employed, is not known. For this analysis we have made the simplifying assumption that each of these reflects the population average for their age and gender. The age and gender specific probability that an individual will be in employment in each of the following 30 years is taken from analysis of 2011 Census of Population and Housing data (Australian Bureau of Statistics, 2013b). This was then applied to the deaths data to identify the expected number of years of employment lost in each calendar year. To the extent that the premature deaths occur amongst dependent methamphetamine users, it is likely that this simplifying assumption will overstate the workplace costs of premature mortality, as there is evidence that they have lower employment rates than average for their age cohort (see, for example, the research by Torok and colleagues (2008)). However, from the point of view of the overall estimate of the social cost of methamphetamine, any impact on employment rates from dependent use represents a social cost (in terms of the non-wage value of that labour), which has not been able to be valued in this report. As such, any overestimate of the workplace costs of premature death will not result in an overall over estimate of the social costs, but rather represents a transfer from an otherwise unquantified cost item to premature deaths.

For the age and gender profile of the central estimate of individual deaths identified in the coronial data as at least partially attributable to methamphetamine, this was 130.4 employee years in 2013/14, peaking at 130.5 employee years in 2014/15, before dropping back to reach 60.2 employee years by 2043/44.

The upper bound, including estimated methamphetamine attributable deaths due to homicide and using the AF based approach to calculating suicides, is an estimated 191.1 employee years lost in 2013/14, peaking at 193.5 employee years in 2018/19, before dropping back to reach 111.9 employee years by 2043/44.

In the absence of evidence of the wages for those who died prematurely due to methamphetamine use (whether their own or someone else's) would have earnt, it has been assumed that the economic output of those in work would have equalled the population mean. Gross domestic product per employee is calculated from price estimates of GDP for June 2014 from the ABS national accounts and employment numbers (Australian Bureau of Statistics, 2016a, d) and is $138,083 in 2013/14. GDP per employee is assumed to grow at its actual real rate of 1.1% in the year to June 2015 before returning to its long-run average real growth rate of 1.5% thereafter.

As wages received are a purely private benefit, only that share of GDP per employee accruing to businesses and to government is in scope for this study. The average labour share of GDP over the past 20 years has been 54% (Australian Bureau of Statistics, 2016a, d), and so only 46% of the per employee GDP has been included as a cost in this analysis.

The value of lost GDP accruing to businesses and government actually realised in 2013/14, due to premature methamphetamine mortality that occurs in 2013/14 (e.g. our central estimate), is **$8.3 million**. This will significantly understate the costs as it is only a single year's cost.

The upper bound estimated total present value of lost GDP accruing to businesses and government over 30 years due to methamphetamine attributable premature mortality in 2013/14, including homicide deaths and the broader definition of suicide deaths, is **$175.0 million**.

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 2013/14 values, using the change in the CPI (Australian Bureau of Statistics, 2016c) and applying to the central estimate of 130.4 deceased persons in work as at 2013/14, gives a total cost of **$1.0 million**. The upper bound estimate (based on 191.1 deceased persons in work) is $1.5 million.

Combining these two forms of costs gives a total central estimate of workplace productivity costs from premature methamphetamine attributable mortality of **$9.3 million**. The upper bound of workplace costs is **$176.5 million**.

6.5.2 Reductions in labour in the household

Collins and Lapsley based their estimates of production losses in the household sector on the ABS publication Unpaid Work and the Australian Economy 1997 (Australian Bureau of Statistics, 1997; Collins and Lapsley, 2008). This remains the best available source of data on unpaid work in the household despite being very dated. Under the 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 would be 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 cost (Collins and Lapsley, 2008).

The ABS report details two broad approaches that can be taken to valuing unpaid household labour: individual function replacement cost and the opportunity cost of time. Within these broad approaches, unpaid household labour can be valued by the cost of hiring specialists to undertake each task, by the cost of hiring a housekeeper to undertake all unpaid labour in the household, or by a hybrid of the two; and, opportunity cost can be measured based on pre-tax or post-tax income. We prefer individual function replacement costs, 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 is also the approach taken by Collins and Lapsley in their study (Collins and Lapsley, 2008).

The total value of male unpaid labour in the household is estimated at approximately $82,000 million in 2007 values and female unpaid labour is valued at $154,000 million. Converting these to per adult estimates using the population data in ABS (1997) and to 2013/14 values using the CPI (Australian Bureau of Statistics, 2016c) gives values of unpaid household work of $19,196 per adult male and $34,272 per adult female. It was assumed that the value of unpaid labour in the household for those aged less than 18 was zero.

Our central estimate is that there were 135.1 male methamphetamine attributable years of *adult* life lost and 36.1 adult years of life lost amongst females in 2013/14, falling to 124.4 and 35.1 respectively by 2043/44. Using just the single year estimate for 2013/14, the cost of lost labour in the household in that year of only those premature deaths that occurred in that year is **$3.8 million**.

The upper bound cost estimate includes methamphetamine attributable costs and the broader, AF based, calculation of methamphetamine attributable suicide deaths, and is calculated as the expected lifetime costs of deaths that occur in 2013/14. The upper bound estimate is 193.1 methamphetamine attributable male adult years of life lost in 2013/14 and 65.3 years of adult female life lost, peaking at 194.1 and 65.8 years of life lost respectively in 2018/19 before falling to 187.6 and 64.6 years of life lost respectively by 2043/44. Applying the gender specific per capita values of unpaid household to these attributable deaths (assuming they stay constant in real terms), and calculating the net present value over 30 years using a 7 per cent real discount rate, gives an estimated net present value of lost unpaid work in the household of **$70.2 million**.

6.6 Avoided Health Care Costs

As some methamphetamine users die prematurely, this produces some reductions in lifetime social costs relating to the healthcare costs they would have incurred in future years had they lived to their expected age. As with the costs of lost economic output, the YLLs for each premature death were calculated using age and gender specific estimates for years of life remaining from the Australian Bureau of Statistics' life tables (2015b).

Annual expected healthcare costs averted in 2013/14 were calculated by combining the estimated years of life lost by age at 2013/14 with data on average total health care expenditure per person ((Australian Bureau of Statistics, 2015b), p. 19) and the distribution of healthcare expenditure by age group and gender ((Australian Institute of Health and Welfare, 2010) p.14). These costs were projected out over a 30 year analysis period by "aging" the cohort by 1 year in each period and applying the age specific healthcare cost for the new age. Where the expected years of life remaining for the age as at 2013/14 indicated that an average individual of that age would only be alive for a fraction of a year, that fraction was applied to the cost estimate. Where the expected years of life estimate suggested that an average individual of that age would not be alive, a cost of $0 was used. AIHW reports that average healthcare inflation over the period 2002/03 to 2014/15 was slightly less than overall price inflation, and so it was assumed that the 2013/14 expenditure estimates remained constant in real terms over the analysis period ((Australian Institute of Health and Welfare, 2015b), p.11).

As for the value of lost labour in the household, the central estimate only includes in the single year estimate for 2013/14 the cost of lost labour in the household of only those premature deaths that occurred in 2013/14. This gives an estimated single year avoided cost of **-$1.0 million**. This is likely to significantly underestimate the offsetting cost saving to government.

The estimated total net present value (over 30 years using a 7% real discount rate) of healthcare costs avoided due to premature methamphetamine attributable mortality was a **saving of $24.0 million**.

6.7 Intangible Costs

Much of the cost to society arising from premature mortality relates to intangible costs, e.g. those costs that relate to 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 society's average willingness to pay to reduce the risk of premature death by one case. Estimates of this value are generally derived from individual's direct market behaviour, such as willingness to pay for products that produce 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 recommend using an estimate of the value of a statistical life developed by Abelson (Abelson, 2008), who recommended using a value of a statistical life of $3 to 4 million in 2006/07 values. Abelson's recommended value was not derived from a meta-analysis of valuation studies. Rather, whilst it took note of a range of published meta-analyses of 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. Taking the mid-point of $3.5 million and converting this to 2013/14 values using the growth in current price GDP per capita gives a 2013/14 estimate of $4.5 million.

Internationally, much higher values are often used. For example, Viscusi and Aldy (2003) undertook a meta-analysis of studies that used wage differentials and of those that looked at price premia paid for increased safety features in goods purchased and found the mean of the studies was US$6.7 million in 2000 prices. US government agencies typically use values of this magnitude. For example, the US Department of Transport used a value of a statistical life of US$9.1 million in 2013 (US Department of Transportation, 2015). This was derived by averaging 15 hedonic wage studies (e.g. studies that 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 adopts a similar approach, albeit using a slightly different value derived from a slightly different set of studies. Converting the US Department of Transport VoSL estimate to Australian dollars using Purchasing Power Parity exchange rates (Organisation for Economic Cooperation and Development, 2016a), and then to 2013/14 values using the growth in per capita current prices GDP (Australian Bureau of Statistics, 2016a) from 2012/13 to 2013/14, gives a value of a statistical life of $13.5 million.

To ensure consistency with other estimates, we will use the Abelson values for our main estimate. Applying this VoSL to the central estimate of 170.2 cases of methamphetamine attributable premature mortality gives an estimated intangible cost of **$769.6 million.**

If, instead, the value of a statistical life estimate used by the US Department of Transport (2015) were to be used, then the estimated intangible cost of the central estimate of 170.2 cases of methamphetamine attributable premature mortality would be $2,298.0 million.

If, instead, the upper bound estimate of 261.2 premature deaths were to be used then the intangible cost of premature mortality using the Abelson value is $1,181.5 million, and the cost using the US Department of Transport (2015) value of a statistical life would be $3,527.7 million.

6.8 Total Costs of Premature Mortality

Our central estimate of the cost of the estimated 170.2 cases of methamphetamine attributable premature mortality in 2012/13 is **$781.8 million**, with net tangible costs of **$12.1 million** and intangible costs of **$769.6 million** if the Abelson (2008) value of a statistical life is used (see Table 6.3). If, instead, the US Department of Transport (2015) value was used, the intangible cost would be **$2,298.0 million** and the total costs **$2,310.1 million**. As noted previously, the large number of cases yet to be finalised in the NCIS at the time of the data analysis suggests the number of methamphetamine attributable deaths may be underestimated.

The upper bound estimates are calculated using a higher estimate of methamphetamine attributable mortality of 261.2 premature deaths, including the 114.7 deaths due to suicide/intentional self-harm calculated using an AF approach rather than the 55.75 cases identified in the NCIS data, and also including 38.5 deaths due to methamphetamine attributable homicide. The upper bound estimates also include the full cost of long term harms (and offsetting cost savings) arising from premature mortality, calculated as present values over a 30 year analysis period.

The tangible costs of methamphetamine attributable mortality are **$222.6 million** in the upper bound estimate. If the Abelson value of a statistical life is used, the intangible costs are **$1,181.5 million** and the total cost is **$1,404.1 million**. If the US Department of Transportation value of a statistical life is used, then the upper bound estimate of intangible costs is **$3,527.7 million** and the total costs are **$3,750.3 million.**

Overall, the costs associated with these deaths mean that premature death was the second largest contributor to the overall costs, after those arising from the crime and justice area. Notably, if the present values are considered (i.e. the high bound estimate), the cost of these deaths effectively doubles, highlighting the young age at which these deaths occur and the consequent years of life lost.

Table 6.3: Social cost of methamphetamine attributable premature mortality, $ 2013/14

Costs	Central estimate [a] Abelson VoSL [1]	Central estimate [a] US DoT VoSL [2]	Upper bound estimate [b] Abelson VoSL [1]	Upper bound estimate [b] US DoT VoSL [2]
Tangible costs				
NPV of lost economic output (non-employee)	8,266,139	8,266,139	174,996,164	174,996,164
Recruitment/training costs to employers	1,001,802	1,001,802	1,468,527	1,468,527
NPV of value of lost unpaid household work	3,831,382	3,831,382	70,178,114	70,178,114
NPV of healthcare costs avoided	-988,286	-988,286	-24,022,785	-24,022,785
Total tangible costs	**12,111,038**	**12,111,038**	**222,620,020**	**222,620,020**
Intangible costs	.	.	.	.
Value of statistical life	769,647,208	2,298,014,106	1,181,486,564	3,527,684,843
Total cost	**781,758,246**	**2,310,125,144**	**1,404,106,584**	**3,750,304,863**

Notes: VoSL = Value of a statistical life: [1] (Abelson, 2008): [2] (US Department of Transportation, 2015)

[a] Central estimate is based on an estimated 170.2 cases of methamphetamine attributable premature mortality, including 55.75 cases of suicide/intentional self-harm and 0 cases of homicide. The central estimate also only includes a single year of value from the long-term costs and offsetting cost savings resulting from premature mortality.

[b] Upper bound estimate is based on an estimated 261.2 cases of methamphetamine attributable premature mortality, including 114.7 cases of suicide/intentional self-harm and 32.2 cases of homicide. The upper bound estimate also includes the full present value (assessed over 30 years) of the long-term costs and offsetting cost savings resulting from premature mortality.

6.9 Limitations and Recommendation for Further Research

The major limitation of obtaining mortality data from the NCIS to estimate the costs of methamphetamine attributable mortality is that access was restricted to closed cases only, i.e. cases that have been finalised by the coroner. Cases are defined as "closed" when any pending coronial investigation is completed and the record is closed on the NCIS. According to the NCIS case closure statistics as at 1 April 2016 (http://www.ncis.org.au/wp-content/uploads/2016/04/Monthly-Case-Closure-Statistics.pdf), 18% of the 2013 NCIS cases and 33% of the 2014 cases remained open. As such, the numbers reported are likely to be an underestimate of the number of methamphetamine-related deaths during the study period. This is particularly the case for homicides, where there are low rates of case finalisation due to the coronial investigation remaining open pending the completion of criminal investigations.

In the 175 cases where methamphetamine was noted as a substance producing injury, but not as a medical cause of death, the extent to which methamphetamine use played a causal or incidental role in deaths due to non-MVA trauma and homicide was unable to be ascertained from the available NCIS information.

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CHAPTER 7: COST OF CRIME RELATED TO METHAMPHETAMINE USE

Steve Whetton & Anna Ferrante

7.1 Methamphetamine Attributable Crime

One of the potential forms of harm arising from methamphetamine use is an increased number of criminal offences. Some of these offences are directly related to methamphetamine, e.g. they are cases related to the importation, sale or possession of methamphetamine. However, there is also the possibility methamphetamine use will lead to crime indirectly, through economic crime to fund methamphetamine consumption (economic/compulsive crime); through crime aimed at supporting or protecting systems of drug distribution and use, such as violence used to recover debts from users (systemic crime); or, through crime resulting from altered mental state and/or reduced inhibition caused by consumption of, or withdrawal from, methamphetamine (pharmacological crime) (Darke, 2010; McKetin et al., 2006b; Nicosia et al., 2009; Stretesky, 2009; Torok et al., 2008).

Previous studies have typically found crime to account for a substantial share of the social costs of methamphetamine. Moore (2007) estimated methamphetamine attributable crime cost Australia $3,039 million in 2005 (in 2005 values), 81% of the total social cost identified in that study. Nicosia et al. (2009) estimated methamphetamine attributable crime cost the US $4,209.8 million in 2005 (in 2005 USD$), accounting for 18% of their social cost calculation (or 39.9% of costs if the cost of addiction to the user is excluded from the social cost estimate). Collins and Lapsley did not separately estimate the costs of methamphetamine, but crime costs accounted for $3,644.5 million, or 74%, of their estimated $4,919 million social cost of illicit drugs in Australia in 2005 (Collins and Lapsley, 2008). As documented through this chapter, crime remains a major social cost.

Criminal justice system data are not generally suited to statistical analyses relating to drug use, as information such as methamphetamine use, 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 (Coghlan et al., 2015). The DUMA survey has several shortcomings, most notably that it only surveys offenders from selected police stations [9], which may not be representative of the population of offenders for the country as a whole. Given the lack of data on the geographic distribution of dependent methamphetamine use, it is not possible to identify whether the rates of methamphetamine consumption amongst offenders detained by police at the selected DUMA sites is representative of the country as a whole, or under or overestimates it.

Other limitations of the DUMA survey are that:

- It can also 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 who consent to participate in the research. The long-term participation rate is 90%; in 2013-14 it was 69% (Coghlan et al., 2015);

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9 For the 2013/14 survey, data were collected in the following police stations: Brisbane (Queensland); Bankstown Surry Hills and Kings Cross (New South Wales); Adelaide (South Australia); and East Perth (Western Australia) (Sweeney and Payne, 2012)

- 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 (e.g. falsely attributing offending to a substance as a self-exculpatory strategy, or 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 a substance, or to fund substance use);
- 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 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 [10]. 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;
- The attributable fractions for substances calculated from it only relate to crime committed by those who have used the substance in the past month. This means it will not capture that proportion of “systemic” crime where the perpetrators are not, themselves, recent users of the substance in question; and,
- It will not necessarily capture the apparent higher rates of crime victimisation of dependent methamphetamine users (Torok et al., 2008), except to the extent that the perpetrators are themselves users of the same substance.

As noted above, there are very high rates of violence victimisation, with 50% reporting having been the victim of at least one violent crime in the past 12 months (compared with 5.3% of all Australians aged 15 and older), with 87% reporting multiple incidents (Torok et al., 2008). At least some of this increased rate of victimisation will be as a result of increased offending by methamphetamine users, as in many cases both the victim and the perpetrator were methamphetamine users. This higher rate of victimisation could be directly linked to methamphetamine. For example, “systemic” crime – crime committed as a contract enforcement mechanism in drug supply (the perpetrators of which will not necessarily be substance users), as a result of decreased inhibition resulting in methamphetamine users placing themselves in a dangerous situation, or could be an increased risk of crime associated with activities engaged in to fund methamphetamine use, such as being a sex worker (who face significantly elevated risks of violent crime both from clients and associates). Overall, it suggests there may be substantial levels of violence victimisation that lie outside the scope of the DUMA survey that are therefore not captured in our estimates.

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 underestimating the role of substance use in offending. Notwithstanding these limitations, the DUMA survey remains the best available source of data on drug use of offenders in Australia.

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[10] We note that the term “attributable fraction” may have different interpretations for epidemiologists or criminologists. See Payne and Gaffney and page 76 for details on the derivation of AF and DUMA data (2012).

Results from DUMA surveys consistently indicate use of illicit substances is high amongst police detainees, although the pattern of substance use changes over time. Amongst respondents to the 2013/14 survey, at least one drug was detected in 73% of those who consented to urinalysis and 38% had multiple drugs detected. Cannabis was the most frequently detected drug in 2013/14, identified in 46% of detainees, with methamphetamine [11] the next most frequent at 34%. This high prevalence of methamphetamine detection is a recent phenomenon, with the proportion of respondents to the DUMA survey whose urinalysis detected methamphetamine increasing from 15% in 2009/10 to 34% in 2013/14; methamphetamine is the only substance that has seen a substantive increase in prevalence of detection over that period (Coghlan et al., 2015; Sweeney and Payne, 2012).

However, simply detecting an illicit drug in an offender does not provide evidence that the substance had any role in the offending behaviour. Researchers at the Australian Institute of Criminology (AIC) have developed an approach to estimating causation that draws on a combination of self-reported causation by the police detainees, rated on a one to three scale for each substance, with questions on the reason why they attribute their offending to that substance(s) (Payne and Gaffney, 2012). This approach extends and improves on earlier methods developed by Makkai and Temple (2008) and produces attributable fractions that are conceptually similar to those used in calculating healthcare costs.

For this project, analysis of the 2013/14 DUMA survey results was undertaken by the AIC to identify the proportion of police detainees who attributed their offending to methamphetamine. AIC methods for estimating attributable fractions follow those used previously (Payne and Gaffney, 2012). This methodology uses the responses to several survey questions to determine the proportion of detainees who attribute their *current* offending (i.e., offences for which individuals were detained at time of interview), either entirely or partly, to drug use. Only those detainees who reported having consumed methamphetamine within the past 30 days were included in the calculations. The detainees were asked to consider the main reason why they had been detained and to indicate via a three-point scale the extent their drug use contributed to their present situation. The questions were asked separately for each different drug type including methamphetamine, so 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 follows national standards (i.e., in order, violence, property, drug, driving under the influence (DUI), traffic, disorder, breach and other).

Across all offences, methamphetamine was identified as the causal factor in 18.0% of offenders' most serious offences (see Table 7.1), playing the greatest role in drug offences (32.4%) and the smallest role in public order offences (5.3%). Not all offenders attribute their "driving under the influence" or their drug offences to the substance in question. As it could be argued that such offences are, by definition, attributable to substance use, the AIC also produces estimates where attribution of these offences is factored up to be 100%, which the AIC calls "adjusted" estimates. These "adjusted" estimates have been used in previous social impact studies (Collins and Lapsley, 2008). In this study, we have used the more conservative "unadjusted" estimates. This means that not all cases of driving under the influence of methamphetamine or of drug offences related to methamphetamine will necessarily be attributed to methamphetamine.

[11] Urinalysis shows ATS; as elsewhere in the report these are assumed to be methamphetamine.

Juvenile crime costs and methamphetamine: Excluded

Whilst the costs related to juvenile offending are significantly less than for adults, they are nonetheless still significant. Assuming that 12.3% of crime related police costs arise from juvenile offending, in keeping with their share of offenders processed by police (Australian Bureau of Statistics, 2014b), and that between 64% and 80% of police time is related to crime costs (see section 7.2), then between $799 million and $1,002 million in police costs relate to juvenile offending. Based on RoGs figures for 2013/14 (Steering Committee for the Review of Government Service Provision, 2015a), the total recurrent expenditure on the Children's Court was $31.8 million, whilst the cost of youth justice services (comprising detention-based supervision, community-based supervision and group conferencing) was approximately $673 million. Juvenile detention accounted for the majority of this expenditure ($409 million).

Evidence quantifying the relationship between drug use and juvenile offending is limited and there is no reason to assume that the attributable fractions derived from adult respondents to the DUMA survey (see Table 7.1) would be appropriate as a measure of methamphetamine attributable **juvenile** crime. The best available data on juvenile offending are from a 2005 national study of youth Drug Use Careers of Offenders (Juvenile DUCO) (Prichard and Payne, 2005a, b). Despite its age, it remains the most comprehensive Australian data collection on drug use by juvenile offenders.

The Juvenile DUCO study found young people incarcerated in juvenile detention centres had extensive offending and drug use histories, both in terms of violent and property crime, and regularly used alcohol, cannabis and, to a lesser extent, methamphetamine. Compared with the general population of youth of the same age, the study found that juvenile offenders tend to: (a) use drugs much more often; (b) use a wider range of drugs; and, (c) start using drugs and alcohol at an earlier age. In addition, escalation (a term used to describe the progression to more frequent and more serious offending) was most common for juveniles who bought illegal drugs (89% of those who ever bought drugs went on to become regular drug buyers).

The study found one in five juvenile offenders was a current regular user of methamphetamine, and just under one third were regularly using two or more substances in the six months prior to their arrest. At the time of committing their last offence, a substantial proportion of juvenile offenders reported they were intoxicated by drugs only (24%), alcohol only (22%), or a combination of both types of substances (24%). Further analysis revealed the drugs most commonly used by young people prior to offending were cannabis (75%) and methamphetamine (39%). Of those who had reported being 'high' at the time of the offence, 64 (35%) reported being intoxicated by two or more drugs.

There were several other notable findings from the juvenile DUCO study:

- Overall, the level of substance use in the juvenile detainee population was significantly higher than in the general population of adolescent youth;
- The rate juvenile detainees progressed to regular use of alcohol and cannabis was comparable to the escalation rates reported by the adult DUMA participants;
- However, in relation to methamphetamine, inhalants and ecstasy, juveniles tended to progress to regular substance use much more quickly than adult prisoners;
- For non-Indigenous youth, regular substance use clearly preceded violent offending and regular property offending; and,
- Poly-drug use was an area of concern, with 29% of youths being regular users of multiple substances.

The study identified a range of problems associated with juvenile substance use and crime including poor family relationships (neglect and violent abuse), wider family substance use problems and poor educational outcomes (high rates of truancy, suspension and early school leaving), which collectively require earlier and more holistic interventions.

The DUCO study attempted to link substance use to the cause of offending. It found that one in five (19%) of juvenile detainees admitted using methamphetamine at the time of their last offence, while a third of the sample attributed *daily drug or alcohol* use to the commissioning of their last offence.

Table 7.1: Self-reported methamphetamine attribution of crime amongst police detainees by most serious offence, DUMA survey June 2013 to July 2014, per cent of total offenders [a]

	Violence (%)	Property (%)	Drug (%)	DUI (%)	Other traffic (%)	Breach (%)	Public order (%)	NEC or unknown (%)	Total (%)
Central estimate	16.7	22.5	32.4	4.9	13.3	17.5	5.3	7.3	18.0
Confidence intervals (95%)	14.4 to 19.1	19.5 to 25.8	27.3 to 37.9	1.4 to 11.5	8.6 to 19.0	15.2 to 20.1	2.9 to 8.6	1.4 to 18.6	16.7 to 19.3

[a] Only those detainees who reported using methamphetamine in the past month were able to attribute their offence to methamphetamine

Source: AIC DUMA collection 2013/14 [computer file], confidence intervals calculated by the authors using an average of the estimates from the Wald, Clopper-Pearson Exact Binomial, Agresti-Coull Adjusted Wald, Wilson, and Jeffreys estimators. DUI = driving under the influence

There are several other sources of data that could provide a check on these estimates of methamphetamine attributable fractions, although none are comprehensive. Torok and colleagues (2008) surveyed a group of regular methamphetamine and heroin users, 118 of whom were primarily methamphetamine users. Of this group, 51% reported having committed at least one violent crime in the past 12 months, with 72% of those having committed multiple offences. The cohort surveyed was one characterised by frequent use (at least weekly) and by relatively high scores on the severity of dependence scale (mean = 7.7 with the scale ranging from 0 to 15 and a score greater than 4 indicating problematic methamphetamine use). As such, they are probably most similar to definitions of dependent users rather than regular users. If the overall dependent user cohort (estimated at 160,000 individuals (Degenhardt et al., 2016a)) committed violent crime, including multiple offences, at the same rates as the sample interviewed in the Torok study, then there would be at least 140,000 [12] violent crimes committed annually by dependent methamphetamine users (assuming those who committed more than one offence committed an average of two offences). This is equivalent to 13.8% of all violent crimes identified in the victims of crime survey, adjusting for multiple victimisation (Australian Bureau of Statistics, 2015a). Given at least some methamphetamine attributable crime is likely to be committed by non-dependent methamphetamine users (or, indeed, non-users in the case of systemic violence) then the data in the Torok study (2008) appears to be consistent with the DUMA fraction for violent crime.

As data do not exist that would allow identification of how much of the excess victimisation is by perpetrators whose offending would not be attributed to substance use (and therefore properly attributable to that substance), increased crime victimisation has not been included in the cost calculations.

Another form of crime for which alternative data sources exist and that can act as a crosscheck is reported drug offences. In the 2013/14 Victorian crime statistics (Victoria Police, 2014b) methamphetamine, amphetamine and their precursors together accounted for 28.2% of all illicit drug offences. In NSW, 24% of all illicit drug charges in 2013/14 related to methamphetamine (Personal communication, NSW BOCSAR statistical file, 2015). If offence patterns are similar in other states, then the DUMA fractions would be slightly overstating the role of methamphetamine in drug offences.

[12] (58,752*2 +22,848*1)=140,352

Finally, Torok et al. asked survey respondents about all forms of crime committed within the past month, with 30% reporting having committed property crime, similar to the 22.5% reported in Table 7.1 (Torok et al., 2008). Unfortunately, data on the frequency of offending is not available (except that 1% reported having committed property crime daily with the remaining 29% recorded as having committed it less frequently than daily), nor is it clear how representative the study month was of annual patterns of offending. However, ***if*** it were representative, if on average property crimes were committed once per month, and if the overall dependent user cohort (estimated at 160,000 individuals (Degenhardt et al., 2016a)) commits property crime at the same rate as the sample interviewed in the Torok study, then there would be at least 576,000 property crimes committed annually by dependent methamphetamine users. This is equivalent to 39% of all property crimes identified in the victims of crime survey (Australian Bureau of Statistics, 2015a).

These alternative sources of data seem to suggest methamphetamine use is associated with a substantially higher involvement in criminal activity than the broader population, and that the scale of the involvement is of a broadly similar magnitude as that identified in the DUMA survey, although individual categories may be somewhat overstated.

To account for uncertainty in attributable fractions derived from the DUMA estimates, we have adopted an approach similar to that used by Nicosia et al. (2009), with a lower bound attributable fraction (AF), based on the lower bound of the 95% confidence interval (CI), for those offence categories with the strongest theoretical link to substance use (drug, DUI and property crime) and an AF set to 0 for all other offence categories. The central AF estimate is the central estimate for the three most closely linked offence categories, and the lower bound of the 95% CI for all other offence categories. The upper AF estimate was based on the upper bound of the 95% CI for each offence category. These are presented in Table 7.2.

Table 7.2: Methamphetamine attributions of crime used in cost calculations, per cent of total offenders by crime category

	Violence (%)	Property (%)	Drug (%)	DUI (%)	Breach (%)	Public order (%)	NEC or unknown (%)	Total (%)
Central estimate	14.4	22.5	32.4	4.9	15.2	2.9	1.4	16.2
Lower bound	0.0	19.5	27.3	1.4	0.0	0.0	0.0	6.5
Upper bound	19.1	25.8	37.9	11.5	20.1	8.6	18.6	21.1

Source: AIC DUMA collection 2013-14 [computer file]: DUI = driving under the influence

Note that the court data used to identify the number of driving offences does not distinguish between DUI and other traffic offences (which have methamphetamine attributable fractions from the DUMA data of 4.9 and 13.3 respectively). On the assumption that the majority of driving offences are likely to be driving under the influence, we have used the more conservative (lower) methamphetamine attributable fractions for driving under the influence for all driving related offences.

7.2 Police Costs

The real recurrent expenditure on state and territory police services in Australia was approximately $10,100 million in 2013/14 (costs related to AFP activities outside of general policing in the ACT have not been included in this section – see section 7.6). However, only a subset of policing costs should be included in the analysis of methamphetamine 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. [13]

Smith et al. (2014) reported that it is reasonable to allocate 80% of police costs to crime, based on 2011 data from NSW Police. An alternative estimate can be derived from the WA Police 2014 Annual Report (WA 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, with “Crime Prevention and Public Disorder”; “Community Support (non-offence)”; “Emergency Management”; and, “Traffic Law Enforcement and Management” classed as non-crime activities, giving an estimate of 64% 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 this analysis.

Police costs to be used in estimating the costs of methamphetamine attributable crime also need to be adjusted down as our attributable fractions are derived from data on adult offenders, and may not be applicable to offenders aged under 18 years of age. Some 12.3% of offenders processed by police are aged 17 or younger (Australian Bureau of Statistics, 2014b), and we use this as an approximation of the share of police time spent on juvenile offenders, with 87.3% on adult offending.

Applying these two proportions (64% and 87.3%) to overall police costs of $10,100 million gives an estimate of $5,700 million in police costs that can be attributed to the response to offences committed by adults. This is the base from which the cost of methamphetamine-related police time is calculated.

To allocate the costs of police time across different offence categories, we obtained data on the total number of offenders processed by police in 2013/14. This was sourced from the ABS publication “Recorded Crime – Offenders” (Australian Bureau of Statistics, 2015c). 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 (Australian Bureau of Statistics, 2014b). 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 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 (Australian Bureau of Statistics, 2014b) as a reasonable proxy for the average complexity of cases by offence category and, therefore, for the cost of the police investigation. These weights are shown in Table 7.3.

As noted earlier, statistical information on the courts does not distinguish between driving under the influence and other traffic offences (which have methamphetamine attributable fractions from the

[13] Some traffic management costs are drug-related, however, such as roadside drug testing. These are described separately in a later section.

DUMA data of 4.9 and 13.3 respectively). Consequently, we have used the more conservative (lower) methamphetamine attributable fractions for driving under the influence for all driving offences.

Allocating police costs between offence categories on this basis, and then applying the attributable fractions for offences set out in Table 7.3 gives a central estimate of total methamphetamine attributable police cost of **$836.9 million,** with a lower bound of **$471.8** million and an upper bound of **$1,165.5 million**.

Table 7.3: Methamphetamine attributable police costs by most serious offence, 2013/14 [1]

	Violence	Property	Drug	DUI	Breach	Public order	Not allocated	Total
Number of offences	97,994	104,881	71,479	198,610	25,525	76,617	22,428	597,534
Weighting for relative complexity (from court data)	1.40	1.21	1.13	0.71	0.83	0.62	1.51	
Estimated weighted share of police time on crime (%)	23.4	21.6	13.7	23.9	3.6	8.1	5.8	
Estimated value of police time on adult crime ($million)	1,330.5	1,228.6	780.7	1,363.9	205.1	459.3	327.5	5,695.6
Central estimate of MA attributable police costs ($million)	191.6	276.4	253.0	66.8	31.2	13.3	4.6	**836.9**
Lower bound of MA attributable police ($'million)	0.0	239.6	213.1	19.1	0.0	0.0	0.0	**471.8**
Upper bound of MA attributable police ($'million)	254.1	317.0	295.9	156.8	41.2	39.5	60.9	**1,165.5**

Source: (Australian Bureau of Statistics, 2014b; Steering Committee for the Review of Government Service Provision, 2015a); AIC DUMA collection 2013/14 [computer file], calculations by the authors. [1] Costs relating to juvenile offenders are excluded. DUI = driving under the influence

7.2.1 Police costs – road-side drug testing

The police costs estimated above exclude police time spent on "Traffic Law Enforcement and Management", including roadside drug testing, so the cost of police time and consumables are estimated separately. Roadside oral fluid tests to detect the use of certain proscribed drugs (cannabis, methamphetamine, MDMA) are used across Australia, typically in conjunction with bus-based random breath tests. The tests involve three stages: a preliminary screen ($38); a secondary test ($41.40; 6.2% of tests) and a laboratory analysis ($200: 5.4% of tests) (Table 7.4).

Table 7.4: Cost of consumables for "drug driver" screening

Test	Number of tests	Cost per test	Total cost ($)
First screen	121,181	38.00	460,4878
Second screen	7,513	41.40	311,038
Laboratory	6,544	200.00	1,308,800
Total			**6,224,716**

The time to administer screening tests also needs to be included in costs. The average cost, including the time to administer a test, is $143.28 per person tested (Cameron, 2013). In 2013/14, Victorian police conducted 42,780 tests (Victoria Police, 2014a), WA police conducted more than 7,800 tests (2014), Queensland police conducted 23,740 tests (Queensland Police Service, 2014) and New South Wales police approximately 32,000 tests (Centre for Road Safety, 2015). On a pro-rata basis by population, these 106,397 tests equate to 121,181 tests across Australia. Including police time and the consumables related to drug driving screening, the estimated cost is ($143.28 * 121,181) $17,362,814.

Between 2007 and 2012, the percentage of positive methamphetamine (only) tests in Queensland was 40.8%, with a range of 21.7% to 66.7%, however, the figure for 2012 was 50.5%. Overall, methamphetamine occurred or co-occurred in 76.9% of positive tests in 2012 (Davey et al., 2014). Using 50.5% as a lower bound and 76.9% as an upper bound yields cost estimates for methamphetamine related drug driving screening of between $8,768,221 and $13,352,004. The mid-point was **$11,060,113.**

7.3 Court Costs

Total recurrent expenditure on criminal courts in Australia was $794.7 million in 2013/14 (Steering Committee for the Review of Government Service Provision, 2015a). However, that includes Children's Court costs for which we do not have reliable attributable fractions for methamphetamine. Deducting Children's Court costs leaves $762.9 million in court costs in-scope. These court costs include the cost of operating such specialist courts as drug courts [14] but do not include the cost of Federal courts (which process Commonwealth offences such as customs offences). Thus, with the exclusion of Children's Court and the Federal courts, the court costs are likely to understate cost attributable to methamphetamine.

Offender based attributable fractions calculated by the AIC from the DUMA survey in 2013/14 were used to assess the court costs attributable to methamphetamine. As with police costs, these court costs need to be allocated between offence categories (based on the alleged perpetrator's most serious offence (MSO)) so that the relevant attributable fraction can be applied to them. The attributable fraction for driving under the influence was applied to all driving offences as data was not available on the relative share of driving under the influence and other traffic offences. This allocation was made on the basis of the proportion of total defendant weeks for that level of court.

[14] Drug courts operate in New South Wales, Victoria, Queensland, Western Australian and South Australia and are typically available to adult offenders only (restrictions on eligibility vary from state to state). In NSW, there is an additional Youth Drug and Alcohol Court that functions under the control of the Children's Court and services juvenile defendants.

Table 7.5: Methamphetamine attributable court costs by most serious offence and level of court, 2013/14

	Violence	Property	Drugs	Traffic	Breach	Disorder	Not allocated	Total
Higher Courts								
Number of defendants finalised	2,827	257	3,144	21	268	69	6,352	12,938
Total defendant weeks	118,001	11,396	214,106	546	10,385	4,699	259,602	618,735
Assumed court costs ($million)	65.3	6.3	118.4	0.3	5.7	2.6	143.6	342.3
Central estimate of MA attributable court costs ($million) [a]	9.4	1.4	38.4	0.0	0.9	0.1	2.0	**52.2**
Lower bound of MA attributable court costs ($million)	0.0	1.2	32.3	0.0	0.0	0.0	0.0	33.6
Upper bound of MA attributable court costs ($million)	12.5	1.6	44.9	0.0	1.2	0.2	26.7	87.1
Magistrate's Courts								
Number of defendants finalised	79,213	32,906	41,254	198,589	36,132	37,133	56,402	481,629
Total defendant weeks	1,340,372	497,211	420,818	1,785,167	372,558	287,312	940,210	5,643,647
Assumed court costs ($million)	99.9	37.1	31.4	133.0	27.8	21.4	70.1	420.5
Central estimate of MA attributable court costs ($million)	14.4	8.3	10.2	6.5	4.2	0.6	1.0	**45.2**
Lower bound of MA attributable court costs ($million)	0.0	7.2	8.6	1.9	0.0	0.0	0.0	17.6
Upper bound of MA attributable court costs ($million)	19.1	9.6	11.9	15.3	5.6	1.8	13.0	76.3

[a] Methamphetamine attribution made from total court costs using the attributable fractions from Table 7.2

Sources: (Australian Bureau of Statistics, 2014b); (Steering Committee for the Review of Government Service Provision, 2015c); AIC DUMA collection 2013/14 [computer file]; calculations by the authors

Applying the relevant attributable fractions gives a central estimate of total court costs attributable to methamphetamine of $52.2 million for Higher courts (Supreme and District courts), and $45.2 million for Magistrate's courts, giving total methamphetamine attributable court costs of **$97.4 million** (see Table 7.5). The lower bound estimate of total court costs is **$51.2 million** and the upper bound estimate is **$163.4 million.**

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. [15] First, we estimated the average proportion of court activity considered attributable to methamphetamine use (e.g. our estimated methamphetamine attributable court costs divided by the total Higher Court and Magistrate's courts estimates, but excluding Children's Court costs; see Table 7.5 for the source data). This proportion was estimated to be 12.8%.

Expenditure figures were sourced from the annual reports of each of the Legal Aid Commissions across Australia for 2013/14 (Legal Aid Commission (ACT), 2014; Legal Aid Commission New South Wales, 2014; Legal Aid Commission of Tasmania, 2014; Legal Aid Queensland, 2014; Legal Aid Western Australia, 2014; Northern Territory Legal Aid Commission, 2014; Victoria Legal Aid, 2014). Of the $660.8 million expended by these organisations during 2013/14, $314.0 million is estimated to have been 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, we estimate legal aid costs on adult criminal court matters at $301.4 million, with a central estimate of methamphetamine attributable costs of **$40.1 million**, with a lower bound of **$21.1 million** and an upper bound of **$67.2 million**.

State and territory government spending on department of public prosecution (DPP) services was $247.5 million in 2013/14 (Director of Public Prosecutions Northern Territory, 2014; Director of Public Prosecutions South Australia, 2014; Director of Public Prosecutions Tasmania, 2014; Director of Public Prosecutions Victoria, 2014; ODPP ACT, 2014; ODPP NSW, 2014; ODPP Queensland, 2014; ODPP WA, 2014). As for Legal Aid expenditure, we applied a multiplier to this total expenditure to derive a methamphetamine-specific public prosecution expenditure. We estimated this multiplier from the average of Higher and Magistrates' court activity figures, weighted by expenditure (as described earlier) as 12.8%.

As with legal aid costs, it has been assumed the DPP costs on Children's court matters matches their share of direct court costs (4%) giving $261.1 million in DPP costs related to adult criminal court matters, with a central estimate of methamphetamine attributable costs of **$33.3 million**, with a lower bound estimate of **$17.5 million** and an upper bound of **$55.9 million**.

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15 This approach contrasts that used by Baldry et al (who adopted a bottom-up approach ((Baldry et al., 2012) see p.28-29).

7.4 Correction System Costs

Conceptually, there are two ways the correction costs attributable to methamphetamine could be calculated. The first is to calculate the net present value of all future corrections related costs arising from methamphetamine attributable crime committed in 2013/14. The second approach is to calculate the corrections system related costs attributable to methamphetamine incurred due to imprisonment in 2013/14, regardless of when the offence itself occurred. Data availability issues precluded use of the first approach so our costs calculation are based on persons imprisoned in 2013/14 regardless of which year the offending took place. The latter approach is consistent with that used elsewhere in the report.

7.4.1 Estimating the unit costs of imprisonment

The ongoing net recurrent costs (including depreciation of capital items) of corrections facilities cost society a total of approximately $3,500 million in 2013/14 (Steering Committee for the Review of Government Service Provision, 2015a), with 33,791 individuals detained in the corrections system as at 30 June 2014, including prisoners on remand (Australian Bureau of Statistics, 2014c). This gives an annual correction system cost per prisoner of $106,601. We have used this average in calculating the cost per methamphetamine attributable prisoner, although this is likely to underestimate the true per prisoner costs as it excludes some of the costs associated with in-prison drug and alcohol services and related services. We do not have data that would allow us to isolate the cost of these services from the overall prison costs.

7.4.1.1 Additional costs associated with imprisonment

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

- 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.

7.4.1.2 Offsetting savings associated with imprisonment

There are offsetting savings associated with imprisonment, with researchers at the AIC also identifying the following additional forms of offsetting savings (Morgan and Althorpe, 2014)

- 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 user 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, with our estimate of the net costs of imprisonment restricted to the following (with the method used to quantify the text set out in the discussion that follows):

- Net recurrent costs of corrections facilities: **$106,601** (calculation set out above);
- Lost productivity of prisoners in paid work: **$23,567**/male prisoner and **$10,561**/female prisoner;
- Workplace disruption and costs of recruiting replacement employees: **$2,856**/male prisoner and **$1,280**/female prisoner;
- Lost productivity of prisoners in unpaid household work: **$19,196**/male prisoner and **$34,272/**female prisoner;
- Prison assaults (on both staff and prisoners): **$357**; and,
- Reduced government payments (offsetting saving): **-$2,726**/male prisoner and **-$3,219**/female prisoner.

7.4.1.3 Lost productivity of prisoners in paid work

A proportion of offenders were in paid work at the time that 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 per employee is calculated from price estimates of GDP for June 2014 from the ABS national accounts and employment numbers (Australian Bureau of Statistics, 2016a, d) and was $138,083 in 2013/14. For the purposes of this calculation, benefits of paid work captured by the individual have been excluded as they are a private not a social cost. The average labour share of GDP over the past 20 years has been 54%, and so only 46% of the per employee GDP has been included as a cost in this analysis.

Data from the 2013/14 Victorian crime statistics (Victoria Police, 2014b) indicate that 37% of male adult alleged offenders and 17% of female adult alleged offenders were in employment when they were arrested. We have assumed these employment rates are representative of those arrested for methamphetamine attributable offences. These parameters give an estimated annual loss to economic output of **$23,567** per male prisoner and **$10,561** per female prisoner.

7.4.1.4 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 these costs match the costs estimated by the Bureau of Infrastructure, Transport and Regional Economics for replacing deceased employees, namely $6,422 in 2006 values (2009). Converting to 2013/14 values using the change in the CPI (Australian Bureau of Statistics, 2016c) gives a cost per imprisoned employee of $7,685. Applying the employment shares for alleged offenders (Victoria Police, 2014b) gives an estimated average cost to employers of replacing imprisoned workers of **$2,856** per male prisoner and **$1,280** per female prisoner.

7.4.1.5 Lost productivity of prisoners in unpaid household work

The estimated value of labour in the household lost due to imprisonment is calculated on the same basis as that lost due to premature mortality (see Chapter 6). Following Collins and Lapsley, 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 is estimated at about \$82,000 million in 2007 values and female unpaid labour is valued at \$154,000 million. Converting these to per adult estimates using population data (Australian Bureau of Statistics, 1997) and to 2013/14 values using the CPI (Australian Bureau of Statistics, 2016c) gives values of unpaid household work of **\$19,196** per adult male and **\$34,272** per adult female (assuming that the value of unpaid labour in the household for those aged less than 18 was zero).

7.4.1.6 Prison assaults

Data from the Review of Government Services Provision (Steering Committee for the Review of Government Service Provision, 2015c) estimates that in 2013/14, 0.8% of prisoners were the victim of a serious assault and 9.8% were the victim of an assault, with 0.05% of prisoners having committed a serious assault on a prison guard and 0.9% having 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, with serious assaults assumed to be equivalent to assaults requiring hospitalisation and other assaults costed at the average cost of the other assault categories reported in Smith et al. and weighted based on their relative frequency amongst assaults (2014). 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 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, 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. The estimated cost per assault on prisoners was \$26,404 for serious assaults and \$922 for other assaults, and the costs per assault on a prison guard were \$60,973 and \$1,729 respectively if productivity costs are included, and \$26,404 and \$1,041 respectively if they are not. Applying the relative frequencies to these unit costs, the estimated annual cost per prisoner from being the victim of an assault by another prisoner is **\$299** and the estimated per prisoner cost of assaults on prison employees is **\$46** if productivity costs are included, and **\$23** if they are excluded. The lower unit cost estimates have been used in each case for this cost calculation.

7.4.1.7 Reduced government payments (offsetting saving)

Prisoners are not eligible for government income support payments whilst in detention, so there will be a cost saving for the Australian Government to the extent that detainees were unemployed and on benefits at the time of their offence. We have not been able to identify data on the proportion of offenders in receipt of income support benefits at the time of their imprisonment, however, 2013/14 Victorian crime statistics (Victoria Police, 2014b) report that 21% of male alleged offenders and 25% of female alleged offenders were unemployed at the time of their arrest (with the remainder being not in the labour force). The annual value of Newstart allowance for singles in 2013/14 was \$12,922 (Centrelink, 2013). Assuming that these proportions are representative of prisoners detained for a methamphetamine 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 **-$2,726**/male prisoner and **-$3,219**/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 also in receipt of income support benefits (in which case the cost saving would be the difference between two persons in receipt of the couple Newstart allowance and one person in receipt of the single Newstart allowance, which is $10,410). 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, and for those individuals the offsetting saving will be underestimated.

Combining the six sources of cost and offsetting benefit from imprisonment able to be quantified gives a total estimated net annual cost of imprisonment of $149,815 for male prisoners and $149,816 for female prisoners. It is not known whether the net costs would be higher or lower if all of the unquantifiable costs were able to be quantified.

Table 7.6: Adult prisoners and estimated annual costs of imprisonment, by most serious offence category, 2013/14

Selected characteristics	**Prisoners (no.)**		**Annual costs ($million)**	
	Males	Females	Males	Females
Homicide & related offences	2,632	241	394.3	36.1
Acts intended to cause injury	6,556	513	982.2	76.9
Sexual assault & related offences	3,651	41	547.0	6.1
Dangerous or negligent acts endangering persons	852	71	127.6	10.6
Abduction, harassment & other offences against the person	408	27	61.1	4.0
Robbery, extortion & related offences	2,974	183	445.6	27.4
Unlawful entry with intent	3,721	247	557.5	37.0
Theft and related offences	1,180	202	176.8	30.3
Fraud, deception & related offences	571	203	85.5	30.4
Illicit drug offences	3,594	441	538.4	66.1
Prohibited & regulated weapons and explosives offences	389	21	58.3	3.1
Property damage& environmental pollution	419	32	62.8	4.8
Public order offences	222	12	33.3	1.8
Traffic & vehicle regulatory offences	755	58	113.1	8.7
Offences against justice procedures, gov't security and operations	3,128	289	468.6	43.3
Miscellaneous offences	79	10	11.8	1.5
Post-sentence detention	69	0	10.3	0.0
Total	**31,200**	**2,591**	**4,674.2**	**388.2**

Sources: (Australian Bureau of Statistics, 2014c; Morgan and Althorpe, 2014; Steering Committee for the Review of Government Service Provision, 2015a); AIC DUMA collection 2013/14 [computer file]; author calculations

7.4.2 Estimating the total costs of methamphetamine attributable imprisonment

The estimated total cost of imprisonment in 2013/14 can then be calculated by applying the estimated unit cost of imprisonment to the total prisoner population by gender.

Data on the total population of prisoners were taken from the ABS publication “Prisoners in Australia”, which reports on the national prison census of adults imprisoned in correctional facilities in Australia as at June 30 (June 29 for Victoria) (Australian Bureau of Statistics, 2014c). Whilst individual prisoners whose details are captured in the prison census may only be imprisoned for some fraction of the year, our analysis makes the assumption that average number of prisoners across the year will be similar to the number enumerated at the census, as will the distribution of most serious offence type amongst the prison population. Prisoners were grouped to broad offence categories based on their most serious offence (or the most serious offence with which they had been charged in the case of prisoners on remand). The ABS data include prisoners on remand as well those imprisoned after conviction.

Table 7.7 sets out the estimated number of prisoners whose imprisonment is attributable to methamphetamine, and the estimated annual cost of imprisonment by broad offence category. This is calculated from ABS data on the number of prisoners (2014c), the unit cost estimates for imprisonment as described above, and the methamphetamine attributable fractions set out in Table 7.2. It is estimated that, under the central estimate of the methamphetamine attributable fractions, at the time of the data collection in 2013/14 there were 6,026 prisoners in Australia whose offending could be attributed to methamphetamine. The lower bound estimate is 2,395 prisoners and the upper bound estimate is 7,587 prisoners. It has been assumed the proportion of costs by offence category that can be attributed to methamphetamine matches the proportion of prisoners attributed to it. As with police costs, the methamphetamine attributable fraction for driving under the influence was used for all traffic offences.

The total estimated methamphetamine attributable costs of imprisonment are **$902.9** million under the central estimate, with a lower bound of $358.8 million and an upper bound of $1,136.7 million.

Table 7.7: Methamphetamine attributable costs of adult imprisonment, by most serious offence category, 2013/14

Selected characteristics	Central estimate		Low bound		High bound	
	Number	$million	Number	$million	Number	$million
Homicide & related offences	414	62.0	0	0.0	549	82.2
Acts intended to cause injury	1,018	152.5	0	0.0	1,350	202.3
Sexual assault & related offences	532	79.6	0	0.0	705	105.6
Dangerous or negligent acts endangering persons	133	19.9	0	0.0	176	26.4
Abduction, harassment & other offences against the person	63	9.4	0	0.0	83	12.4
Robbery, extortion & related offences	455	68.1	0	0.0	603	90.3
Unlawful entry with intent	893	133.8	774	115.9	1,024	153.4
Theft and related offences	311	46.6	269	40.4	357	53.4
Fraud, deception & related offences	174	26.1	151	22.6	200	29.9
Illicit drug offences	1,307	195.9	1,102	165.0	1,529	229.1
Prohibited & regulated weapons and explosives offences	59	8.8	0	0.0	78	11.7
Property damage & environmental pollution	101	15.2	88	13.2	116	17.4
Public order offences	7	1.0	0	0.0	20	3.0
Traffic & vehicle regulatory offences	40	6.0	11	1.7	93	14.0
Offences against justice procedures, gov't security and operations	519	77.8	0	0.0	687	102.9
Miscellaneous offences	1	0.2	0	0.0	17	2.5
Post-sentence detention	0	0.0	0	0.0	0	0.0
Total	**6,026**	**902.9**	**2,395**	**358.8**	**7,587**	**1,136.7**

Sources: (Australian Bureau of Statistics, 2014c; Morgan and Althorpe, 2014; Steering Committee for the Review of Government Service Provision, 2015a); AIC DUMA collection 2013/14 [computer file]; calculations by the authors based on net annual cost of imprisonment of $149,815 for male and $149,816 for female prisoners [16]

7.4.3 Community based correction costs

The cost of community corrections relating to methamphetamine use was estimated from ABS data on the number and length of community service orders issued by the criminal courts in 2013/14 by broad offence type [17] (Australian Bureau of Statistics, 2014b) and data on the total cost of the community corrections system (Steering Committee for the Review of Government Service Provision,

[16] e.g. Homicides males + females from Table 7.6 (2632+241) * AF (Table 7.2) 0.144 * $149,815 = $62.0 million

[17] 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, however, so the impact of their omission is reduced.

2015a). For the purposes of allocating costs to methamphetamine, it was assumed the cost of a given order was directly proportion to the length of the order. The order length was assigned to the principal offence for each defendant, where principal offence was determined by the method of finalisation (charges that are proven are ranked above those that are non-proven, transferred or withdrawn) and offence severity (as per the National Offence Index). [18]

For each offence category, the total hours of service was estimated. This was then used to estimate the proportion of community corrections resources that were devoted to dealing (supervising) with such cases. The total costs of community corrections activity (Steering Committee for the Review of Government Service Provision, 2015a) was then split between offence categories on this basis.

As was the case for courts data, the DUMA-derived methamphetamine attributable fractions were applied to the community corrections activity in each category of offence to estimate the overall proportion of community based corrections that could be attributed to methamphetamine use.

It was estimated that 14.1% of community corrections activity could be attributed to methamphetamine use. This equates to approximately **$67.5 million** for 2013/2014 under the central estimate of methamphetamine attribution. The estimated cost using the lower bound estimate of methamphetamine attribution is **$32.2 million** and the upper bound estimate is **$96.8 million**.

7.5 Australian Border Force

The Australian Border Force has a wide range of obligations including protecting national borders and managing the movement of people and goods across them (Australian Border Force, 2016). Drug detection activities often occur simultaneously with other activities with items entering Australia commonly being inspected for a variety of possible breaches of Australian law. The Australian Border Force is responsible for detecting all prohibited import items, not just illicit drugs. As with the work conducted by Moore, there remains no conceptual or practical methods by which the relevant activities can be precisely estimated (Moore, 2005). We attempted throughout this project to obtain estimate of costs from the Australian Border Force (previously known as Australian Customs and Border Protection Service), but due to the multi-functional nature of the work undertaken by staff, it was not possible for them to provide an estimate for expenditures on drug detection activities separately from the general budget.

Ritter et al. provided an updated estimate of the costs associated with illicit drug control arising from the tasks undertaken by the Australian Border Force for the year 2009/2010 (Ritter et al., 2013). This estimate was $157.66 [19] million (Ritter et al., 2013). These costs were, in turn, based on an estimation by Moore that illicit drug control represented 15.4% of the departmental budget (Moore, 2005), with this percentage derived from an estimate of costs to the US Customs Service in 2003. If we, in turn, apply the same assumptions and the 15.4% estimate previously used to the 2013/14 total departmental expenses for the Australian Border Force of $1,420.39 million (Attorney-General's Department, 2014), this results in an annual expenditure of $218.74 million on detecting all ***illicit*** drugs**.**

[18] The counting rules and ordering are described more fully at http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4513.0Explanatory%20Notes12014-15?OpenDocument#PRINCIPAL%20OFFENCE

[19] CPI adjusted to 2013/2014 $175.2 million

Given the changes in the work undertaken by the Australian Border Force, we believe it may no longer be appropriate to use 2003 US Customs Service data. Furthermore, there is the subsequent challenge of apportioning the total spent on detecting to types of illicit drugs. For example, the ratio of costs for different drugs is likely to be very different to the ratio for treatment or prevention programs. Given the uncertainly in this area, we have used the number of seizures of illicit drugs as a proxy measure (Australian Crime Commission, 2015). Joint Border Force and Federal police seizures totalled 12,760 cases. Of these 2,766 [20] (21.7%) were for methamphetamine. We have not included this figure (**$47.5 million**) in the central estimate of costs, but have counted it in the upper bound estimate. However, we emphasise this is an area that requires a considerable amount of additional data and research into methods (McFadden Consultancy, 2016).

7.6 Australian Federal Police (AFP)

The Australian Federal Police (AFP), in conjunction with the Australian Border Force, are responsible for the interdiction of cross border illicit drug movements. The AFP also have policing responsibilities in the ACT, the costs of which are captured in the analysis of police costs in Section 7.2. In 2009/10, of the total budget of $1,235 million, $435.8 million was allocated to the Criminal Investigation and Close Operational Support programs, the two activities thought most closely linked to illicit drugs (Ritter et al., 2013). Within this total, 42% is estimated to be associated with illicit drugs.

In 2010/2011, Criminal Investigation became part of Operations – Policing and in 2013/2014, together with Close Operational Support and National Security – Policing, formed the Federal Policing and National Security program (Australian Federal Police, 2014). Due to this restructure, the estimate of AFP costs are based on the 2012/13 budget, when the combined cost of Operations – Policing and Close Operational Support was $268.2 million [21]. Taking the 42% previously allocated to illicit drugs results in a total of $112.7 million. Using the same proportion as above (21.7%) for Border Force, gives a crude approximation of the potential cost of methamphetamine-related operations (**$24.5 million**). Due to uncertainly around the derivation, this is only included in our upper bound measure.

7.7 Costs to Victims of Crime

As well as the costs arising from the investigation of crime, the administration of justice and the detention of offenders, there are also substantial costs incurred by the victims of crime. Administrative data from police and court authorities are generally poor guides to the extent of crime victimisation, as many victims do not report the offence to the police. Reporting rates for selected crimes vary, ranging from 34% for face-to-face threatened assault to 88% for motor vehicle theft (Australian Bureau of Statistics, 2015a).

The most comprehensive assessment of the prevalence of crime victimisation in Australia is provided by the ABS' survey "Crime Victimisation, Australia" (2015a). The number of persons reporting they had been a victim of crime, by offence type, is set out in Table 7.8. 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.

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[20] 6,587 ATS seizures; number of methamphetamine versus MDMA seizures 2,766 versus 3,821.

[21] In 2012/2013 expenditure for community policing in the ACT was $156.5 million (Australian Federal Police, 2014).

It is important to note that Table 7.8 reports the 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 probably understate the cost of crime to victims.

Table 7.8: Number of victims of selected crimes in Australia by whether the crime was reported, ('000) 2013/14

Offence	Victim told police (000)	Victim did not tell police (000)	Total victims (000)
Personal crimes			
Physical assault	215.2	196.7	418.2
Threatened assault			
Face-to-face	169.5	321.0	494.2
Non face-to-face	64.2	120.6	183.1
Total assault	-	-	*866.6*
Robbery	37.0	25.1	65.6
Sexual assault	18.5	29.8	48.3
Household crimes			
Break-in	173.0	53.2	228.9
Attempted break-in	73.0	97.2	170.8
Motor vehicle theft	47.8	6.8	54.4
Theft from a motor vehicle	126.0	130.6	258.8
Malicious property damage	261.7	265.9	528.9
Other theft	93.7	142.7	238.8

Sources: (Australian Bureau of Statistics, 2015a); AIC DUMA collection 2013/14 [computer file]

These data provide the population estimate from which we estimate the number of victims of methamphetamine attributable crime, and the cost to victims of that crime. The number of victims of methamphetamine attributable crime was calculated by applying relevant methamphetamine specific attributable fractions derived from the 2013/14 DUMA survey as set out in Table 7.2. In the central estimate, there were an estimated 141,200 victims of methamphetamine attributable violent crime, with the lower bound estimate being 0 and the upper bound 187,300. A further 333,100 persons were the victim of methamphetamine attributable property crime under the central estimate of methamphetamine attribution, with a lower bound estimate of 288,700 and an upper bound estimate of 382,000 (see Table 7.9). This estimate does not take into account multiple victimisations, and as such may understate the frequency and cost of methamphetamine attributable crime.

Table 7.9: Number of victims of selected methamphetamine attributable crimes in Australia, ('000) 2013/14

Offence	Central estimate	Low bound	High bound
Personal crimes			
Physical assault	60.2	0.0	79.9
Threatened assault			
Face-to-face	71.2	0.0	94.4
Non face-to-face	26.4	0.0	35.0
Total assault	124.8	0.0	165.5
Robbery	9.4	0.0	12.5
Sexual assault	7.0	0.0	9.2
Household crimes			
Break-in	51.5	44.6	59.1
Attempted break-in	38.4	33.3	44.1
Motor vehicle theft	12.2	10.6	14.0
Theft from a motor vehicle	58.2	50.5	66.8
Malicious property damage	119.0	103.1	136.5
Other theft	53.7	46.6	61.6

Source: (Australian Bureau of Statistics, 2015a); AIC DUMA collection 2013/14 [computer file]; calculations by the authors

The most comprehensive set of estimates of the costs of crime have been compiled by researchers at the Australian Institute of Criminology (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.

Unit costs for each cost category were converted to 2013/14 values using the change in current price Gross State Product (GSP) per capita (Australian Bureau of Statistics, 2016a) from June 2011 to June 2014 for intangible costs and lost output, and the CPI for medical costs, property loss and property damage. Table 7.10 sets out the unit costs to victims of personal crime while Table 7.11 reports the unit costs for household crime.

Table 7.10: Unit costs to victims of "personal" crime from Smith et al. converted to 2013/14 values

	Medical costs ($)	Lost output ($)	Intangible costs ($)
Assault			
Hospitalised	12,383.5	34,568.9	14,020.2
Injured, treatment other than hospital	736.6	2,889.7	2,996.7
Injured no treatment	-	717.1	717.1
No injury	-	42.8	428.1
Sexual assault			
Injury	1,014.2	6,849.6	5,458.2
No injury	-	56.7	567.2
Robbery			
Hospitalised	12,383.5	34,568.9	13,827.6
Injured, treatment other than hospital	736.6	2,889.7	3,034.1
Injured no treatment	-	722.4	717.1
No injury	-	42.8	428.1

Sources: (Australian Bureau of Statistics, 2016a, c; Smith et al., 2014); calculations by the authors

Table 7.11: Unit costs to victims of "household" crime from Smith et al. converted to 2013/14 values

	Property loss & property damage ($)	Lost output($)	Intangible ($)
Burglary [a]			
Completed	1,863.9	85.6	1,121.6
Attempted	228.5	56.7	747.0
Motor vehicle theft	4,237.1	172.3	2,443.4
Theft from a vehicle [b]	1,107.0	62.1	812.3
Malicious property damage	605.1	46.0	1,331.0
Other theft	545.5	9.6	247.2

[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

Sources: (Australian Bureau of Statistics, 2016a, c; Smith et al., 2014); calculations by the authors

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 et al. (Dolan et al., 2005) use a value of 0.56 lost DALYs for rape and 0.16 lost DALYs for other sexual assault compared to a lost DALY of 0.19 for assault resulting in serious injury (roughly equivalent to the assault – hospitalised category used by Smith (2014)).

To reflect this divergence of approaches, we have included the Smith et al. estimates of intangible costs of sexual assault as a lower bound, and an alternative estimate using the ratio between Dolan et al.'s DALYs for rape and sexual assault to calculate alternative values from the Smith et al. intangible costs of assault resulting in hospitalisation (Dolan et al., 2005; Smith et al., 2014).

Valuing DALYs is not without controversy (Baker et al., 2010; Dolan, 2010; Donaldson et al., 2011; Miller and Hendrie, 2011). The most straightforward approach (used, for example, in Moore 2007 and Nicosia et al., 2009) is to assume the value of a DALY equals that of a statistical life year. The value of a statistical life year is typically calculated by making an assumption of the average years of life remaining for the individual whose behaviours gave rise to the value of a statistical life estimate (typically assumed to be 40 years) and then annualise using the same approach used to calculate the annual payment for an annuity of a given total value, e.g.:

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

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 7%

years = assumed average years of life remaining at the time of the study for the sample used to derive the VoSL estimate

The limitation of this simple approach is that research has shown the value of a life year is contextual, for example, it can depend heavily on factors such as age, current health state, expected years of life remaining, ability to pay, and individual views on optimal distribution of resources through the life cycle (Baker et al., 2010; Dolan, 2010; Donaldson et al., 2011). The prospective expressed willingness to accept less years of life in exchange for avoiding various health conditions or impairments also often appears too high given the degree of adaption observed in individuals with those forms of impairment (Dolan, 2010).

For this reason, it is often maintained that accurate estimates of DALYs can only be obtained through specific studies of the preferences of the population of interest. However, such studies are typically very time intensive and require substantial resources to implement. As such, they are ill suited for public policy analysis. There is also the concern that in adopting "bespoke" values for a DALY, the difference in valuation may be driven by sampling error in the study rather than any difference in the underlying "true" value, as well as creating an inconsistency between the way averted deaths are valued compared to averted years of healthy life lost to disability. For these reasons, a VoSLY estimate has been used in this study to value lost DALYs.

Annualising Abelson's value of a statistical life estimate ((2008), see Section 6.6) gives a VoSLY, and therefore a value per DALY lost, for 2013/14 of $281,798. Plausible bounds can be placed on the value per DALY lost by using the implicit threshold value per DALY used for PBS approval of $45,000 as a lower bound (Community Affairs References Committee, 2015; Harris et al., 2008) and the VoSLY derived from an annualisation of the value of a statistical life used by the US Department of Transport (2015), $841,393, as an upper bound.

The original Smith et al. estimates of the intangible cost of sexual assault (scaled up to 2013/14 values) were $5,458 for sexual assault resulting in injury and $567 for other sexual assaults (compared to $14,020 for assault resulting in hospitalisation) (Smith et al., 2014). The alternative estimates calculated from drawing on relative DALYs from Dolan et al.'s study are $41,180 and $10,974 respectively (Dolan et al., 2005) using the central estimate for a VoSLY, $25,200 and $7,200 respectively using the lower bound value of a DALY, and $471,180 and $134,623 respectively for the upper bound estimate. For the cost estimates, we use the Smith et al. values for the cost of sexual assault as the lower bounds, and the values derived from the Dolan et al. lost DALY estimates and the value of a DALY based on Abelson's value of a statistical life for the central estimate and upper bound.

Applying the unit costs outlined in Tables 7.10 and 7.11 to the estimated number of victims of methamphetamine attributable crime gives a total estimated cost to victims of personal crime under the central estimate of methamphetamine attribution of **$579.3 million** (Table 7.12). The cost of "household" crime to individual victims (e.g. excluding the cost of crime to businesses) was **$676.1 million** (Table 7.13). This gives a total central estimate of the cost to victims of crime of **$1,255.4 million**.

7.7.1 Central estimates

Table 7.12: Central estimate of total costs to victims of personal crimes in Australia by offence type and severity, 2013/14

Offence	No. of MA attributable victims	Medical costs ($million)	Lost output ($million)	Intangible costs ($million)	Total costs ($million)
Assault					
Hospitalised	2,284	28.3	78.9	32.0	139.2
Injured, treatment other than hospital	19,742	14.5	57.0	59.2	130.7
Injured no treatment	33,955	0.0	24.3	24.3	48.7
No injury	68,797	0.0	2.9	29.5	32.4
Total	124,778	42.8	163.3	145.0	351.1
Sexual assault	.	.	.	.	.
Injury	3,091	3.1	21.2	127.3	151.6
No injury	3,864	0.0	0.2	42.4	42.6
Total	6,955	3.1	21.4	169.7	194.2
Robbery	.	.	.	.	.
Hospitalised	331	4.1	11.4	4.6	20.1
Injured, treatment other than hospital	1,289	0.9	3.7	3.9	8.6
Injured no treatment	1,686	0.0	1.2	1.2	2.4
No injury	6,140	0.0	0.3	2.6	2.9
Total	9,446	5.0	16.6	12.3	34.0
All Personal Crime	.	.	.	.	.
Total	**141,180**	**50.9**	**201.3**	**327.0**	**579.3**

Sources: (Australian Bureau of Statistics, 2016a, c; Smith et al., 2014); calculations by the authors

Table 7.13: Central estimate of total costs to victims of household crimes in Australia by offence type and severity, 2013/14

Offence	Number of MA attributable cases	Costs of property loss & property damage	Cost of lost output	Intangible costs	Total Costs
Burglary					
Completed	51,503	96.0	4.4	57.8	158.2
Attempted	38,430	8.8	2.2	28.7	39.7
Total burglaries	89,933	104.8	6.6	86.5	197.8
Motor vehicle theft	12,240	51.9	2.1	29.9	83.9
Theft from a vehicle	58,230	64.5	3.6	47.3	115.4
Malicious property damage	119,003	72.0	5.5	158.4	235.9
Other theft	53,730	29.3	0.5	13.3	43.1
Total	**333,135**	**322.4**	**18.3**	**335.4**	**676.1**

Sources: (Australian Bureau of Statistics, 2016a, c; Smith et al., 2014); calculations by the authors

7.7.2 Lower bound estimates

The cost of household crime to victims under the lower bound estimate of methamphetamine attribution is shown in Table 7.14. The lower bound of the AF for violent crime is zero, so *there are no methamphetamine attributable personal crime costs.* Thus, the estimated costs to victims of crime in the lower bound are all household crimes, totalling **$585.9 million** (see Appendix 3, Table 1).

7.7.4 Upper bound estimates

Under the upper bound estimate of methamphetamine attribution, the estimated total costs to victims of crime of personal crimes increases to $768.6 million, and that of household crime to $775.2 million (see Appendix 3, Table 2 and 3). This gives a total upper bound estimate of the cost to victims of crime of **$1,543.8 million**.

Table 7.14: Summary Chapter 7 costs

Cost area	Central estimate ($000,000)	Lower bound ($000,000)	Upper bound ($000,000)
Police (Table 7.3)	836.9	471.8	1,165.5
Roadside testing (7.2.1)	11.1	8.8	13.4
Court (Table 7.5)	97.4	51.2	163.4
Legal aid (7.3)	40.1	21.1	67.2
Public Prosecutors (7.3)	33.3	17.5	55.9
Imprisonment (Table 7.7)	902.9	358.8	1,136.7
Community correction (7.4.1)	67.5	32.2	96.8
Australian Border Force (7.5)	-	-	47.5
Australian Federal Police (7.6)	-	-	24.5
Personal crime victim (Table 7.12, Appendix 3)	579.3	0	768.5
Household crime victim (Table 7.13, Appendix 3)	676.1	585.9	775.2
Total [a]	**3,244.5**	**1,547.3**	**4,314.6**

[a] The estimate does not include juvenile crime

7.8 Limitations and Recommendations for Further Research

A key limitation in this section is the reliance on DUMA-based estimates of methamphetamine attributable fractions for crime. The shortcomings of the DUMA survey and the estimates derived from it are discussed at length in Section 7.1. Also, we were not able to separately identify the cost of drug courts (although they are included in total court costs). To the extent possible, we have attempted to validate our estimates using data from alternative sources. The costs associated with police, justice and prison systems represent the largest single area of methamphetamine-related costs, accounting for about 65% of total costs. While substantial, this is less than the 81% previously reported from methamphetamine (Moore, 2007) and the 74% for illicit substances overall (Collins and Lapsley, 2008). Within this domain, the major cost areas were imprisonment, police and crime victimisation.

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 earlier. Similarly, we have not included costs arising from prosecutions occurring in the Federal courts. Although, this would likely entail few cases, prosecutions involving the international importation of drugs could be complex and time consuming.

In common with other sections of this report, the issue of poly-drug use is problematic in attempting to assign costs specifically to methamphetamine, although the approach used by the AIC attempts to attribute offending to individual substances based on the offender's self-assessment.

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CHAPTER 8: CHILD MALTREATMENT & PROTECTION

Robert J Tait & Steve Whetton

8.1 Background – Child Protection

The RAND review reported that in 2005 the cost of methamphetamine-related child endangerment in the US was US$904.6 million, the third leading social cost of methamphetamine use after premature death/intangible costs of addiction, and crime and criminal justice costs (Nicosia et al., 2009). In addition to health costs due to exposure to toxic chemicals, parental substance use is a risk factor for neglect, maltreatment, physical abuse and sexual abuse by parents or drug using acquaintances (Haight et al., 2005; Messina et al., 2014). Each case of childhood neglect is estimated to cost more than US$210,00 (in 2010 dollars) over a lifetime in terms of direct costs (e.g. childhood and adult health care, lost productivity, criminal justice) and nearly US$1.3 million per childhood death (Fang et al., 2012). There are also major impacts on the enduring quality of life to infants and children raised in a neglectful setting (Nicosia et al., 2009). Child maltreatment in Australia is estimated to contribute 1.4% of all disability-adjusted life years (DALYs) in males and 2.4% in females just relating to depression, anxiety and self-harm (Moore et al., 2015).

The estimate of the cost of amphetamine use in Australia by Moore does not identify any costs specifically related to the impact on children, other than the health costs of birth related and maternal conditions (e.g. low birth weight, antepartum haemorrhage, new-born drug toxicity) (Moore, 2007). In contrast, the impacts of alcohol have been extensively documented, ranging from verbal abuse through physical abuse to death (Laslett et al., 2015). Thus, this area is in urgent need of investigation. However, it is important to recognise the multifactorial nature of these cases; removal of a single factor such as illicit drug use would not necessarily prevent the death of an individual child (Field, 2014).

In estimating costs of harms to children, this report needs to exclude those cost related to health, police and justice to avoid double counting those items that appear in other sections of the report. However, child protection costs represent a discrete component that can be evaluated. Although there are marked variations in legal definitions and systems across Australian jurisdictions, similarities remain in the stages between initial notification and outcomes such as interventions or court orders (Bromfield and Higgins, 2005).

8.2 Number of Cases

Although data on the number of child protection cases are available, the reasons for substantiated cases beyond the broad “physical”, “sexual”, “emotional” and “neglect” categories are not generally available (Australian Institute of Health and Welfare, 2016). In the Victorian system, after notification and investigation, cases are either dismissed or substantiated. For the period 2001 to 2005, substantiated cases represented 20.5% (n=38,511) of the 188,063 notifications to child protection. Of these, 35.3% (n=13,579) had a parental history of “substance abuse”, comprising 15.9% (n=6119) drug use only and 19.4 % (n=7462) with alcohol and drug use (Laslett et al., 2013).

Nationally, in 2013/14 there were 40,844 children (aged 0-17) with substantiated cases (Steering Committee for the Review of Government Service Provision, 2015c). When the above proportions (15.9% and 19.4%) are applied to the number of cases in 2013/14, the result is 6,494 “drug use” cases and 7,924 “drug and alcohol” cases for the 12 month period. The relative share of methamphetamine users amongst those receiving treatment for their substance use should provide a reasonable proxy for the role of methamphetamine in these “drug use only” and “drug and alcohol” substantiated cases in the child protection system. Methamphetamine is the principal drug of concern in 27.4% of treatment episodes for illicit drugs, and is the additional drug of concern in 14% of cases where alcohol is the primary drug of concern (Australian Institute of Health and Welfare, 2015a). Using these shares as a basis for estimation, 1,779 cases arise from methamphetamine use as the principal drug of concern, and a further 1,109 where methamphetamine was an additional drug of concern to alcohol. Weighting the latter down by 50% due to the involvement of alcohol, this gives 2,333.7 cases potentially attributable to methamphetamine, or 5.7% of the total.

An alternative estimate of the role of methamphetamine in child protection cases can be derived from a detailed review of 467 cases representing children’s first entry into care in South Australia. Study findings suggests that about 70.2% (n=328) involved parental substance use. A detailed case series of 99 randomly selected out of the original sample revealed that 75.8% involved substance use with about 50.7% (n=38) of cases including methamphetamine with, or without, other substance use (Jeffreys et al., 2009). The case review identified all factors mentioned in the case file as having contributed to the decision to place the child in care. No weighting or precedence of the factors could be identified. If it is assumed that each of the factors contributed an equal weight to the decision to take the child into care, and that none of the factors were caused by another factor [22], then the share of total factors can be used to identify the role of methamphetamine in care decisions.

Weighted up to the whole sample, there were an estimated 166.3 cases in which methamphetamine use was one of the factors contributing to the removal of a child into care for the first time, out of a total of 2,285.4 factors identified in the case review, with methamphetamine use therefore accounting for 7.3% of all factors identified in the care decision (see Table 8.1 below). On the assumption that each factor in the decision carried an equal weight, this suggests that 7.3% of the decisions to take a child into care could be attributed to methamphetamine.

8.3 Child Protection Costs

In 2013/14, the total cost of child protection services in Australia was $4,000.6 million (Steering Committee for the Review of Government Service Provision, 2015a). Using the substance use treatment data to allocate a share of “drug use only” and “drug and alcohol” substantiated cases to methamphetamine gave an estimated share of 5.7% of cases. The alternative approach of identifying methamphetamine’s total share of factors identified in the South Australian case review suggested a methamphetamine share of 7.3%. These estimates give a range of $228.5-$291.1 million. For the purpose of this report, we use the mid-point as our main estimate: **$259.8 million**.

[22] Without a basis for weighting the factors, these were the assumptions that underpinned the estimate. We note, that we do not know in which direction any difference from the assumptions is likely to skew the estimates.

Table 8.1: 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 intellect. 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**

Note: [a] 139 cases; [b] 328 cases. CP = child protection: GOM = Guardianship of the Minister
Source: (Jeffreys et al., 2009), calculations by the authors

8.4 Child Death Reviews

The major costs of child deaths are addressed in Chapter 6 with other cases of premature mortality. However, there are additional specific costs associated with assessing some child deaths. Using similar approaches to other child death review procedures, the WA Ombudsman reviews deaths that match key criteria, including that concerns have been raised with the Department for Child Protection and Family Support. In 2013/14, the Ombudsman reviewed 24 deaths at a cost of $18,407 per review. While not asserting causality, 58% of cases involved the use of drugs as a contributory social or environmental factor (with alcohol use identified in 57% of cases and parental mental health issues in 31%) (Field, 2014). No specific categories of illicit drugs were cited. Methamphetamine was the principal drug of concern in 27.4% of illicit drug treatment episodes (Australian Institute of Health and Welfare, 2015a). Assuming that this figure of 27.4% translates to WA, then 27.4% of 58% equates to 15.9% of cases with methamphetamine as a likely contributory factor, and thus involved in 3 to 4 deaths

Investigations of child deaths are conducted by relevant state or territory authorities and so there are variations in which deaths are subject to detailed review. There were 192 deaths in the target year or the most recent available year that were either explicitly subject to detailed review (NSW, WA) or known to the child protection system and thus likely to be reviewed. Based on the WA cost, this equates to (192*$18,407) = $3,534,144 in review costs in addition to any coronial or police investigations. Using the 15.9% from the paragraph above as the proportion involving methamphetamine, the cost of conducting these child death reviews will be **$561,929.**

Table 8.2: Child protection deaths

State or Territory	Source	Reviewable deaths	Year
New South Wales	1	22	2013
Queensland	2	[a] 80	2013/14
South Australia	3	[a, b] 26	2013
Tasmania	4	2	2006
Victoria	5	[a] 28	2012
Western Australia	6	24	2013/14
Australian Capital Territory	7	[a, c] 3	2013/14
Northern Territory	8	[a] 7	2013

[a] Known to the child protection system; [b] the figure for QLD appears disproportionately large compared to other states, suggesting differences in the referral systems; [b] Estimated number as ACT aggregates 5 year figures: 15 of 109 cases (13.8% known to child protection); 1 = (Barbour, 2015); 2 = (Armitage, 2014); 3 = (Eszenyi, 2014); 4 = (Children and Family Services, 2007); 5 = (Reeves, 2013); 6 = (Field, 2014); 7 = (Gregory, 2014); 8 = (Bath, 2014)

8.5 Child Endangerment from Clandestine Laboratories

As noted below in Chapter 9, the clandestine manufacture of methamphetamine involves a range of volatile and toxic substances, placing residents and neighbours at risk of hazardous exposure. It is estimated that about 30-40% of clandestine laboratories have children present (Hawkrigg and Winterton, 2013; New Zealand Police Association, 2013). Young children are likely to be more susceptible than adults to the adverse effects of toxic exposure and those aged six months to two years are likely to experience high levels of exposure (e.g. from crawling (dermal exposure) and placing objects in their mouths) (Shukla and Bartgis, 2008). Of the 744 clandestine laboratories detected in

2013/14, 608 were involved in ATS production. With an average of two children per case (enHealth, 2013) this is likely to amount to 426 children in the year (608 laboratories * 35% * 2 children). There would also be further cases where laboratories were not discovered (enHealth, 2013). Data from the US indicates very high levels of neglect (93%) and other harms to children recovered from clandestine laboratories (Messina and Jeter, 2012). The sub-cohort of children present near or in these laboratories would appear to be at especially high risk of both physical and emotional harm. There are insufficient data to estimate costs specifically arising from exposure to clandestine laboratories and to determine if these costs differ from those incurred by children where there is parental illicit drug use, such as child protection orders.

Table 8.3: Summary Chapter 8 costs

Cost area	Central estimate	Low bound	High bound
Child protection cases	$259,811,470	$228,514,272	$291,106,668
Child death reviews	$561,929	[a]	[b]
Clandestine laboratory exposure	unknown	unknown	unknown
Total	**$260,373,399**	**229,076,201**	**$291,670,597**

[a] Low bound estimate – duplicated central estimate: [b] High bound estimate – duplicated central estimate

8.6 Limitations and Recommendations

It should be noted that in relation to alcohol, only 0.7% of children exposed to adult risky drinking behaviour are substantiated in the child protection system; the remainder incur less severe harms or are not detected (Laslett et al., 2015). Clearly, risky drinking is not a sufficient cause for notification, but it does serve as a reminder that there is a continuum of potential harm arising from substance use. It seems probable that the same applies to children exposed to adult methamphetamine consumption. In 2004, it was estimated that more than 27,000 children under 13 lived with an adult who used methamphetamine at least monthly (Dawe et al., 2006). (See Chapter 12 for a revised estimate of the number of children living with a dependent parent. We estimate, based on 160,000 people dependent on methamphetamine, the figure is now in the range of 85,184 to 120,854). These children are at increased risk of harm even if they do not appear as a cost to child protection agencies. By way of comparison, in 2004/5 the cost of alcohol-related child protection cases was estimated at $671 million. With a CPI increase, in 2013/14 this would be $852 million (Australian Bureau of Statistics, 2016b; Laslett et al., 2010).

The cost estimates of child endangerment from the US, which ranks child endangerment as the third leading cost to society of methamphetamine use, clearly identify the importance of this domain (Nicosia et al., 2009). Unfortunately, in Australia, these data do not appear to be readily available, in particular those relating to child protection. We were unable to identify any national repository of the data. Therefore, we submitted a data request to a State authority. No summary data were available on variables related to illicit drug use – this information could only be accessed by inspecting individual case files as occurred in South Australia (Jeffreys et al., 2009).

Data from Western Australia provides an alternative approach to identifying harms to children who have parents with substance use disorders (O'Donnell et al., 2010). The West Australian Data Linkage System has been used to combine information on substantiated child maltreatment and hospital admission data from their parents, prior to the date of the child maltreatment. These data were used to determine if parents had particular types of hospital admissions (e.g. mental health, substance use) prior to the notification date (O'Donnell et al., 2010). While this approach does provide unique and valuable information, clearly not all persons with a significant substance use problem will have a hospital admission with that diagnosis nor will all parents, especially fathers, still be in contact with the child. Nevertheless, 32.2% of mothers and 18.5% of fathers had substance use admissions prior to notification to child protection (O'Donnell et al., 2010). Unfortunately, the current data reports on all forms of substance related admissions and does not separately identify by different types of drug. Nevertheless this could be replicated to assess stimulant related admissions. Even though not all parents would incur a relevant hospital admission, it would provide population data rather than small samples from case file inspection.

In common with many other areas in this report, the issue of poly-drug use (by the parents) is a further challenge in attributing harm. This is further complicated by the fact that the drug use and harms involve different individuals. It is therefore more difficult to assert that methamphetamine use by the parent was responsible for the harm and not some other characteristic of parental behaviour. Finally, even in studies where individual case files have been inspected, it is rarely possible to differentiate between the presence of substance use and use of that substance being a causal factor in the maltreatment of the child.

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CHAPTER 9: SOCIETAL COST OF METHAMPHETAMINE PRODUCTION

Marian Shanahan & Robert J Tait

9.1 Background

Globally, in 2012, about 107 tons of methamphetamine were seized, up from about 24 tons in 2008; a rise that has occurred despite increasing controls on precursor chemicals used in its manufacture (United Nations Office on Drugs and Crime, 2014a). The problems of contamination and dangers to first responders arising from the clandestine manufacture of methamphetamine has long been described (Irvine and Chin, 1991; US Department of Justice, 2005). In 2005, it was estimated that the cost associated with clandestine laboratories in the US, in terms of harms to producers and first responders (e.g. burns, toxic exposure, explosions) and to the environment (remediation and clean-up of toxic spills), amounted to US$61.4 million (Nicosia et al., 2009). This estimate excluded harms to children exposed to dangerous home environments, although costs of child endangerment were included elsewhere in the report (Nicosia et al., 2009).

The limited research available reports that methamphetamine laboratories are found in a variety of locations including warehouses, factories, homes or apartments, hotel rooms, cars, abandoned buildings, and rural and remote areas including state and national parks (Australian Crime Commission, 2014; Cohen et al., 2007; US Department of Justice, 2011). They range from large scale industrial to small, user initiated laboratories. The majority of methamphetamine laboratories in the US (US Department of Justice, 2011) and in Australia (Australian Crime Commission, 2014) are small scale. These are colloquially referred to as “mom and pop” or “shake and bake” laboratories. Both large and small laboratories have risks, however, smaller laboratories are more likely to be portable, be temporary, be run by less skilled operators, have makeshift equipment and be more volatile (Shukla and Bartgis, 2008).

These factors can increase the risk to first responders and bystanders as the sites are not initially recognisable as methamphetamine laboratories. Also, their temporary nature tends to lead to discarding of equipment, which is frequently (91% of detections in Oklahoma in 2001 and 2002) handmade and improvised (Shukla and Bartgis, 2008). In the US, nearly 10,000 clandestine laboratory sites or dumps were recorded in 2014 (Drug Enforcement Agency, 2015; United Nations Office on Drugs and Crime, 2014a, 2015). In Australia, 744 were reported, although only 608 were confirmed as methamphetamine-related, with “unknown” (n=92) the next largest category (Australian Crime Commission, 2014). Most detections were small, consumer-based laboratories (51.6%: <50 g per cycle) or other small laboratories (26.0%: <500 g per cycle) with few medium (12.3%: 0.5-50 kg) or industrial facilities (10.1%: >50 kg) (Australian Crime Commission, 2014).

The production of methamphetamine involves the use of many potentially hazardous chemicals including metal/salt reagents (e.g. red phosphorus, sodium cyanide), solvents (e.g. acetone, benzene) acid-base reagents (e.g. hydrochloric acid, ammonia), precursors (e.g. acetaldehyde, ephedrine) plus by-products or contaminants (e.g. mercury, lead oxide) (Irvine and Chin, 1991). The production of each kilogram of methamphetamine produces 5-7 times the weight of waste product, which is often discharged into domestic drains, burnt, buried or dumped in the environment (White, 2004). In Australia, most laboratories are detected in residential areas (67.8 %) (Australian Crime Commission, 2014) thereby increasing the potential for harms to other people. The ability of the chemicals and by-products to remain on hard surfaces, and seep into soft furnishings, walls and even through wooden floors, places neighbours and future residents at risk should proper remediation not occur (Al-Obaidi and Fletcher, 2014).

There are also direct and indirect harms and costs from the presence of clandestine laboratories in rural and public areas (Cohen et al., 2007). Adverse impacts include:

- Environmental consequences including direct contamination of soils and water with existing evidence of animal and fish deaths;
- Explosions and forest fires (in the US 15% of laboratories were detected following a fire or an explosion);
- Threats to people include health impact to farmers, parks and recreational workers or tourists who unknowingly encounter the lab or its contaminants, and threats/actual violence from encountering those running the methamphetamine laboratories; and,
- Threats to the economy include farmland/parks made unusable from contaminants, or decreased visitation to areas due to fear of violence or contaminants.

The European Monitoring Centre for Drugs and Drug Addiction reports that it is probable millions of tonnes of hazardous waste from drug production are released into the environment every year. It is further calculated that the 6.7 tonnes of amphetamine seized in the EU in 2013 generated an estimated 134 to 201 tonnes of toxic waste [23], with much of the waste being disposed of down drains or dumped in fields or forests (European Monitoring Centre for Drugs and Drug Addiction and Europol, 2016). Reportedly, 157 dump sites were located in the Netherlands alone, averaging 800kg per site.

In summary, there are a range of health and public health risks related to the production of methamphetamine. It is not possible to quantify all the harms discussed above. The remainder of this Chapter will describe the attempt to attach a value to the clean-up costs only for detected methamphetamine laboratories in Australia, thus resulting in a significant under valuation of costs. We also estimate costs associated with burn injuries from laboratory accidents, as these would be unlikely to be captured in the approach used in Chapter 5 for other hospital admissions.

9.2 Remediation Guidelines and Site Remediation Costs

The costs are estimated by examining the procedures and costing the time to implement them and other associated costs. The Australian guidelines for drug laboratory remediation lays out four phases:

1. Trigger for assessment;
2. Preliminary assessment and action;
3. Site assessment and remediation; and,
4. Validation (Australian Government, 2011).

The trigger for assessment is often the police detection of a laboratory, although not necessarily as laboratory sites may be found in rental property/hotel rooms once the property has been vacated. There are also risks to a diverse range of professions or occupations, particularly those entering houses (e.g. nursing staff, building inspectors, tradespeople, cleaners) (Worksafe New Zealand, 2015).

[23] In Europe, the Leuckart synthesis method is widely used, which produces 20-30kg of waste per 1kg of product (European Monitoring Centre for Drugs and Drug Addiction and Europol, 2016)

Alternatively, the clandestine laboratory may be detected by firefighters post explosion or fire. The police and other relevant agencies are usually responsible for the removal of equipment, and other materials used in the production process.

Once this removal occurs, the responsibility is passed to the relevant local authority with an Environmental Health Officer (EHO) ensuring the site is secure, communicating with the owner of the property and ensuring satisfactory remediation occurs. The property owner is responsible for the remediation of the property, which may extend from simple cleaning through to complete demolition of the property if the damage is extensive.

Assessment, which includes swabbing of surfaces and testing, should occur prior to cleaning to identify potentially harmful substances and to establish the best way for their removal. Once the results are obtained, cleaning occurs (if dangerous substances are detected, hopefully by a certified cleaning agency). Following cleaning, the site is reassessed, swabbed and if considered remediated, the EHO would be able to sign off and remove any restrictions on entering/using the property.

Imposing a number of assumptions and based on data collected from several personal communications (Environmental Health assessors, and trainers and certifiers), some of the costs of remediation, from the point when the property was handed to the EHO, were estimated.

The number of relevant (e.g. identified as amphetamine-type stimulants but excluding MDMA) clandestine laboratories were sourced from the 2013/14 Illicit Drug Data Report (IDDR) (n=608) (Australian Crime Commission, 2015). The primary methods of production were hypophosphorous (n=284; 50.7% were in Queensland) and Nazi/Birch (n=95; 88.4% were in WA) with other methods including red phosphorous and phenyl-2-propanone (P2P). The red phosphorus and hypophosphorous acid methods generally create a greater level of contamination as they require boiling of the mixture, which releases vapour into the environment (Salocks, 2009).

Table 9.1: Sources and estimating unit costs

Variable	Method	Source	Average cost
EHO office time	10 hours for less complicated cases, hourly wage $36 plus 28% on-costs and 35% for overheads. Differential costs for medium and large laboratories were generated by using the same ratio as for cleaning costs, for each relative to the cleaning costs for the small labs	Vic EHO email personal communication	Small $587 Medium $2,201 Large $11,736
Assessment/ swabbing/testing/ organising cleaning	Provided with a range ($3500 to $6500). The minimum level was used for the small labs, the maximum for the large and the mid-point for medium scale labs	Personal conversation with manager of company who undertakes such activities; includes travel costs as there are few companies certified to do this in Australia	Small $3,500 Medium $5,000 Large $6,500
Clean-up	Applied numbers as provided for small job and the mid-point for the other two. Small job: Approximately $2000; Medium job: $5,000-$10,000; Large job: $20,000 to $60,000	Personal communication via email/phone with manager of a company who trains certifiers and cleaners	Small $2,000 Medium: $7,500 Large: from $40,000
Re-swabbing and test and certify	Provided with a range ($3500 to $6500). The minimum level was used for the small labs, the maximum for the large and the mid-point for medium scale labs	Personal conversation with manager of company who undertakes such activities; includes travel costs as there are few companies certified to do this in Australia	Small $3,500 Medium $5,000 Large $6,500

Table 9.2: Table of costs

Number of clandestine laboratories detected	User-based	Other small	Medium	Industrial scale
%	51.6	26.0	12.3	10.1
N=608	314	158	75	61
Types of costs				
Environmental clean up		*Not Available*		
Council costs	587	587	2,201	11,736
Assessing/swabbing/testing (first)	3,500	3,500	5,000	6,500
Clean-up	2,000	2,000	7,500	40,000
Swabbing/testing/certifying (on completion)	3,500	3,500	5,000	6,500
Demolition/remediation		*Not Available*		
Sum of unit costs per site	9,587	9,587	19,701	64,736
Total	**$3,007,648**	**$1,515,481**	**$1,437,348**	**$3,975,308**
Grand total				**$9,935,786**

Note: Police, emergency services, general health (hospital/ED) and child engagement costs are addressed elsewhere in the report

9.2.1 Western Australian data

Data provided by the Western Australian Environmental Health Directorate were used to substantiate the detailed estimate of the costs of the clandestine laboratory management system presented above. In WA, in 2013/14, 66 notifications occurred – notably fewer than the 92 reported by police (Australian Crime Commission, 2015) – of which only 55 were for methamphetamine production. The Nazi/Birch method predominates in WA, with 98% of detected laboratories using this method, and 90% being classified as small scale (<50g). The Directorate estimated fixed costs of $20,000 for the notification system plus $18,000 for managing databases, providing specialist advice and guidance material plus $1,000 for public information and intelligence collection (total $39,000).

A contractor in WA also provided estimates of the costs of assessment and clean-up (excluding travel costs). A site assessment ($300) typically requires 10 swabs (@$130/swab) plus 10 validation samples after completion (@$130/swab). Remediation of hard and soft surfaces typically costs $5,000. In 2013/14, 45 laboratories required clean-up at an estimated cost of $355,500 (($300 + $2,600 + $5,000) x 45). The total for WA for fixed costs and clean-up is thus $394,500.

If the WA figures are applied to national data, of 608 sites reported by police (45/92) 48.9%, or 297 sites, would be assessed and professionally remediated. Using the WA costs [$300 + $2,600 +$5,000 + (39,000/55)] x 297 = $2,556,900.

It should be noted that in WA 90% of detected laboratories were small scale compared with 51% in the national data. Therefore, this is likely to be at the lower limit of costs, with heavily contaminated or damaged sites costing $50,000 or more. In the target year, six laboratories in WA were identified following fires or explosions. Furthermore, even though only 66 sites were notified to the Environmental Health Directorate, we cannot assume there were no costs for the remaining sites. Additionally, the estimates provided for site assessment, initial and follow-up testing do not include travel costs to the laboratories, which will often be located in rural or remote locations (also see Section 11.8).

Based on the likely underestimates, the preponderance of smaller labs in WA, and the prevalence of the hypophosphorous method outside WA that is considered to cause more contamination (Salocks, 2009), we have decided to use the higher estimate of $**9.9 million.**

9.3 Estimating Injury Costs

In the US, the cost of injuries and deaths arising from clandestine methamphetamine production exceeds the cost of cleaning up sites, at US$32.22 million compared with US$29.16 million (Nicosia et al., 2009). In the US, the identification of relevant harms was facilitated by the Hazardous Substance Emergency Events Surveillance system and the Toxic Substance and Disease Registry, which was operating in 15 States in 2005. These two systems allowed methamphetamine-related events and sites to be identified (Nicosia et al., 2009). Nationally it was estimated there were seven deaths and 261 injuries. Notably most injuries were incurred by first responder (51%), although the most severe injuries were sustained by bystanders or those involved in production (Nicosia et al., 2009).

Without a registry of events in Australia, determining the number of deaths and injuries related to clandestine production is likely to be problematic. A review of cases at a specialist burns service in Western Australia identified nine cases (10 presentations) for the period November 2009 to October 2010 (O'Neill et al., 2011). In that year, 112 clandestine ATS laboratories were identified by police in WA out of a national total of 585 (19.1%) compared with 92 out of 608 (15.1%) in 2013/14 (Australian Crime Commission, 2011, 2015). The 10 presentations varied in acuity and length of stay, although two cases discharged themselves against medical advice and five were discharged early due to behavioural issues or threats to staff (O'Neill et al., 2011). As the chart review was conducted at a specialist burns unit, the cases presenting may represent the most serious cases.

Using the data from the paper (description, length of stay, details such as whether surgery was performed and whether they required a stay in intensive care), we assigned each person a diagnosis related groups case weight and then estimated the costs (Independent Hospital Pricing Authority, 2016) – the total cost was $326,984. If an average cost weight for all burns was used, the cost was $121,694. The higher initial cost reflects the fact that two cases required intensive care, and four required hospital stays of two weeks or more.

If these costs are extrapolated to the national level, and assume the rate of explosions and burns are constant nationally, this equates to **$1,775,056** ($326,984 * 608)/112).

We were unable to identify any harms to emergency service personnel attending clandestine laboratories with all the burns cases in WA being for suspected laboratory “cooks”.

Table 9.3: Summary Chapter 9 costs

Cost area	Central estimate	Low bound	High bound
Remediation/clean-up	$9,935,786	[a] $2,556,900	[c]
Burns	$1,775,056	[b]	[c]
Environmental costs	Unknown	Unknown	Unknown
Total	**$11,710,842**	4,331,956	11,710,842

[a] See section 9.2.1; [b] Low bound estimate – duplicated central estimate; [c] High bound estimate – duplicated central estimate

9.4 Limitations and Recommendations for Further Research

The costs presented in this Chapter cover only a limited range of costs arising from methamphetamine production, namely those of remediation/clean-up and burns. The lack of State-based or an overall national surveillance system corresponding to that used in the US, means that identification of personal injuries to first responders and others is highly problematic. As deaths and injuries accounted for the majority of costs arising from clandestine manufacture in the US, the figures reported here will greatly underestimate the true cost for Australia. We were also not able to identify harms to children associated with clandestine laboratories, although it is well recognised that children living in homes where methamphetamine is manufactured are at risk of exposure to methamphetamine, their precursor chemicals, and fires.

Further, we have not captured the full costs of contamination. Given evidence from Europe and the US, it is highly likely there has been soil and water contamination that has either not been identified, not been remediated, or we have not been able to ascertain these costs. Further, the costs are provided as a total cost, as it is not clear who has paid for the remuneration. It may be a private property owner or it may be the council/state as they own the property or failure of the land owner complying with remediation orders.

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CHAPTER 10A: ROAD CRASH COSTS

Steve Whetton

10.1 Road Crashes

Driving under the influence of any of a number of intoxicating substances can increase the rates at which transport crashes occur. The increase in risk arises from impairment to the cognitive and psychomotor skills necessary to drive safely including reductions in attentiveness, poor judgement and/or increased impulsiveness, reduced lane control, increased reaction times, and other impairments to fine and gross motor skills (Drummer et al., 2003b; Verstraete and Legrand, 2014). Evidence from crash studies suggests that alcohol and cannabis are the substances that cause the greatest number of road crash fatalities and hospitalisations, due to their greater population consumption prevalence and also to the nature of their effect on cognitive and psychomotor skills (Ch'ng et al., 2007; Drummer et al., 2003a; Verstraete and Legrand, 2014).

The impact of methamphetamine on driving performance is believed to vary substantially with dose. At very low doses (10-30mg), the stimulant properties of methamphetamine may reduce the effects of fatigue but even low doses of methamphetamine may impair other aspects of driving performance, for example, through impaired judgement. At higher doses, the negative impacts of methamphetamine predominate, with methamphetamine users exhibiting poor driving performance such as incorrect signalling, poor lane control, reduced following distances to other vehicles, increased rates of speeding, failing to stop at a red traffic light and slow reaction times (Verstraete and Legrand, 2014).

The tangible and intangible costs of premature mortality due to methamphetamine attributable transport accidents are included in the broader estimates of premature mortality costs (see Chapter 6). For the other forms of harm it is first necessary to quantify their overall frequency, then identify the proportion that can be attributed to methamphetamine, and finally to identify a unit cost for that form of harm.

10.1.1 2006 Road crash frequency

Road crashes can be a difficult area to quantify, as lower severity crashes do not have to be reported to police and so are generally underreported. There are also differences in how transport crashes are classified between different jurisdictions; even for serious accidents 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 last 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 2006 (2009). BITRE estimated the total number of crashes in the reference year by applying estimates of the proportion of unreported crashed by severity to data provided by state and territory governments on the number of reported road crashes.

BITRE estimated there were 653,000 road crashes in 2006 involving 1.15 million vehicles. There were 1,602 deaths as a result of road crashes in 2006, with a further 31,204 persons admitted to hospital (2009).

Table 10.1: Estimated number of road crashes resulting in injury by severity of injury, 2006

Severity category	Number of crashes	No. of persons injured by severity	No. of vehicles involved
Fatalities	1,455	1,602	1,886
Hospitalised	25,498	31,204	
Not hospitalised injury	188,200	216,500	428,643
Property damage only crashes	438,700		715,862
Total	**653,853**	**249,306**	**1,160,794**

Source: (Bureau of Infrastructure Transport and Regional Economics, 2009), pp. 10, 13, 14

Data on the number of fatal road crashes in 2013/14 were taken from the national road fatalities database (Bureau of Infrastructure Transport and Regional Economics, 2016). Data on hospital separations attributable to road crashes were sourced from an analysis of the AIHW hospital morbidity database (Shanahan, 2016, personal communication). As 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 non-hospitalised injury accidents have increased by 12.2%, the same rate as land transport accident hospital separations over the period, which increased from 52,283 in 2005/06 (Pointer, 2015) to 58,697 in 2013/14 (Shanahan, 2016, personal communication), a rate of increase that roughly reflects the increase in population over this period [24].

Table 10.2: Estimated road crash frequency by severity, 2013/14

Severity category	Injuries by severity
Fatalities [a]	1,156
Hospitalised injuries [a]	44,656
Not hospitalised injuries [a]	243,060
Non-injury crashes [b]	492,519

Note: [a] Number of persons injured/killed; [b] Number of crashes

Sources: (Bureau of Infrastructure Transport and Regional Economics, 2009, 2016) pp. 10, 13, 14; (Bureau of Infrastructure Transport and Regional Economics, 2009, 2016); Shanahan, 2016, personal communication

10.1.2 Methamphetamine attribution

Attribution of transport crash harms to methamphetamine ideally requires an estimate of the relative risk of an accident when the driver is intoxicated by methamphetamine and the prevalence of methamphetamine intoxication amongst drivers. Unfortunately, data on the extent and frequency of intoxication amongst drivers is limited and of generally poor quality (for example the proportion of positive drug tests in roadside drug tests by police are unlikely to be representative of the overall population of drivers as they are generally targeted at times of the day and areas in which it is thought drug driving is more likely to occur; in many cases procedures have historically not routinely tested for

[24] The alternative approach would have been to scale them up using the ratio of road crash hospital separations in 2013/14 to those in 2005/06, an increase of 43%. It is not clear why road crash hospital separations increased at a significantly faster rate than land transport hospital separations as a whole (road crash hospital separations make up 76% of land transport hospital separations), and as differences in coding strategy (based on ICD-10 codes that identify separations relating to road crashes and non-road crashes) between our analysis of hospital separations and that undertaken by BITRE (Bureau of Infrastructure Transport and Regional Economics, 2009) cannot be excluded, the more conservative approach has been taken.

drugs if a positive alcohol test is returned). Prevalence studies often ask respondents whether they have ever driven under the influence of intoxicating substances, but do not typically report on the frequency of this behaviour.

Methamphetamine intoxication appears to be a common feature in serious road traffic accidents, for example, Drummer et al. in a study that examined 3,398 road crash fatalities in Victoria, New South Wales and Western Australia over the period 1990 to 1999 (Drummer et al., 2003b) found that 4.1% of drivers in road crash fatalities tested positive to amphetamine type stimulants. Ch'ng and colleagues, who undertook analysis of a random sample of blood tests from drivers involved in serious injury crashes who presented at the emergency department of the Alfred Hospital in Melbourne, similarly found 4.1% of injured drivers tested positive to methamphetamine (Ch'ng et al., 2007) although it is not possible to establish the role of methamphetamine in the accidents.

One approach to establishing the degree to which road crashes can be attributed to methamphetamine is to calculate the extent to which there are "excess" rates of being at fault for the accident amongst those drivers involved in the crash who tested positive for methamphetamine. This is the approach taken by Drummer et al. (2003a), who found those who tested positive for drugs or alcohol were at fault in 88% of fatal accidents, whereas those drivers in whom no substances were detected were at fault in 71% of accidents. Specifically for methamphetamine, Drummer et al found the odds ratio of being involved in a crash was 2.27 for drivers of all vehicles and 8.83 for drivers of heavy vehicles (e.g. buses and trucks) (Drummer et al., 2003b). The attribution for drivers of all vehicles marginally failed to meet the standard criteria for statistical significance with a 95% confidence interval of 0.9 to 5.6 (most likely because the sample of methamphetamine users in the analysis was quite small as those with any other substance detected were excluded and the sample was split into three to analyse different periods of the sample frame individually). To convert the odds ratio to a relative risk (which is needed to calculate an attributable fraction), we used the approach outlined by Grant (2014), with 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;

p_0 = the baseline risk.

Applying this formula to the odds ratios from Drummer, using a baseline risk of $1.67e^{-3}$, gives relative risks of 2.27 for light vehicles and 8.72 for heavy vehicles (2003a). However, there is also a second limitation of this approach in that the calculation of the odds ratios relies on the assumption that those intoxicated by methamphetamine were no more likely to be ***involved*** in a road crash than the broader population, just more likely to be ***at fault***.

Use of attributable fractions derived from Drummer et al. represents a plausible approach to establishing a methamphetamine attributable share of road crashes. There are two possible sources of the prevalence of driving whilst influenced by methamphetamine obtained through population surveys: the National Drug Strategy Household Survey (NDSHS) and a survey undertaken by the Australian Drug Foundation (Mallick et al., 2007). In the NDSHS, 13.1% of regular methamphetamine users reported having driven under the influence of methamphetamine in the past year, as did 4.7%

of occasional methamphetamine users, giving an overall prevalence of 0.36% of Australian drivers. Mallick et al. found much higher rates of drug driving amongst methamphetamine users, with 52.7% of methamphetamine users reporting having driven whilst under the influence of methamphetamine; this rate would give population prevalence estimate for all Australian drivers of 2.08% (Mallick et al., 2007). These prevalence estimates, combined with the relative risks calculated from Drummer et al. (2003a), give attributable fractions of 0.45% and 2.57% respectively.

The second approach to allocating a share of road crash costs to methamphetamine is to use the share of total road crash fatalities that have been attributed to methamphetamine based on the NCIS data. This relies on two assumptions: attribution of methamphetamine as a cause of death by the forensic pathologist was appropriate; and, the proportion of injury accidents attributable to methamphetamine will match the proportion of road crash fatalities. It is also subject to the broader limitation of analysis of the NCIS data that only "closed" cases are included in the data made available to researchers. At the time mortality data were extracted for this report, 18% of the 2013 NCIS cases and 33% of the 2014 cases remained open. As such, the number of methamphetamine attributable road crash deaths may be underestimated by the current analysis of the NCIS data.

A total of 21.5 cases of road crash deaths were attributed to methamphetamine in our analysis of the NCIS data. Total road crash fatalities over 2013/14 were 1,156 (Bureau of Infrastructure Transport and Regional Economics, 2016), so methamphetamine attributable deaths were 1.86% of the total.

As it is internally consistent with estimates used in other sections of the report, we used the proportion of methamphetamine attribution (1.86%) based on the share of fatalities in the NCIS data as our central estimate of methamphetamine attribution. The estimate derived from Drummer et al.'s odds ratio (2003a) and the NDSHS estimate of the prevalence of drug driving was used as a lower bound (0.45%), and that derived from Drummer et al.'s (2003a) odds ratio and the Mallick et al. (2007) estimate of the prevalence of drug driving was used as an upper bound (2.57%).

In each case, the available evidence for methamphetamine attribution arises from the highest severity accidents, those resulting in a fatality or an injury resulting in hospitalisation. There is no reason to believe the causal factors resulting in non-injury accidents are the same as those that result in high severity accidents. As such, the confidence with which methamphetamine attributable fractions can be applied is lower. For this reason we have not included the costs of any non-injury crashes in the central estimate of costs, but have included them in the upper bound estimate.

10.2 Costs of Road Crash Accidents

There are 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 methamphetamine attributable transport accidents are included in the broader estimates of premature mortality costs (see Chapter 6) and so are not assessed in this Chapter.

10.2.1 Estimated cost of hospital separations due to methamphetamine attributable crashes

The International Classification of Diseases, 10th revision (ICD-10-CM) (World Health Organization, 1992) was used to identify hospital separations caused by land transport crashes, with all separations with codes from V01 to V79 extracted from the database. Those sub-codes relating to non-road crash injuries were then excluded. Each hospital record also has the relevant Australian Refined Diagnosis Related Group (AR-DRG) code. DRG grouper software utilises each patient's diagnoses, age, gender, and other relevant information to allocate the relevant DRG, for which there are DRG case weights which, in turn, are used to estimate the cost per case. A total of 44,656 hospital separations due to road crashes were identified in the 2013/14 data. The average cost of these separations was $8,511, giving a total cost of hospital separations resulting from road crashes of $380.1 million.

Applying the average methamphetamine attributable fractions for road crashes gives a central estimate of methamphetamine attributable hospital separation costs of **$7.1 million** [25], with a lower bound of $1.7 million and an upper bound of $9.8 million.

10.2.2 Other costs of hospitalised road crash injuries due to methamphetamine attributable crashes

There are two broad approaches that could be taken to the other costs of road crashes severe enough to result in a hospital separation: calculating the costs of each specific form of harm individually (e.g. outpatient medical care, lost lifetime output in the workplace, lifetime value of lost household labour, modifications to dwellings and vehicles to adjust for impairment, long-term care costs over the lifetime); or, use compensation payments for these injuries, where such long-term costs should be "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. consistent valuation of workplace and household labour, of QALYs) and as such has much to recommend it. However, using the value of compensation payments has the advantage of avoiding uncertainty of the expected years of life remaining after a road crash resulting in a severe impairment as well as giving a cost that is incurred entirely in the study year, although it excludes some important costs such as costs to employers of replacing injured staff and property damage. Therefore, although the former approach is widely used, to allow comparison with costs from other domains estimated in this report, the central estimate is based on costs incurred in the study year, with the cost of property damage, insurance administration and legal costs estimated separately.

The Transport Accident Commission (the Victorian provider of third party injury insurance) paid out $1,045 million in compensation in 2013/14 (Transport Accident Commission, 2014). Victoria accounted for 26% of road crashes in 2006 (Bureau of Infrastructure Transport and Regional Economics, 2009), which implies national costs of $3,964 million.

Applying our estimate of the proportion of road crashes attributable to methamphetamine (see Section 10.1.2) gives a central estimate of costs of **$73.7 million** [26], with a lower bound of $18.0 million and an upper bound of $101.8 million.

The Bureau of Infrastructure, Transport and Regional Economics (2009) estimates road crash injuries created workplace disruption costs (including temporary replacement costs for temporarily impaired

[25] $380,100,100 * 0.0186 = $7.1 million
[26] $3,964,000,000 * 0.0186 = $ 73.7 million

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 2013/14 values using the CPI (Australian Bureau of Statistics, 2016c), and factoring it up to reflect the increase in vehicle crash hospitalisations over that period (M. Shanahan, personal communication) gives an estimate of $104.4 million.

Our central estimate of the workplace disruption costs that can be attributed to road crashes caused by methamphetamine is **$1.9 million**, with a lower bound estimate of $0.5 million and an upper bound of $2.7 million.

10.2.3 Costs of road crash property damage

The total cost of property damage from road crashes resulting in injury in 2006 was estimated as $1,357.0 million (Bureau of Infrastructure Transport and Regional Economics, 2009). Converting this to 2013/14 values using the CPI (Australian Bureau of Statistics, 2016c) gives an estimate of $1,624 million. The average cost of a road crash not resulting in injury in 2006 was $9,950 (Bureau of Infrastructure Transport and Regional Economics, 2009). Converting this to 2013/14 values using the CPI (Australian Bureau of Statistics, 2016c) and multiplying it by the estimated number of non-injury crashes in 2013/14 (see Table 10.2) gives an estimated total cost of $5,864.7 million.

Applying our estimates (1.86%) of the proportion of road crashes attributable to methamphetamine gives a central estimate of property damage costs for accidents resulting in an injury of **$30.2 million**, with a lower bound of $7.4 million and an upper bound of $41.7 million.

Applying the estimated methamphetamine attribution to the costs of property damage only accidents gives a central estimate of $109.1 million with a lower bound of $26.6 million and an upper bound of $150.6 million. As discussed above, the uncertainty regarding whether the methamphetamine attributable road crash shares are applicable to property damage only crashes mean that these costs have not been included in our central estimate of costs. We have, however, included the central estimate of property damage only costs in our upper bound estimate.

10.2.4 Costs of legal fees and insurance administration from road crashes

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 (2009). Combining these two cost items, converting them to 2013/14 values using the change in the CPI from June 2006 to June 2014 (Australian Bureau of Statistics, 2016c), and adjusting them up to reflect the change in accident frequency, gives an estimated total cost of $656.7 million, **$12.2 million** of which is attributable to methamphetamine under our central estimate of the attributable fraction, with a lower bound estimate of $3.0 million and an upper bound of $16.9 million.

Table 10.3: Summary of chapter 10A costs

Domain	Central estimate	Low bound	High bound
Road crash hospital separations	7,068,995	1,721,696	9,763,232
Compensation payments for road crash injuries	73,734,592	17,958,495	101,837,375
Workplace disruption costs due to road crashes	1,941,588	472,885	2,681,593
Property damage caused by road crashes resulting in injury	30,203,719	7,356,294	41,715,393
Property damage caused by non-injury road crashes [a]	-	-	109,075,371
Legal fees and insurance administration related to road crashes	12,213,511	2,974,673	16,868,499
Total road crash costs	**125,162,405**	**30,484,043**	**281,941,464**

[a] Only included in high bound estimate due to uncertainty concerning AF

Limitations and recommendations for Chapter 10A are included with those for Chapter 10B (see 10.6 and 10.7).

CHAPTER 10B: WORKPLACE COSTS

Ken Pidd, Ann Roche, Victoria Kostadinov, Vinita Duraisingam & Steve Whetton

As the majority of Australians who have used methamphetamine at least once in the previous 12 months are employed (Pidd, 2015), methamphetamine use has implications for workplace safety and productivity (Pidd and Roche, 2015a). However, there is a paucity of research concerning workplace safety and productivity costs associated with methamphetamine use. The few studies that do examine this issue indicate that methamphetamine use may have cost implications for workplaces.

A recent U.S. study (Ramirez et al., 2013) of toxicology test results of occupational fatalities in Iowa between 2005 and 2009 reported amphetamine-type stimulants (ATS) were detected in eight out of 85 (9.4%) cases. Similarly, Li et al. examined the results of more than 1,000,000 U.S. post-accident workplace drug tests over a 10-year period (1995-2005) and reported that 1.2% were positive for illicit drugs, with 6% of these testing positive to amphetamine (Li et al., 2011).

Australian research also indicates that workplaces may bear financial costs associated with methamphetamine use. McNeilly and colleagues reported ATS were detected in 2% (8 out of 355) of Victorian work-related fatalities that occurred between 2001 and 2006 (McNeilly et al., 2010). In a secondary analysis of National Drug Strategy Household Survey data, Pidd et al., reported that methamphetamine was one of the most commonly used illicit drugs at work, second only to the non-prescribed use of painkillers/analgesics (Pidd et al., 2011). Similarly Roche, Pidd, Bywood, et al. found methamphetamine users were more likely to be absent from work or attend work under the influence of drugs compared to users of other illicit drugs (Roche et al., 2008b).

10.3 Occupational Injury

To estimate the cost of methamphetamine attributable occupational injuries, a similar methodological approach to that adopted for transport accidents was undertaken. First, the overall extent and costs of occupational injuries were quantified and adjusted for harms addressed in other sections of this document (i.e., premature mortality and transport accidents). The proportion of occupational injuries and associated costs that can be attributed to methamphetamine was then identified.

10.3.1 Number of injuries

As with transport accidents, occupational injuries can be difficult to quantify. In general, national data for occupational injuries are only collated on an annual basis for serious (≥5 days off work) compensable injuries. Low severity, non-compensable injuries tend to be underreported. The most recent available estimates of compensable, non-compensable and less serious occupational injuries indicated that in 2012/13 there were 374,500 occupational injuries, costing approximately $28,200 million (Safe Work Australia, 2015). Data to inform these estimates were obtained from the National Dataset for Compensation-based Statistics (NDS) and the Australian Bureau of Statistics Work-Related Injuries Survey (WRIS). Only injuries that resulted in an absence from work were included in these estimates. A breakdown by injury severity and compensation status is presented in Table 10.4.

Table 10.4: Compensable and non-compensable occupational injuries by severity 2012/13

		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**

[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
Source: (Safe Work Australia, 2015)

It is important to note that the methodology used to determine these estimates was based on an incidence approach (Safe Work Australia, 2015), rather than the prevalence approach adopted in other sections of this document. The incidence approach adopted by Safe Work 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 cost of new cases over the lifetime of a case was used to represent the cost in the reference year of cases that were already in the compensation system at the start of the current reference year (Safe Work Australia, 2015). It is important to note that given the nature of the available data, it is not possible to identify the extent to which methamphetamine attributable workplace injuries occurred to the methamphetamine user themselves, or to others. As such, it is very likely these estimates include some private costs to methamphetamine users themselves.

10.3.2 Occupational injury costs

The cost estimation methodology utilised by Safe Work Australia (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.

Applying these costs to the total number of compensable and non-compensable occupational injuries for 2012/13 resulted in a total estimated cost of $28,230 million (Table 10.5).

Table 10.5: Total costs ($ million) of occupational injuries by severity 2012/13

	Short absence [a]	Long absence [b]	Partial incapacity [c]	Full incapacity [d]	Fatality	Total
Total cost ($ million)	960	4,340	19,250	2,800	880	28,230

[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

Source: (Safe Work Australia, 2015).

The methamphetamine attributable cost of premature mortality is addressed in Chapter 6, while the methamphetamine attributable cost of transport accidents is accounted in sections 10.1 and 10.2. To determine the methamphetamine attributable costs of non-fatal and non-transport occupational injuries, data in Table 10.7 were adjusted by removing the costs of fatalities and transport accidents. The total cost of workplace fatalities for 2012/13 was $880 million (Table 10.5) while transport accidents accounted for 3.9% (n=700) of serious compensable occupational injuries in 2012/13 (Safe Work Australia, 2014). Assuming a similar proportion of lower severity and non-compensable transport related occupational injuries, the adjusted cost is $26,284 million (Table 10.6).

Table 10.6: Total costs ($ million) of non-fatal and non-transport occupational injuries by severity 2012/13

	Short absence [a]	Long absence [c]	Partial incapacity [d]	Full incapacity [d]	Total
Total cost ($ million)	923	4,171	18,499	2,691	26,284

[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

Sources: (Safe Work Australia, 2014, 2015)

Safe Work Australia's estimate (2015) 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 10.7).

Table 10.7: Total costs of non-fatal and non-transport occupational injuries borne by employers, employees and the wider community 2012/13

	Cost (%)	Total cost ($ millions)
Employer	6	1,577
Employee	69	18,136
Community	25	6,571
Total	**100**	**26,284**

Source: (Safe Work Australia, 2015)

To determine methamphetamine attributable non-fatal and non-transport occupational injuries, the relative risk of an occupational injury when employees are affected by methamphetamine and the prevalence of methamphetamine affected workers needed to be estimated.

In a case control study of more than 1,000,000 post accident workplace drug tests, Li et al. (2011) reported an odds ratio of 3.4 for an occupational injury among employees who tested positive for drug use. To calculate the attributable fraction for methamphetamine, this odds ratio needs to be converted to a relative risk. Grant (2014) provides the approach to this, with 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;

p_0 = the baseline risk.

Applying this formula to the odds ratios from Li and colleagues, using a baseline risk of 0.032480486 (based on 374,500 occupational injuries among a total workforce 11,530,000 in 2012/13) gives a relative risk of 3.154 (Li et al., 2011).

Data collected by Safework Laboratories Australia indicated a national positivity rate of 2.9% for opioids, 1.7% for cannabis, 1.6% for ATS, and 0.8% for benzodiazepines from a sample of 98,599 random workplace drug tests conducted in 2015 (A. Leibie, Safework Laboratories Australia, personal communication, 17th May 2016). Prior to 2015, reliable national data concerning workplace testing is unavailable (A. Leibie, Safework Laboratories Australia, personal communication, 17th May 2016).

Combining these data with the above relative risk calculation gives an aetiological fraction (AF) of 0.132654387 for all drugs detected and an AF of 0.029893946 for ATS. This results in a total ATS attributable cost associated with non-fatal and non-transport occupational injuries of $785.7 million. Of this total cost, $47.1 million is borne by employers, $196.5 million by the community, and $542.1 million by injured employees. Updating these 2012/13 costs to 2013/14 by CPI (3%) gives a total cost of **$809.3** million with **$48.6** million borne by employees, **$202.3** million by the community, and **$558.4** million by injured employees.

10.4 Workplace Absenteeism

In addition to occupational injuries, further costs can be incurred through absenteeism. Estimates of drug-related absenteeism in Australian workplaces have been limited to alcohol and the general category of illicit drug use (Pidd et al., 2006; Roche et al., 2008a; Roche et al., 2015b). To estimate the extent and cost of methamphetamine related workplace absenteeism, secondary analyses were conducted on 2013 National Drug Strategy Household Survey (NDSHS) data (Australian Institute of Health and Welfare, 2014a). Furthermore, patterns of drug use among the employed are likely to differ from the general population, so for these calculations we use an estimate specific to the employed (231,893) (Pidd and Roche, 2015b).

Logistic regression was conducted in the first instance to establish whether employees who use methamphetamine [27] are more likely to be absent from work than those who use other types of illicit drugs, but not methamphetamine. Only respondents who were employed and aged ≥ 14 years were included in the analyses. Two dichotomous self-reported measures of absenteeism were used:

- Whether respondents had missed at least one day of work, school, TAFE, or university in the past three months due to *their own use of drugs;* and,
- Whether respondents had missed at least one day of work, school, TAFE, or university in the past three months *due to injury or illness*.

Controlling for age and gender, workers who reported using methamphetamine at least once in the past year were statistically significantly more likely to have been absent due to their drug use than those who used other illicit drugs (Table 10.8). However, methamphetamine use did not significantly predict absence due to injury/illness (Table 10.9) (Roche et al., 2015a).

Table 10.8: Methamphetamine user odds ratios for absenteeism due to drug use 2013

	P	OR	95% CI	
			Lower	**Upper**
Methamphetamine use *(Reference category: other illicit drug users)*	0.00	4.13	2.16	7.91
Sex: *(Reference category: males)*	0.57	1.20	0.64	2.27
Age: *(Continuous)*	0.02	0.96	0.93	0.99

[27] Either exclusively or in combination with other drugs

Table 10.9: Methamphetamine user odds ratios for absenteeism due to illness or injury 2013

	P	OR	95% CI	
			Lower	Upper
Methamphetamine use *(Reference category: no illicit drug use)*	0.09	1.25	0.97	1.61
Sex: *(Reference category: males)*	0.00	1.26	1.16	1.37
Age: *(Continuous)*	0.00	0.98	0.98	0.99

The costs associated with methamphetamine users' absenteeism were then calculated. Two methods were used to accomplish this:

- The first method multiplied the number of days methamphetamine users reported missing work due to drug use in the past three months by four to obtain a seasonally unadjusted annual estimate. This number was then multiplied by $267.70 (one day's wage plus 20% employer on-costs, based on the average weekly income in 2013) (Australian Bureau of Statistics, 2014a); and,
- The second method similarly multiplied the mean number of days absent due to injury/illness in the past three months by four to also obtain a seasonally unadjusted annual estimate. The difference in mean number of days absent for those who used methamphetamine compared to those who did not use any illicit drugs, and those who used drugs other than methamphetamine, was then calculated. This figure was also multiplied by $267.70, as above. It should be noted that absenteeism due to alcohol use was asked separately.

Table 10.10: Rates of drug related absenteeism among methamphetamine users and associated costs

Method 1: Self-reported absence due to drug use				
Illicit drug Use	**Estimated population**	**% Absent due to drug use**	**Total days absent due to drug use**	**Cost ($) [a]**
None (abstainers)	8,278,476	-	-	-
Methamphetamine	231,893 [b]	29.1%	124,880	33,430,438
Other drugs	1,348,801	5.4%	616,120	164,935,439

[a] Number of days lost due to drug use multiplied by $267.70 (2013 average daily wage plus 20% employer on-costs); [b] estimated number in the workplace (Pidd and Roche, 2015b)

As shown in Table 10.10, methamphetamine users self-reported missing almost 125,000 days at work due to drug use per year, equating to an annual cost of over $33.4 million (Method 1). However, secondary analysis of 2013 NDSHS survey data, and other reports (McKetin et al., 2013a; Quinn et al., 2015) indicate methamphetamine users are likely to be poly-drug users. Table 10.11 details the proportions of current (i.e., used at least once in the past 12 months) methamphetamine users who also used other types of drugs at least once in the past 12 months (Australian Institute of Health and Welfare, 2014a).

Table 10.11: Proportions of current [a] methamphetamine users who used different drugs, for non-medical purposes, at least once in the past 12 months

Drug type	%	Drug type	%	Drug type	%
Cannabis	68.9	Painkillers	18.1	Ketamine	5.5
Ecstasy	55.0	Tranquillisers	13.7	Steroids	4.5
Cocaine	44.8	Inhalants	11.8	Methadone	2.3
Hallucinogens	22.8	New psycho actives	10.0	GBH	2.0
Synthetic cannabis	20.0	Opiates	8.3	Heroin	1.5

Source: (Australian Institute of Health and Welfare, 2014a)
[a] used methamphetamine at least once in the past 12 months

To account for drug related absenteeism due to the non-medical use of drugs detailed in Table 10.11, the total cost for methamphetamine was divided *by* 3.892 (the summed proportions of current methamphetamine users who also used other drugs). This resulted in an annual cost of methamphetamine attributable absenteeism of **$8.59 million**. This may well be a conservative estimate as it was obtained from a self-report measure of absenteeism that respondents self-attributed to drug use and was used as our low bound estimate.

Table 10.12: Rates of drug related absenteeism among methamphetamine users and associated costs

Method 2: Illness/injury absence attributable to drug use				
Illicit drug use	**Mean days absent due to illness/injury**	**Mean difference [a]**	**Excess absence [b]**	**Cost ($) [c]**
None (abstainers)	8.77	-	-	-
Methamphetamine	13.06	4.29	994,444	266,212,595
Other drugs	10.61	1.84	2,486,055	665,516,792

[a] Mean days absent due to illness/injury for drug users minus mean days absent for abstainers
[b] Difference in mean absence multiplied by estimated population
[c] Excess absence multiplied by $267.70 (2013 average daily wage plus 20% employer on-costs)

When excess illness/injury absenteeism attributable to methamphetamine use was calculated (Method 2), employees who used methamphetamine were absent for almost a million more days annually than those who did not report using drugs, equating to over $266 million (Table 10.12). After accounting for the costs of drug related absenteeism due to the use of other illicit drugs, the annual cost of methamphetamine attributable absenteeism due to illness or injury is **$68.40 million** [28]. This is likely to be an overestimate as the majority of methamphetamine users also report smoke tobacco and/or drink alcohol at risky levels (Roche et al., 2015a). Both these licit drugs have substantial negative implications for physical health and are unaccounted for in the estimate presented above. This figure was used as the high bound estimate, with the mid-point (**$38.50 million**) used as the central estimate.

The methamphetamine attributable costs of workplace absenteeism reported in Table 10.10 and 10.12 only reflect likely workplace costs directly associated with paid sick leave. There are also likely to be other indirect costs, such as the costs of finding and paying a replacement worker to backfill the absent employee's work role or the cost of lost productivity if a replacement worker cannot be sourced.

[28] $266,212,595 / 3.892 (Table 10.11) = $68.4 million

10.5 Other Workplace Costs

There is likely to be a range of additional methamphetamine attributable workplace costs that cannot be quantified due to lack of data. These include the following:

- *Presenteeism* can be defined as attending work despite suffering an illness or injury, resulting in lower productivity. As methamphetamine use can result in poor physical and mental health, tiredness, poor concentration and poor work performance, it is likely that methamphetamine use contributes to presenteeism. However, there are no available data concerning presenteeism in Australian workplaces;
- *Turnover* costs are incurred when employees who leave or are dismissed are replaced and include hiring, training, reduced productivity, and lost opportunity costs. Methamphetamine use is likely to contribute to these costs when an employee is dismissed for failing a workplace drug test as a result of their methamphetamine use, leaves when their use escalates to dependence and restricts their ability to work effectively, or is dismissed due to drug related poor performance. However, there are no reliable data concerning turnover costs in Australian workplaces;
- *Workplace drug testing* is a strategy increasingly undertaken in a number of Australian workplaces. Costs involved with workplace testing involve the purchase of testing services and lost production while employees undergo the testing process and, of course, legal and industrial relation costs incurred in the establishment of, and possible defence of, workplace testing procedures. Methamphetamine use substantially contributes to these costs with methamphetamine being the third most common illicit drug detected in workplace tests (A. Leibie, Safework Laboratories Australia, personal communication, 17th May 2016). Across the Australian workforce, the total costs of workplace drug testing are likely to be substantial. Nearly 7% of the Australian workforce reports that their workplace conducts drug tests (Pidd et al., 2015), with one of the larger workplace drug testing service providers undertaking nearly 100,000 tests in the 2015 calendar year (A. Leibie, Safework Laboratories Australia, personal communication, 17th May 2016). However, precise and accurate data concerning the extent and costs of workplace drug testing across the national Australian workforce are not available; and,
- *Employee wellbeing* costs are incurred when employee mental and physical health is affected by the behaviour of co-workers and traumatic workplace incidents. Employed methamphetamine users are more likely to have higher levels of psychological distress and more likely to have physically or verbally abused someone while affected than users of other illicit drugs (Roche et al., 2008b). Thus, methamphetamine use may contribute to counselling and/or Employee Assistance Program costs as well as safety and productivity costs associated with poor worker wellbeing in general.

It is important to note methamphetamine (and other drug) related workplace costs are unlikely to be evenly distributed across Australian workplaces. Previous Australian research indicates that the prevalence of methamphetamine (Roche et al., 2008b) and other illicit drug use (Pidd et al., 2008) varies substantially across different occupational and industry groups. For example, the hospitality, construction and transport industries have much higher prevalence of methamphetamine use (9.5%, 5.4% and 5.4% respectively) compared to other industries (Roche et al., 2008b). Methamphetamine attributable workplace costs are likely to be higher in these industries. The prevalence of methamphetamine use is also particularly high (12.6%) among employed males aged 18-29 years old (Roche et al., 2008b). As this is the age group most likely to be attending vocational training, methamphetamine use may also contribute to costs associated with training attrition. A recent study reported that the prevalence of methamphetamine use is higher in rural areas compared to metropolitan areas (Roche and McEntee, 2016). Hence, workplaces in rural settings may bear a disproportionate burden of methamphetamine attributable workplace costs.

Table 10.13: Summary Chapter 10B costs

Cost area	Central estimate ($000,000)	Low bound ($000,000)	High bound ($000,000)
Occupational injury	[a] 250.9	[c]	[d]
Absenteeism	[b] 38.50	8.59	68.40
Total	**289.4**	**259.5**	**319.3**

[a] $48.6 million employer costs + $202.3 million community costs ($558.4 employee costs listed as internalities); [b] mid-point of estimate range; [c] Low bound estimate – duplicated central estimate: [d] High bound estimate – duplicated central estimate

10.6 Limitations

10.6.1 Accidents

Methamphetamine is known to increase the prevalence of risk taking behaviour as well as to impair motor skills and judgement (Drummer et al., 2003b; Verstraete and Legrand, 2014). The impacts of this on road crashes and workplace accidents are explored in previous sections of this Chapter, 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. For example, 15 of the cases of premature mortality where methamphetamine was one of the causes of death identified from the NCIS data involved accidental injuries that were not road crashes. At present, whilst case studies have identified a role for methamphetamine in increasing risk, there are no reliable estimates of the extent to which methamphetamine contributes to excess rates of these forms of injury. As such they have not been included in our calculations.

10.6.2 Occupational injuries

Data concerning occupational injuries is limited with annual data largely restricted to serious (resulting in ≥5 days off) compensable injuries. For the purposes of our methamphetamine attributable occupational injury cost estimates, data concerning less serious compensable and non-compensable injuries were largely sourced from a self-report survey, which may not accurately reflect the extent and nature of occupational injuries. In addition, there are only limited data concerning the extent of workplace testing and the prevalence of positive tests by drug type. Data used in cost estimates could only be sourced from one large national workplace testing service provider (Safework Laboratories Australia) and methamphetamine positives were grouped with other amphetamine-type substances.

10.6.3 Absenteeism

Data used for our estimates of methamphetamine related workplace absenteeism were obtained from self-report measures of absenteeism due to illness or injury and absenteeism self-attributed to drug use. Thus, the data may not accurately reflect the extent of illness/injury absenteeism or drug related absenteeism. Also, a proportion of the absenteeism costs calculated may have been already accounted for in the methamphetamine occupational injury estimates if the survey respondent is reporting absenteeism due to an occupational injury.

10.6.4 Reduced participation in the workforce

There is strong evidence to suggest regular methamphetamine use, and particularly dependent use, is correlated with reduced participation in the workforce (Torok et al., 2008). For example, amongst the participants in Torok and colleagues' study, who were primary methamphetamine users, only 9% were in employment (2008). However, we are not aware of any recent Australian research that would allow the extent of the impact on employment to be quantified, either in terms of scale or in direction of causation. The latter is likely to be important, as at the moment it is not possible to identify the extent to which the observed low employment rates are as a result of those already out of the workforce being drawn to regular methamphetamine use, or whether regular methamphetamine use has led to exit from employment. As such, these costs are not quantified in this research.

10.7 Recommendations for Future Research

10.7.1 Accidents

There is considerable uncertainty in the data on the prevalence of driving under the influence of methamphetamine in Australia, which means that odds ratios for methamphetamine causation of road crashes can only calculate the excess rate of being *responsible* for the crash, but cannot assess whether there is an increased probability of being *involved* in a crash. As 4.1% of drivers involved in a road crash fatality (Drummer et al., 2003b), and 4.1% of those involved in road crashes resulting in hospital admissions (Ch'ng et al., 2007) tested positive to methamphetamine, it is likely that those who drive under the influence of methamphetamine are both more likely to be at fault for a crash they are in, as well as more likely to be in a road crash.

There is a lack of information on whether methamphetamine, or indeed illicit substances more broadly, are associated with excess rates of other forms of injuries such as falls, burns and scalds, drowning, and sharp object injuries.

10.7.2 Workplace productivity

Research evidence concerning the extent and nature of drug related harm in the workplace is limited, especially in the Australian context. Existing Australian research has identified workforce groups that are at high risk of drug related harm and workplace factors that are associated with this risk. Future research needs to examine the relationship between the workplace physical, organisational and psychosocial environment and employee consumption patterns to identify how these factors contribute to risk of drug related harm. Particular focus should be on young workers. The school to work transition period appears a pivotal point where many young workers adopt long-term drug related behaviours and attitudes, with the workplace environment potentially playing an influential role. Understanding the role the workplace plays in this regard would enable the development of workplace strategies that may reduce drug related harm both in the short- and long-term.

Quality research is also needed that examines the relationship between drug use, occupational injury and absenteeism in Australian workplaces. Such research would not only result in more reliable estimates of drug-attributable costs of occupational injury and absenteeism, but also provide evidence to inform the development and implementation of harm and cost reduction strategies. In addition, while workplace policies and strategies such as drug testing, education and training are becoming more common in Australian workplaces, there is little evidence of effectiveness. Studies that utilise rigorous methodologies are needed to evaluate the effectiveness of different strategies and identify factors that contribute to effective responses.

Overall, lack of data concerning non-road crash injuries, workplace injuries, and workplace productivity, together with lack of data concerning the prevalence of driving or working under the influence makes it difficult to provide precise cost estimates. In addition, the issue of poly-drug use limits conclusions that can be drawn regarding costs that are directly attributable to methamphetamine use.

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CHAPTER 11: RURAL & REMOTE ISSUES

Kimberly Cartwright and & Dennis Gray

11.1 Background

The impetus for a qualitative study looking into the social costs of methamphetamine use in rural and remote areas came from the desire to know more about the effects of methamphetamine in those areas either not identified in nationally available data sets or where it was not possible to make meaningful cost estimates due to the low representation of rural and remote areas in the data. This chapter aims to provide a context to the social harms arising from methamphetamine use in rural and remote areas, acknowledged to exist but difficult to quantify, so as to assist researchers to estimate their costs in the future. These harms may encompass intangible costs associated with methamphetamine use that manifest in the same way regardless of geographical locale, such as the impact on families and children of users, which also could be used to guide cost estimates in metropolitan areas and regional areas. Finally, this chapter also aims to shed light on new or emerging social costs making their impacts felt in rural and remote communities.

11.2 Study Design

This component of the project was conducted as a descriptive cross-sectional study. Resources available for the study meant the number of sites included was limited to two. Within this constraint, we selected sites that enabled us to capture data on remote as well as rural locations and data on communities with differing socio-economic profiles. These sites are sufficiently different and internally diverse to provide a broad indication of the range of harms (though not their extent) associated with methamphetamine use as perceived by workers in related fields.

Whilst use of methamphetamine has been reported as a concern in rural and remote Australia, it is not necessarily used in all communities. In those in which it is used, use may be sporadic and, of course, there is variation in the nature of the communities themselves. Given these factors, as well as the imperative to not cause disruption and to unnecessarily heighten concern, one town was selected that is classified as remote in its own right, is the service centre for a large number of remote communities, and is the location of the offices of organisations providing services to those communities. A large proportion of its 24,000 residents – about one fifth of whom are Aboriginal – is employed in the public administration, health and justice areas, but also in significant tourist and retail sectors. The second site, which has a population of 14,000 of whom about 800 are Aboriginal, is a rural town with a mixed economy. It is a service centre and port for the agricultural hinterland, it has fishing and aquaculture industries, and is a tourist destination. Several of the participants mentioned the town is polarised between the rich and the poor (15 Health AOD; 16 Health AOD; 22 Health AOD). The public high school has a high Aboriginal representation and about half of students reside with one parent (19 Youth).

11.2.1 Data collection and analysis

Data for the study were collected in 27 interviews conducted (by KC) at the two sites: 21 face-to face-interviews with one or two persons; five phone interviews; and, one group interview of alcohol and other drug (AOD) clinicians. All but the five phone interviews were recorded and transcribed. Interviews were conducted in April and May 2016. Interviewees in each of the study sites were representatives of organisations that address the harms associated with methamphetamine use or whose services are impacted by methamphetamine use. These included health care and alcohol and other drug services, youth organisations, community services, emergency services, law enforcement agencies and local government. No methamphetamine users or their families were intentionally interviewed.

To ensure confidentiality, interview transcripts were de-identified prior to thematic analysis. Each interview was assigned a unique identification number and a suffix indicating the service sector in which the interviewee(s), was employed and these are used to identify quotes in the sections that follow [29]. Data analysis commenced soon after the first interviews were transcribed and continued concurrently with subsequent data collection and beyond. This approach enabled us to pursue new issues as they arose. In the analysis, no distinction was made between rural and remote areas, rather they were treated as a single category. This latter approach was taken for both methodological and ethical reasons. First, many of the issues were similar in rural areas and remote areas. Second, the small number of sites in which the study was conducted meant comparisons made between these areas were likely to be unsound. Third, it avoided making erroneous comparisons between costs incurred by Aboriginal and non-Aboriginal communities or groups based on limited data.

11.2.2 Deviations from the standard methodology employed in this report

There are several deviations from the methodological approach described in Chapter 2. Whereas the time frame for the cost estimates produced from the national data is 2013/14, the frame of reference for this study is necessarily more recent, 2015/2016, with many participants recalling trends from "the past 18 months" or from December 2014, when the peak of methamphetamine-related incidents is generally acknowledged to have occurred in the towns. Another deviation is in reference to costs excluded in the derivation of the quantitative estimates presented in the other chapters (e.g. marginal costs, opportunity costs, and potential costs). Low prevalence, poly-drug use, and paucity of causal evidence at the study sites made it difficult for many of the participants to identify real costs directly attributable to methamphetamine consumption. As one respondent remarked, "It is pretty early days in terms of understanding the social and pharmacological properties of this particular, relatively new brand of drug" (11 Justice). Interviewees tended to recall one or two instances they either encountered methamphetamine in their work or they heard second-hand from associates, family and friends. In some instances, they identified the social costs or surmised potential costs at higher prevalence levels; in other instances, they spoke about methamphetamine use in combination with alcohol and other drugs within the context in which they worked, which, in turn, was then used to make suppositions about some of these costs for which there is an evidence base in other contexts.

11.2.3 Limitations of the study

A limitation of the study is the non-generalisability of findings to all rural and remote communities. Given the diversity of experience in rural and remote areas, including among Aboriginal populations, the study only provides a context for understanding the social harms from methamphetamine use taking place in two distinct communities. We also adopted a semi-structured approach to the interviews so as to capitalise on the participants' experiences with methamphetamine users. Therefore, the conversations reflect the particular situations of individual participants, which are anecdotal and may be mentioned by only one interviewee. If an expressed view captures a real or indicative social cost that we believe is important for future consideration, we included it in the paper. Further research will be required to provide an empirical basis for the suppositions made.

[29] For example, 20 Youth represents interview id number 20 in the Youth Sector

11.3 Context

11.3.1 Prevalence

Compared with alcohol, cannabis and, to a lesser extent, volatile substances, consumption of methamphetamine was reported to be relatively low in the two communities. According to a police detective, “They said at the hospital they probably have three people with some drug induced psychosis and this sort of behaviour [in a month] compared to hundreds and hundreds with alcohol [misuse]” (2 Justice). Several health service providers declined to be interviewed because they had no, or virtually no, exposure to methamphetamine users. For example, in one of the site towns, the area manager of the St. John’s Ambulance Service reported she could only identify one case of a possible methamphetamine user accessing ambulance services in the previous eight months (24 Emergency). Interestingly, efforts made to interview remote area health providers were not successful due to the perceived absence of methamphetamine presentations.

Many of those interviewed reported that, in general, methamphetamine was used in combination with alcohol and other drugs, and alone represented a very small amount of total drug use in both communities. However, others claimed methamphetamine consumption was becoming “normalised” among working adults in non-Aboriginal and Aboriginal communities alike (20 Youth; 9 Community Svces), whereby asking someone if they have a Valium (to come down from the effects of methamphetamine) was akin to asking someone if they have a cigarette (16 Health AOD). Clearly, this divergence of views suggests more research needs to be conducted to better ascertain prevalence and patterns of methamphetamine use in such areas.

11.3.2 Methamphetamine users in the study areas

By and large, it was reported methamphetamine users in the study areas are more commonly male non-Aboriginal tradespeople between the ages of 20 and 50 who buy for their own use and for their friends, many of whom are reportedly functioning and using socially or to keep alert on long work shifts. There is a perceived smaller group of school-aged youth who tend to smoke or ingest methamphetamine to either escape their problems or fit in with their peers. Notwithstanding the foregoing, several participants asserted methamphetamine experimenting was common in professional circles, including the fields of justice, health, drug and alcohol treatment provision and social services (9 Community Svces; 13 Health AOD; 16 Health AOD).

Methamphetamine has yet to make a marked impact on the Aboriginal community because the price of a point (i.e. 0.1 gram) is high relative to alcohol. According to a medical practitioner working at an Aboriginal community-controlled health service in one of the locations, “it’s a big problem for a very small number of people amongst the Aboriginal community. We’re really only aware of about five people in the community” (14 Health AOD). Other participants in the same town claimed otherwise, saying methamphetamine use among Aboriginal Australians is more widespread and that even Aboriginal youth were using it (1 Youth; 2 Justice; 3 Health AOD; 9 Community Svces; 23 Emergency). A review of the weekly roster from the night youth patrol in one of the towns indicated that none of the Aboriginal youth with whom they came in contact showed signs of substance use except for one who was recorded as having a “medical problem” (12 Community Svces). There were also conflicting reports as to whether methamphetamine is present in remote, alcohol-free communities. Some claimed it was a growing problem (2 Justice; 23 Emergency; 3 Health AOD; 5 Youth), while others said the few known cases were isolated incidents (10 Community Svces; 12 Community Svces; 14 Health AOD).

There are also discrepant views as to whether methamphetamine use is confined to poly-drug users or whether it is attracting those who do not consume other substances. Several participants, including clinicians at an AOD clinic, stated they believed the rate of increase in methamphetamine consumption in the town predominantly reflected use by those already using alcohol and other drugs rather than by an increase in the number of people initiating (15 Health AOD), an assertion that is consistent with national data (8 Health AOD). Other participants, including AOD clinicians, disagreed, stating that there was a lot of experimentation in the 20 to 50 age group. “The mere fact that it is smoke-able means it’s a lot easier for new people to come into the game” (16 Health AOD), a supposition for which there is evidence in other settings (see for example, McKetin, 2008). It was also asserted in two separate interviews that Aboriginal boys are more likely to start smoking methamphetamine than their non-Aboriginal counterparts because Aboriginal boys typically begin smoking tobacco at younger ages (11 to 13 years) and Aboriginal boys are more likely to be passed a “methamphetamine-laced” cigarette from someone in their families (1 Youth; 16 Health AOD).

11.4 Community Impacts

Excessive alcohol and drug use affects communities in various ways (Loughran and McCann, 2006, 2011). Repeated early mortality brought about by drug overdose or violence represents a “cumulative loss to the community” and wears down the health and vibrancy of the community as a whole (Loughran and McCann, 2011). The environment in which youth grow up is highly correlated with their future prospects (McBride Murry et al., 2011), whether it be the influence of individual families, peers pressure or the socio-economic and cultural wrappings around certain neighbourhood addresses. Aboriginal communities on average have a disproportionately high amount of excessive alcohol consumption and suffer the concomitant effects of discord, violence, child neglect, and other social harms (Saggers and Gray, 2001).

In the study sites, the general opinion was methamphetamine use was a relatively new phenomenon with great potential to devastate the communities (4 Health AOD; 12 Community Svces; 5 Youth; 2 Justice; 1 Youth; 14 Health AOD; 18 Health AOD; 3 Health AOD). There were signs communities were starting to be affected by methamphetamine; and respondents, particularly those with adult children, could provide anecdotal evidence about the impacts methamphetamine dependence already had on various population groups in town.

> It affects the community in such a big way because everyone’s connected. … All those boys on that footy team, half of them are in jail. Most of them are addicts. … People are starting to go, ‘Oh my gosh, because the doctor’s son is on it or the lawyer’s daughter is on it.’ Before, when it was just this other low socio-economic group, they didn’t care. ‘They’re not my children; it’s not my problem, it’s in somebody else’s household’ (9 Community Svces).

According to a school counsellor at one of the study sites, methamphetamine use amongst parents directly affected the school to a much greater extent than use among the students, although their children displayed signs of emotional disturbance, such as being distracted, causing fights and missing school (19 Youth). At the other site, it was alleged ‘dealers’ infiltrated the schools by luring the more vulnerable students to become dependent on methamphetamine and then recruited them to sell to their fellow students to finance their use. According to one person, some ‘dealers’ sold from homes situated near schools (1 Youth). Easy access to methamphetamine and other drugs near schools has consequences not only for school-going youth, their parents and the school itself, but also for youth who are participating in residential AOD treatment at the same time they are attending school. Such a schooling experience compromises their prospects for recovery (1 Youth).

It was asserted Aboriginal parents, in particular, who for a variety of reasons are already reluctant to send their children to school, would withdraw their children if they suspected methamphetamine and other drugs were easily obtainable at the school (7 Community Svces). “When one of them leaves that school often they’ll all leave in a group” (7 Community Svces). Several years ago, feeling their concerns were not being addressed by school authorities, a group of Aboriginal parents simultaneously withdrew their children from the school. This had a big impact on that particular school and on social services, which had to organise mid-year placement of the 30 children in another school (7 Community Svces). School-related violence was also perceived to be at least partly attributable to methamphetamine use. One of the participants commented that girls from her daughter’s school who were intoxicated on methamphetamine followed her daughter home and critically assaulted her (9 Community Svces).

The social harms resulting from methamphetamine use were perceived to be alarming (or potentially so) because, since “everyone” is taking it in one form or another, it cannot be easily dismissed as being an issue affecting only lower socioeconomic groups or as “an Aboriginal problem”. Yet ironically, as stated by participants, there was a state of denial about the mainstreaming of methamphetamine use (9 Community Svces; 6 Health AOD), which some argue, underlies why the “ice epidemic” is being addressed from a crime rather than from an early childhood developmental perspective (4 Health AOD; 6 Health AOD; 16 Health AOD). It was reported that residents did not want to openly acknowledge methamphetamine use was becoming a serious issue among middle class non-Aboriginal residents. As one respondent remarked, many people in the town erroneously linked violent crime to methamphetamine use among Aboriginal people and this was widening the “racial divide” (3 Health AOD), a divide brought about by decades of discriminatory policies against Aboriginal people, resulting in their segregation and exclusion from the social and economic life of the town.

Widespread methamphetamine use also has the potential to create fissures within close-knit communities, including Aboriginal communities. Because Aboriginal kinship structures are tightly organised around extensive family relationships that are based on a system of mutual obligation and reciprocity, it has been suggested that the Aboriginal community offers a “protective layer” to temper the social harms associated with methamphetamine consumption – an informal safety net rarely found in non-Aboriginal family networks (4 Health AOD; 13 Health AOD; 14 Health AOD). “The mob will take care of you” (16 Health AOD). But Aboriginal families also have their breaking points (3 Health AOD; 7 Community Svces; 9 Community Svces; 21 Health AOD). The breaking point comes when relatives are no longer willing to house methamphetamine-using family members, often coinciding with the advent of young children into the household when the focus is shifted from the welfare of the user to the welfare of the child (7 Community Svces). At that point, methamphetamine-using relatives are told to leave or taken to a distant community (7 Community Svces).

Some participants said Aboriginal elders, who have had varying degrees of success in enforcing the prohibition against alcohol consumption in some remote Aboriginal homeland communities, were becoming increasingly concerned about their ability to keep methamphetamine out of their communities (3 Health AOD; 7 Community Services; 12 Community Services; 21 Health AOD).

> A lot of the Aboriginal parents or older people that I see are very, very nervous of this drug. … It’s different with alcohol; if you go home drunk to a community the chances are most people in the community are drinking anyway so you’re just one of the norm. This is not part of the norm. I think if you go, if you use ice and I’ve spoken to a lot of parents and they’re very frightened, they’re very frightened of this drug, they hate it. So it’s not something that’s accepted in their community …

> and people are actually gathering together in communities to try and make sure ice doesn't come in (3 Health AOD).

When asked what in particular frightens these Aboriginal parents, the respondent remarked it is "the perceived violence that goes along with it [methamphetamine] …. And there are little kids involved with it" (3 Health AOD). In her view, methamphetamine could have a larger social impact on remote communities than on Aboriginal families living in town or in town camps. She asserted that remote communities have begun to shun young methamphetamine users to keep out the drug:

> What I'm seeing is that, as an example, one of the people I know, [the] younger brother is on the stuff and pretty much the family has just tried everything, [they've] given up and that's it. Now that determines a lot in terms of their future, whether they can get invited to go to men's business, whether they get to do the ceremony they're supposed to do when they get older, all those sorts of things. And that has a massive impact on their life. That sort of social impact tribally is quite high. … I think it is going to finish up being excommunication from their people and that would have an enormous mental health issue on them, a disconnection issue (3 Health AOD).

These views must be presented against the backdrop of alcohol and its known effects on all communities; effects which to date were perceived by many participants to be greater than those caused by methamphetamine. Alcohol-related impacts included homicide, suicide, domestic violence, child neglect, low school attendance, food insecurity, and poor health and hygiene contributing to various preventable diseases.

11.5 Impact on Families

Having a co-resident dependent methamphetamine user in a household was perceived as a source of both emotional and financial distress to families. Family members were exposed to the highs and lows characteristic of the methamphetamine-using experience, whereby during the "high," the user grows more intoxicated, more sleep-deprived, and more prone to irritation and erratic and violent behaviour; and during the "low," the user sleeps for days and awakens to intense cravings and a desperate need to satisfy these cravings (3 Health AOD; 13 Health AOD). Consequently, other family members cannot sleep well; children are exposed to high-risk and/or inappropriate situations and people, sometimes subject to physical and emotional abuse, and suffer neglect (1 Youth; 11 Justice). Aboriginal children and youth are disproportionately affected by the presence of methamphetamine in the household, because many already live in precarious conditions that serve to undermine family stability and the necessary requirements for children to feel safe (2 Justice; 3 Health AOD; 22 Health AOD; 7 Community Svces; 1 Youth).

Some families also lived under the threat of drug dealers, known to forcibly requisition family belongings, even dogs, as payment for unpaid debts and to extort money using verbal threats and violence (18 Health AOD; 5 Youth; 2 Justice). Families also feared forcible entry by the police seeking offenders and/or clandestine laboratories (11 Justice), the stigma of having a "drug addict" as a relative, and potential bankruptcy from financing methamphetamine (11 Justice).

Parents especially felt anxious about the health and well-being of their adult methamphetamine using children and feel conflicted between helping them financially and contributing to their drug use or severing all ties to preserve their own well-being. Parents and family members reportedly provided instrumental support, albeit reluctantly, to their adult children dependent on methamphetamine by taking in their grandchildren or nieces and nephews (9 Community Svces; 22 Health AOD;), paying outstanding house payments, paying bail and even buying cannabis to offset the side effects (1 Youth).

> Out in society there is no support. So, an example is a father that I know in town here, a white fella [and former aircraft engineer]. He said, 'My son's got on ice; I have no idea what to do. I had to go buy gunja, marijuana to help him stop using ice and I'm a law-abiding businessman.' He said that he didn't want to phone me and that he felt ashamed (1 Youth).

Many families reportedly struggled to bear the strain of providing seemingly endless stop-gap measures to delay the inevitable consequences of long-term methamphetamine use, i.e., unemployment, bankruptcy, homelessness, jail time, physical wasting, and severing the relationship completely.

Methamphetamine dependence has also reportedly been responsible for marital breakdown. One of the participants recounted how her colleague, a health professional, was divorcing her husband because his personality changed after using methamphetamine (22 Health AOD). The woman, who still loved her husband, had to take extensive sick leave and receive counselling to cope with the situation. She had expended all the family's financial resources and was negotiating with her superannuation fund to receive a payment from the plan's income protection insurance cover (22 Health AOD).

Some participants claimed that as a result of the 'mainstreaming' of methamphetamine use, the courts were responding by imposing disproportionately harsh penalties in the form of longer jail sentences and higher fines against offenders, eventually resulting in larger costs to the criminal justice system and to health care expenditure (16 Health AOD; 11 Justice; 9 Community Svces).

The (2014) reclassification of methamphetamine as a Schedule 1 drug in the Northern Territory meant all methamphetamine-related cases were heard in the Supreme Court, with a consequent risk of a longer time between being charged and sentencing by an additional four to six months in the best circumstances (11 Justice). It was apparent there was limited evidence about the impact of changing methamphetamine to a Schedule 1 drug. A participant suggested that costs identified so far included: staff time of legal and court personnel; attorney fees; and, longer custodial sentences for the accused involving both emotional and financial costs to families and taxpayers (11 Justice).

It would also be worth researching how, from a financial perspective, the role and operationalisation of bush courts in certain states have changed with the criminalisation of methamphetamine. Siegel (2002) painted a vivid picture of bush court proceedings in isolated Aboriginal communities in Western Australia and the Northern Territory, in which defence, prosecution and magistrate teams are ferried in and out by small eight-seater planes for days at a time, incurring airport licensing fees and the cost of meals and lodging. Also not to be discounted is the impact of criminal proceeding related to methamphetamine on the ability of Aboriginal people to receive fair and equitable due process of law, which some argue is an unjust consequence of the bush court (Siegel, 2002).

Some participants noted the legal response to methamphetamine, particularly the imposition of fines and cumulative penalties for non-payment, placed additional burdens onto users and their families, which, in turn, impeded them from participating in daily life activities often necessary for earning a living.

> The average fine for people, and it's not just meth users, anybody caught up in the whole substance abuse cycle in the State is $40,000 per person. Because you have an outstanding debt you can have no involvement with State Government. Therefore, you can't register your car; you can't get a (driver's) license (16 Health AOD).

In certain states, such as Western Australia, if a person fails to pay a fine within 28 days and does not provide an adequate reason, the Fines Enforcement Agency will automatically suspend his/her driver's licence and vehicle registration and increase the amount of the fine (Department of the Attorney General, 2016). In the Northern Territory, s60E of the Justices Act (1928) authorises the police to immediately jail, without the benefit of a court hearing, persons who fail to pay fines within a 28-day period (Siegel, 2002). As noted by one participant, social justice advocates assert that the fine enforcement system, based on postal notifications, does not take into account Aboriginal people's transience and low literacy levels and predisposes them to situations where they may unknowingly break the law and have to serve time in jail (16 Health AOD). He observed the accumulation of fines that cannot be paid leaves Aboriginal offenders feeling hopeless about their future prospects, which impacted on their willingness to undergo and complete treatment (16 Health AOD).

Some participants observed that the social and cultural context in which many Aboriginal people live compounds the problems Aboriginal families face when confronted with a methamphetamine-using relative. The problems of daily existence were magnified as families often struggled in overcrowded and precarious conditions to house and feed the children of users (21 Health AOD). At one of the sites, Aboriginal youth living in households affected by drug-related problems, including methamphetamine: had irregular meals; were exposed to crime, violence and sexual abuse; sought safety outside the home by convening in public places at night until the youth night patrol took them to a safe place; suffered sleep deprivation; and, had sporadic school attendance (12 Community Svces; 13 Health AOD; 19 Youth).

Methamphetamine-affected families in the Aboriginal community are amongst the most vulnerable and could potentially benefit from government services, however, it was reported that they hesitate to seek help because of the constant intrusion it would bring. According to a participant, Aboriginal families are bombarded by unannounced visits to their homes by the police and other agency personnel; consequently they "live in absolute fear and loathing of that authority" (7 Community Svces):

> From [the door of the community centre, the outreach worker] could see about ten houses and she said you'd see Truancy come and go and it would go from house to house and you'd see Centrelink would come and it would go from house to house, Children and Families would come and it would go from house to house. And it was literally just one after the other and it got to the stage where people would just, and it happens all the time, people just hid in the back of their houses (7 Community Svces).

Some Aboriginal families lived a life of transience, moving between various households or moving to other communities, or even other states, when authorities close in on wanted family members (7 Community Svces) or to escape the effects of government interventions, including the establishment of "dry zones" or, more recently, the introduction of the "welfare card" (19 Youth). In the view of a participant, the high rates of mobility amongst Aboriginal people are "not just about cultural events; it's not about royalties or access; it's around fear… and that displaces the child and that's done by government and it's done regularly" (7 Community Svces). Certainly, family instability – brought on by a confluence of factors – is a barrier to the uptake and utilisation of health services, and AOD treatment services in particular.

11.6 Barriers to Treatment

Barriers to access, utilisation and quality of alcohol and other drug treatment services were reportedly a common feature of rural and remote living – the impact of which has been noted to be exacerbated by prevailing social economic conditions in rural and remote areas (Carson et al., 2007; Gray et al., 2014; Gray et al., 2010). This failure can be attributed to shortfalls in health financing, particularly funding for primary prevention in remote Aboriginal communities, availability of appropriately qualified specialist personnel, and the quality of the interface between health service providers and consumers. The resultant social harm is the additional contribution to the public health burden of morbidity and mortality attributable to methamphetamine, as discussed in Chapters 5 and 6.

11.6.1 Access

One of the main barriers to access stems from the shortage of alcohol and other drug treatment services outside metropolitan areas and especially in rural and remote Australia. At one site, we interviewed staff from an AOD service that admits, from interstate localities, adolescent clients who have methamphetamine-related problems and who are in need of crisis placement. We were told the service incurred costs arising from legal requirements surrounding the escort and care of youth arriving from interstate regional and metropolitan areas. These costs included administration of the paperwork, transport costs (if the youth was to be delivered to the facility by police escort or ambulance or retrieved by an AOD outreach worker from the host facility), accommodation support of accompanying family members at the facility, and staff time attending to the psychosocial needs of family members (1 Youth).

Crisis placement of clients presenting with either methamphetamine intoxication or withdrawal symptoms was especially difficult because many AOD services were perceived to be reluctant to admit such clients. They perceived that they require a greater level of service provision that does not fit with standard treatment programs addressing alcohol, cannabis or opioid dependence (1 Youth; 5 Youth). It was reported that whereas it could take one to two weeks to find a place in a residential care facility for a person dependent on volatile substances, it could take as long as nine months for a methamphetamine user (5 Youth).

Because the rehabilitation window might be longer for methamphetamine dependent clients, who often present with highly complex problems, AOD workers needed upskilling and training to effectively manage those clients at each stage of care (16 Health AOD; 1 Youth; 3 Health AOD). Some service providers also argued methamphetamine dependent clients needed separate rooms within facilities because they need greater peace and quiet while withdrawing or because they may exhibit symptoms of violence or psychosis that may result in property damage or potential harm to other patients or staff with associated costs (16 Health AOD; 1 Youth; 9 Community Svces).

Another barrier to accessing treatment was the requirement for patients to undergo a mental health assessment prior to admission to a residential rehabilitation facility for AOD treatment in general. Due to the shortage of those qualified to conduct these assessments in rural and remote regions, the waiting time to obtain such an assessment can be as long as six weeks (16 Health AOD). According to a youth counsellor, getting the mental health check is a “massive” problem (19 Youth). The exception is where there are comprehensive Aboriginal community-controlled health services that have in-house staff (GPs and Certificate Level IV workers) who are able to conduct such assessments. Deferring an individual’s treatment to satisfy medical requirements (such as, the mental health plan) may result in the individual presenting at hospital with multiple co-morbidities impacting on his/her quality of life and on public health expenditure. The length of this window may extend well beyond the administrative wait times if the user abandons the desire to undergo treatment.

11.6.2 Utilisation

Rural and remote methamphetamine users, Aboriginal and non-Aboriginal alike, were reportedly reluctant to seek help for related problems because they live in a microcosm where everyone knows one another's business. Interviewees reported that clients tended to wait until they were mandated by criminal justice authorities to undergo treatment (3 Health AOD; 8 Health AOD) or they discreetly used the outpatient clinic at the hospital (6 Health AOD) or from their GPs (22 Health AOD) to request benzodiazepines to abate their withdrawal symptoms. Aboriginal people, whose distrust of mainstream health care is well-documented (Henry et al., 2004; Paradies, 2007), may fail to seek medical help altogether (Royal Australian College of General Practitioners, 2012) or, sometimes, reluctantly self-refer to a non-Aboriginal health provider to avoid potential breaches of confidentiality and/or shame from encountering a relative working in an Aboriginal community-controlled health service (20 Youth; 21 Health AOD). A concern for Aboriginal people using non-Aboriginal service providers is such services do not always provide culturally safe or secure care as do Aboriginal community-controlled health facilities, resulting in a sub-optimal recovery process for clients (Gray et al., 2014; Panaretto et al., 2004). This has the potential to result in higher relapse rates and greater utilisation of health services than otherwise might be the case.

The physical and emotional isolation endemic in much remote and rural living are significant barriers to accessing AOD treatment services and completion of treatment programs. These include the time, expense (including travel and accommodation costs) and effort to organise and attend appointments and follow-up visits – barriers that are exacerbated by recovery periods that can be as long as 12 to 18 months (15 Health AOD; 22 Health AOD). Furthermore, the need to leave communities to access treatment may cut people off from social support networks that can be an important factor in recovery (Nannup, 2016).

In remote communities, the only viable option to address acute consequences of methamphetamine use was for the Royal Flying Doctor Service (RFDS) to evacuate the person to the emergency department at the nearest hospital or clinic. Although the frequency of methamphetamine-related evacuations was reported to be low (5 Youth), there are multiple social costs associated with medical air retrievals and the challenge is to separate these costs from operating costs. Mental illness air retrievals are reportedly a significant problem for the RFDS because of the difficulty of getting a person into the aircraft and restraining him/her safely, and because of safety issues for the aircraft and the crew (personal communication, RFDS Flight Nurse, 9 May 2016). Apportioning costs from methamphetamine-related emergencies is difficult because the RFDS does not conduct diagnoses of air retrieval patients, and does not plan to do so in the future (personal communication, RFDS Chief Medical Officer, 9 May 2016). There is also no central repository for medevac patient records. Blood and urine screenings of persons presenting acute behavioural disturbances are conducted at the receiving hospital, the results of which are stored with the patient's records (personal communication, RDFS Chief Medical Officer, 9 May 2016).

11.6.3 Quality

The shortage of AOD specialists in rural and remote communities not only affects access to treatment but also the quality of treatment available. Under-provisioning of specialist personnel, including addiction specialists, clinical psychologists and psychiatrists limits the ability of the health care system to adequately meet the needs of methamphetamine clients. Several practitioners reported the lack of clinical psychologists or intermittent access to them to be a major impediment to their work (3 Health AOD; 6 Health AOD: 18 Health AOD; 20 Youth). The delivery of efficacious methamphetamine treatment is an added burden to the few and under-resourced adolescent addiction programs available, where most clients have multiple and complex care needs requiring an extensive range of social support. So-called "pointy-end" clients tend to have moderate to severe substance use disorders, mood and/or anxiety disorders, learning disabilities and a history of trauma. Many are disengaged from school or work, have a criminal history and live in transitional housing or on the street. To effectively help such clients, AOD workers have to liaise with multiple governmental agencies, something that many lack the capacity or the willingness to do (Nisbet and Lovett, 2016).

It was reported that across alcohol and other drug treatment centres and emergency departments, triage nurses need training in managing methamphetamine presentations to be able to discern the more critical cases, as well as anticipate needs and reactions while they sit in queues waiting to see a doctor. Three medical practitioners, two working at a hospital, the other in an Aboriginal community-controlled health service in one of the sites, separately remarked that the clinical response to methamphetamine use is inadequate. (6 Health AOD; 14 Health AOD; 16 Health AOD; 22 Health AOD). They claimed GPs do not know what signs to look for in a patient using methamphetamine (and often co-presenting with a mental health disorder) and they tended to refer patients to a government-run health service where there is a dearth of medical practitioners and clinical psychologists and a lack of service capacity to provide quality care (14 Health AOD).

Should the prevalence of methamphetamine-related problems increase in rural and remote areas, costs associated with recruitment and retention of specialised clinicians and with the provision of outreach services may become significant. The inability to provide home visits, case management, and follow-up phone calls and support for methamphetamine users may result in early mortality, high relapse rates, and cycling in and out of the hospital. For example, one of the medical practitioners interviewed told the story – related to alcohol but to illustrate risks for methamphetamine users – of a non-Aboriginal man who died within a week of discharging himself from hospital. In a medical review of the incident, it was acknowledged the man, who was mentally ill and lived alone, should not have been discharged.

> He was a very severely alcohol addicted person who probably would have died anyway, but the point is, if he had been an Aboriginal person he would have been followed up. It might not have made any difference but someone would have gone from here and seen him at home. He would have been offered case management and all sorts of… so there is for poor non-Aboriginal people when you've got GPs who don't bulk bill, who charge gap fees, who have 15 minute appointments, you know the service system is not as good for them (14 Health AOD).

In the other study site, an experienced service manager of an Aboriginal community-controlled centre also remarked on the unavailability and inaccessibility of medical health expertise in remote and rural areas. "I think part of the issue is the workplace, whether they're non-Aboriginal or Aboriginal, [they] don't know what to do with people who've got meth problems" (16 Health AOD).

Although prevalence of poly-drug use is not known in the study sites, there are those who reportedly regularly consume a combination of drugs that includes methamphetamine and opiates; GPs prescribe methadone for some of these users. However, a GP remarked that swapping take-away methadone for methamphetamine among poly-drug users was increasing and was, in her opinion, one of the largest social harms linked to methamphetamine use in the town (22 Health AOD).

11.6.4 Barriers to treatment uptake

A potential barrier to the uptake of treatment was perceived methamphetamine use by health professionals themselves. Several participants reported methamphetamine was being used as a recreational drug by fellow workers employed in the public sector. The participants did not state the ramifications of their colleagues using methamphetamine socially, simply indicating there was a "double standard" operating that reflected poorly on the field (9 Community Svces; 6 Health AOD; 13 Health AOD). One respondent witnessed, at a shire society event, a number of her colleagues employed in government, justice, health, youth outreach and social services highly intoxicated on (what she believed to be) crystal methamphetamine (9 Community Svces). She also asserted workers employed in AOD treatment centres used methamphetamine socially (9 Community Svces). A medical practitioner working at a local hospital also mentioned she had encountered her colleagues using methamphetamine outside working hours (6 Health AOD).

Illicit recreational drug use among health professionals, besides being illegal, contravenes professional standards, such as the Australian Medical Association's (AMA) code of conduct, violating key elements of the doctor-patient relationship (i.e. trust and role-modelling), a cornerstone of effective health care delivery. If it is an open secret that "everyone" is using methamphetamine, even medical practitioners, it is conceivable that users and their families might question the integrity of the health system, which could result in reduced uptake of services, especially AOD treatment, among country residents who have no other care alternatives. Some contend private behaviours are not so private in rural and remote communities. At the extreme, this would widen existing urban-rural disparities in health care utilisation and potentially raise health expenditures in rural and remote areas, which are already challenged to provide specialist care for residents with one or more chronic disabilities.

11.7 The Impact of Negative Advertising

11.7.1 Direct costs

Fifteen of the 22 participants interviewed face-to-face mentioned, without prompting, the disturbing nature of televised public service announcements originating from the United States (5 Youth). The local broadcasting networks in the sites aired what we were led to understand were the Montana Meth Project advertisements (Montana Meth Project, 2016), which graphically portrayed methamphetamine-using teenagers living in squalid conditions, lashing out during psychotic episodes, and suffering from open sores, rotting teeth and tactile hallucinations. As a result of the advertisements, local politicians and residents of the site towns began to grow anxious that methamphetamine-use in the community would spiral into an ice epidemic with equally devastating consequences.

The transmission of these public education advertisements has two potential direct monetary costs identified by the participants. The first is the cost to government of broadcasting the television advertisements; the second is the costs associated with public fora in which local residents could ask a well-represented group of professionals – in health care, social services, and law enforcement and criminal justice – questions about the scale of the "ice epidemic", current and future efforts to quell it and costs associated with mandated police training in one of the states. Some participants were concerned that governmental response was to create groups to conduct community meetings when, in fact, there had been no real demand for them in this particular community (15 Health AOD). Participants in both sites remarked that the high profile media debate about methamphetamine use was manufactured (6 Health AOD; 14 Health AOD; 15 Health AOD; 16 Health AOD).

> If the government says there's a crisis and they're backing it with money, then there's a crisis. If that's what you want, we'll give you a crisis if you want a crisis! (10 Community Svces).

In the past 12 months, there were 11 public meetings in one particular state, including a one-day professional development workshop for health practitioners that cost $20,000 (15 Health AOD). The public meetings, some of which had as many as 200 participants, had approximately 10 speakers representing police and other social service agencies, as well as additional police officers in the audience and staff from multiple Aboriginal and non-Aboriginal AOD services (15 Health AOD). The budget for the public forum in a particular remote community included airfare and accommodation expenses for the key speakers (15 Health AOD). Also, in parts of the state, police were mandated to receive training in preparation for the "ice epidemic" in country towns, resulting in direct costs (i.e. wages, training costs, and staff time). The training was also perceived to bear the opportunity cost of time foregone from solving crime and engaging in other high-priority activities, which were felt to have larger impacts than methamphetamine use on country towns. Of course, such costs may be justified if they have a positive impact on reducing methamphetamine consumption.

11.7.2 Intangible costs

Contrary to an evaluation of the Montana Meth advertisements, in which the "disgust" element of the advertisements was found to deter illegal substance abuse (Morales et al., 2012), a number of participants stated they believed a risk of the shock messages resulted in opposite behavioural responses from young people and inadvertently enticed them to try methamphetamine.

> "The publicity around ice has given it a dangerous glamour, which makes it a highly attractive to people with unconventional behaviours" (11 Justice; 19 Youth).

There was also concern it could potentially feed into an aspect of popular culture that appears to normalise or endorse the methamphetamine lifestyle as being "hip and cool" (16 Health AOD).

The shocking images of violence, facial wasting and open sores was believed to discredit the intended message to viewers, especially adolescent methamphetamine users or friends of users who had not seen or experienced these impacts first-hand. Like many youth, they reportedly held the view that "such things won't happen to me" (9 Community Svces). Such a negative effect has been found among a significant proportion of smokers in a study of the impact of graphic images on cigarette packs (Erceg-Hurn and Steed, 2011). If participants are correct in their assessments, care and consideration needs to be taken in the design and implementation of any media campaigns to avoid the risk of increasing methamphetamine use among some segments of the population.

11.8 Third Party Costs of Criminal Activity

Participants working in the justice system and local government remarked that methamphetamine users did not vandalise community assets as might be suspected (2 Justice; 11 Justice; 27 Local Govt). It was believed that occasionally users would damage rental properties or break into shops to steal money from cash registers but, most often, they stole from friends and family members to finance their drug use. Sometimes, users resorted to more extreme ways of raising money; in one particular example, a user sold the family yacht without consulting his parents (11 Justice).

Property owners incur large out-of-pocket expenses for the remediation of methamphetamine production at rental properties (see Chapter 9 for a fuller discussion of the costs of clandestine methamphetamine laboratories). One source, representing a national biohazard clean-up facility, quoted remediation costs for methamphetamine production to be in the range of $15,000 to $60,000

(26 Justice: personal communication, 28 April 2016). Property owners are legally responsible for remediation if they want to let the property again, a requirement enforced by the Shire Councils in the two communities this study was conducted in [and in many others] (26 Justice: personal communication, 28 April 2016). Those responsible for the manufacturing (i.e. former tenants) are rarely held to account because, more often than not, they are in remand and do not have sufficient financial resources to pay damages (11 Justice). Typically, home insurance policies do not provide coverage for the cost of illicit drug manufacturing in rental housing.

11.9 Conclusion

In this chapter, we have identified cost-related concerns of service providers whose roles bring them into contact with methamphetamine use and its consequences. For the study sites there is a paucity of quantitative data on the prevalence of methamphetamine use. One of the most striking findings of this qualitative component is the degree to which service providers differ in their views on the extent of methamphetamine use – for some it was a minor issue, for others a significant problem. This difference appears to be a function of both the extent to which they encounter methamphetamine-related problems in their work lives and in their family and social relationships. Clearly, any future attempts to measure the costs associated with methamphetamine are dependent on prevalence data relating to both use and to the nature and severity of adverse consequences. This is a gap that needs to be addressed.

Those interviewed identified several areas methamphetamine use resulted in social costs. The first of these were the impacts of use on the broader community and on the families of users – impacts likely to be greater amongst Aboriginal people because of potentially higher levels of use exacerbated by Aboriginal socio-economic disadvantage. Also of particular concern were the additional costs of accessing AOD intervention services and the incursion of greater costs when dependent use was not addressed; and, of course, third party criminal costs. Another area of concern was the unintended negative impacts of television advertisements.

The issues raised in this chapter constitute only a first step. Before any substantive work is carried out to quantitatively document costs in rural and remote areas associated with methamphetamine use, there is a need for research that documents these concerns in greater detail and the identification of appropriate sources of information from which the costs can be estimated.

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CHAPTER 12: TENTATIVE ESTIMATES OF THE COSTS OF METHAMPHETAMINE DEPENDENCE TO RESIDENT PARTNERS & CHILDREN

Steve Whetton & Robert J Tait

12.1 Background

There is extensive evidence that substance dependence imposes costs not only on the dependent user themselves but also on their family and friends, particularly those who are resident with the user. These harms are likely to be significant in scale and are an important potential focus for public policy. This means they are also a potentially important aspect of the social cost of methamphetamine use, and represent a potentially significant form of benefit for programs that either reduce rates of transition into dependent use or assist dependent users in managing their dependence (Miller and Hendrie, 2008; Mortimer and Segal, 2006).

Potential harms to the resident family members of dependent substance users include (Casswell et al., 2011; Homer et al., 2008; Laslett et al., 2010; Miller and Hendrie, 2008; Orford, 2015; Orford et al., 2013):

- Domestic violence;
- Emotional abuse/coercive control;
- Financial stress;
- Decreased mental and physical wellbeing;
- Need to provide care to the dependent user;
- Decreased quality of family relationships;
- Alienation from social networks and the wider community; and,
- Feelings of guilt or inadequacy at being unable to prevent the substance dependence.

Whilst acknowledging that substance use problems do not necessarily lead to compromised parenting (Australian Research Alliance for Children and Youth, 2006), they are a significant potential risk factor on their own account, and are also frequently co-morbid with other social, legal and economic risk factors that can contribute to poor parenting (Arria et al., 2012; Australian Research Alliance for Children and Youth, 2006; Orford, 2015; Orford et al., 2013). The issue of substance use and child protection is addressed in Chapter 8, but that Chapter is focussed in the costs of service delivery and quality of life impacts are not included in the calculation. Specific risks and harms to the children of dependent substance users include (Arria et al., 2012; Orford, 2015):

- Increased rates of neglect and abuse;
- An increased risk of developing a substance use disorder as an adult;
- Increased rates of depression and suicidal ideation;
- Increased rates of illicit drug use amongst adolescents;
- Increased rates of early conduct and behavioural problems;
- Increased stress from living with tension and worry and uncertainty and often with denial and secrecy;
- Increased rates of school failure;
- Feelings of embarrassment at being seen with the dependent parent in public;

- Decreased levels of monitoring and supervision;
- Poorer quality parent-child interactions, and lower perception of parental warmth; and,
- Inconsistent discipline.

Attempts to quantify the exact scale of the costs experienced by the resident family members of dependent methamphetamine users (or indeed the family members of substance users more broadly) are still in their infancy, and so there are not yet sets of parameters that have broad acceptance. Indeed, even estimates of the number of affected persons are subject to considerable uncertainty. As such, whilst we have estimated the costs to resident family members in this section, this analysis is tentative and the results should be treated with caution. Thus, the estimates have not been included in our estimate of the total social cost of methamphetamine use, but instead are reported separately. We have also not reported a “central” estimate of the costs to resident family members as, given the current state of knowledge, we cannot confidently assert that one set of estimates should be preferred to the others.

12.2 Number of Resident Family Members of Dependent Methamphetamine Users

There are few data that identify the number of persons who are resident with a dependent methamphetamine user. The best available source of data is from the NDSHS (Australian Institute of Health and Welfare, 2014a). The NDSHS does not directly identify dependent methamphetamine users. The best proxy for a dependent methamphetamine user in the NDSHS is at-least-weekly methamphetamine use (e.g. users who report using ‘once a day’ or ‘weekly’).

The NDSHS reports that a total of 14,997 dependent methamphetamine users live with a partner (Table 12.1). The NDSHS estimate of dependent methamphetamine users is lower that the estimate derived from the best available data (see Chapter 3) and, as such, it is reasonable to assume the NDSHS will underestimate the number of partners and children of dependent methamphetamine users. If we assume the underlying characteristics of the at-least-weekly methamphetamine users in the NDSHS reflect those of the broader population of 160,000 dependent methamphetamine users identified in Degenhardt et al. (2016a), then we can use the latter estimate to scale up the NDSHS estimates. If the estimated is scaled up on that basis, we have an estimated **45,728** partners of dependent methamphetamine users.

The NDSHS also collects data on the number of resident dependent children of dependent methamphetamine users. There are two ways the data on dependent children are reported in the NDSHS. This first reports the number of dependent children resident with the respondent as zero, one, two, three or more. The second reports whether the respondent has at least one resident child aged 0-2, 3-14, and 14 plus. These estimates produce somewhat different outcomes, presumably due to rounding. Again, scaling these estimates up to the estimated total dependent methamphetamine users (Degenhardt et al., 2016a) gives an estimate of either **85,184** or **120,854** children resident with parents who are dependent methamphetamine users (Table 12.2).

Table 12.1: Family structure of weekly methamphetamine users in NDSHS

Family structure of respondent	Number of persons
Single with dependents	7,606
Couple with dependents	8,056
Parents with non-dependent children	2,903
Single without kids	11,263
Couple without kids	4,038
Other	18,607
Total responses	52,472
No data on family structure	4,179
Total weekly users	**56,651**
Number of resident partners of dependent methamphetamine users, NDSHS estimate of dependent users	**14,997**
Experimental estimate of the number of resident partners of dependent methamphetamine users, Degenhardt et al. 2016a estimate of dependent users	**45,728**

Source: (Australian Institute of Health and Welfare, 2014a)

Table 12.2: Resident children of weekly methamphetamine users

	NDSHS estimate of dependent users	Experimental estimate using Degenhardt 2013 estimate of dependent users
Total number of resident dependent children (NDSHS approach 1)	30,161	85,184
Total number of resident dependent children (NDSHS approach 2)	42,790	120,854

Sources: (Australian Institute of Health and Welfare, 2014a); (Degenhardt et al., 2016a)

12.3 Quantifying the Impact on Family Members

Whilst there is broad consensus that there are substantial impacts on resident family members, there is less consensus on how to quantify them than is the case for the quality of life impacts on the dependent substance users themselves. Quality of life impacts are typically quantified through one of two measures of the number of health adjusted years of life lost to a condition, either a Disability Adjusted Life Year (DALY) or a Quality Adjusted Life Year (QALY). DALYs measure healthy years of life lost due to a disability (e.g. a year of life lived with perfect health has a DALY of 0, one with an impairment that reduces the quality of life by 60% has a DALY of 0.6) whereas QALYs measure the quality adjusted life years lived (so a year of life lived with perfect health has a QALY of 1, and one lived with an impairment that reduces the quality of life by 60% has a QALY of 0.4). In this sense, the two measures are simply inverses of one another, however differences in the ways the values for health states are elicited, the way the health state is assumed to change over time, and the way underlying expected health without the condition are treated mean although they are each seeking to assess the same underlying concept, they are likely to arrive at somewhat different estimates of the impact on quality of life. DALYs are generally preferred for burden of disease studies (and, for example, are used in the WHO's Global Burden of Disease studies). For this reason DALY estimates have been preferred to QALY estimates in this study.

Whilst DALY estimates exist for substance dependence, and substance use disorders, we are not aware of any specific estimates of the quality of life impact on partners or dependent children.

Mortimer and Segal recommend using the estimate for the quality of life impact of being a dependent substance user for the impact on resident members of the substance user's family (Mortimer and Segal, 2006). The best available estimate of the DALYs lost due to dependent methamphetamine use is 0.191 (Degenhardt et al., 2013) (estimate adjusted down to reflect the share of asymptomatic dependent users; for symptomatic dependent users, the DALY lost estimate is 0.353). See Chapter 13 for more details. So if Mortimer and Segal's approach were to be followed this would be the DALY used for resident family members.

Other studies that have attempted to quantify the impact on those connected with substance users have tended to suggest the average impact may be somewhat lower than on the substance user themselves. Laslett et al. estimated the quality of life impact of being affected "a lot" by another's alcohol use was equivalent to a QALY of 0.076 (Laslett et al., 2010). This can only be roughly compared to the estimated 0.388 DALY estimate for moderate alcohol dependence in the 2010 GBD study (Mathers and Stevens, 2013), but if it was converted to a DALY using the rough conversion factor developed by Sassi (2006), and it is assumed that those affected were all 35 year olds, then the Laslett et al. estimate would be roughly equivalent to 0.108 DALYs, or roughly one third of the DALY for the dependent user. It should be noted that the Laslett et al. estimates are not restricted to those living with the dependent user nor wholly related to those with alcohol dependence, so they are not necessarily indicative of the scale of impact on resident family members of dependent users.

Salize et al. (2013) estimate that the impact on resident adults of successful substance use treatment for adults is equivalent to 0.108 QALYs gained. Again, as this is a QALY, it is not directly comparable to the DALY for moderate alcohol dependence, however using the rough conversion factor developed by Sassi (Sassi 2006), the DALY averted for a 35 year old family member would be roughly 0.154, or almost half the DALY for moderate alcohol dependence (0.388 DALYs).

Casswell et al. assessed the quality of life index of exposure to a heavy drinker, although they did not estimate a DALY or QALY (Casswell et al., 2011). They found for the population with the greatest level of connection to a heavy drinker (largely domestic partners of the heavy drinker), the mean utility score in the EQ5-D scale of quality of life was 5.1 points lower (the scale goes to 100, the mean score for those with no exposure to a heavy drinker was 90.8, for those with the highest levels of exposure it was 85.7).

Given the findings of Laslett et al. and Salize et al., it appears likely that using the same impact on quality of life for affected family members as for the dependent substance user themselves is likely to overestimate the impact (Laslett et al., 2010; Salize et al., 2013). Instead we have used a DALY equal to one third of the dependent user DALY for the resident partners of dependent methamphetamine users (reflecting the approximate ratio of the DALY derived by Laslett et al. for harm to others and that of a moderate dependent user), and half of DALY for a dependent methamphetamine user for the resident children of dependent methamphetamine users (reflecting the approximate DALY derived from Salize et al. for the implied harm to the family of a dependent user), although we acknowledge the somewhat arbitrary nature of these allocations. The estimated DALYs are shown in Table 12.3.

Table 12.3: Experimental estimate of DALYs per resident partner and child of dependent methamphetamine users

Basis for estimate	Resident partners	Resident dependent children
Based on Degenhardt et al. 2013 estimate of a lost DALY of 0.191 for dependent methamphetamine use	0.064	0.096

Sources: (Australian Institute of Health and Welfare, 2014a); (Degenhardt et al., 2016a), authors' calculations
Note: calculations for table 12.4 used non-rounded values from table 12.3

Scaling these up to the estimated populations for the resident partners and resident children gives an estimate of 3,052 years of life lost to disability (YLD) in 2013/14 due to the quality of life impacts on the partners of dependent methamphetamine users, with a further 8,135 to 11,542 YLD lost due to the impacts on the resident children of dependent methamphetamine users (Table 12.4).

Table 12.4: Experimental estimate of total years of life lost to disability due to the quality of life impact on the resident partners and children of dependent methamphetamine users, 2013/14

Basis for estimate	Resident partners	Resident children (approach 1)	Resident children (approach 2)
Based on Degenhardt et al. 2013 estimate of a lost DALY of 0.191 for dependent methamphetamine use	3,052.4	8,135.0	11,541.5

Sources: (Australian Institute of Health and Welfare, 2014a); (Degenhardt et al., 2016a), authors' calculations

These estimates may understate the costs of methamphetamine use to family members as they do not include the costs to parents of resident children who are dependent methamphetamine users, nor do they include the quality of life impacts on non-resident family members.

12.4 Intangible Cost to Family Members

The next step of the analysis of the intangible costs to the families of dependent methamphetamine users is to value these YLDs. Valuing YLDs is not without controversy (Baker et al., 2010; Dolan, 2010; Donaldson et al., 2011; Miller and Hendrie, 2011). The most straightforward approach (used, for example, in Moore (2007) and Nicosia et al., (2009), and recommended for use in Australian Government cost benefit analyses by Abelson (2008)), is to assume the value of a YLD equals that of a statistical life year. The value of a statistical life year is typically calculated by making an assumption of the average years of life remaining for the individual whose behaviours gave rise to the value of a statistical life estimate (typically assumed to be 40 years) and then annualise using the same approach used to calculate the annual payment for an annuity of a given total value. For example,

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

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 7%
years = assumed average years of life remaining at the time of the study for the sample used to derive the VoSL estimate.

The limitation of this simple approach is that research has shown the value of a life year is contextual, e.g. it can depend heavily on factors such as age, health state, expected years of life remaining, ability to pay, and individual views on optimal distribution of resources through the life cycle (Baker et al., 2010; Dolan, 2010; Donaldson et al., 2011). The prospective expressed willingness to accept less years of life in exchange for avoiding various health conditions or impairments also often appears too high given the degree of adaption observed in individuals with those forms of impairment (Dolan, 2010).

For this reason it is often maintained that accurate estimates of DALYs/YLDs can only be obtained through specific studies of the preferences of the population of interest. However, such studies are typically very time intensive and require substantial resources to implement. As such, they are ill suited for public policy analysis. There is also the concern that in adopting 'bespoke' values for a YLD or DALY, the difference in valuation may be driven by sampling error in the study rather than any difference in the underlying "true" value, as well as creating an inconsistency between the way in which averted deaths are valued compared to averted years of healthy life lost to disability. For these reasons a VoSLY based estimate has been used in this study to value years of life lost to disability.

Extracting the value of a *single year* of life from Abelson's value of a statistical life estimate ((Abelson, 2008), see section 6.3) gives a VoSLY, and therefore a value per YLD, for 2013/14 of $281,798. Plausible bounds can be placed on the value per YLD by using the implicit threshold value per DALY used for PBS approval of $45,000 as a lower bound (Community Affairs References Committee, 2015; Harris et al., 2008) and the VoSLY derived from extracting the value of a single year of life from the value of a statistical life used by the US Department of Transport (2015), $841,393, as an upper bound.

Applying these values to the estimated years of life lost to disability amongst the resident partners of dependent methamphetamine users gives a total cost of between $137 million and $2,568.2 million (Table 12.5). Our central estimate is the value calculated using the Abelson VOLSY, **$860.1 million**.

Table 12.5: Experimental estimate of the cost of DALYs lost due to the quality of life impact on the resident partners of dependent methamphetamine users, 2013/14 $million

Basis of VoSLY estimate	Implied PBS threshold ($000,000)	Abelson 2008 ($000,000)	US DoT ($000,000)
Based on Degenhardt et al. 2013 estimate of a lost DALY for dependent methamphetamine use (0.191)	137.4	860.1	2,568.2

The estimated cost of the quality of life impacts on the resident children of dependent methamphetamine users is estimated to be between $443 million and $9,711 million (see Table 12.6). Our central estimate is the average across the estimated number of children using the Abelson VOLSY, **$2,772.4 million**.

Table 12.6: Experimental estimate of the cost of DALYs lost due to the quality of life impact on the resident children of dependent methamphetamine users, 2013/14 $million

Source of VoSLY estimate	Implied PBS threshold ($000,000)	Abelson 2008 ($000,000)	US DoT ($000,000)
Based on Degenhardt et al. 2013 estimate of a lost DALY of 0.191 for dependent methamphetamine use, 85,184 resident children	366.1	2,292.4	6,844.8
Based on Degenhardt et al. 2013 estimate of a lost DALY of 0.191 for dependent methamphetamine use, 120,854 resident children	519.4	3,252.4	9,710.9
Average	442.7	2,772.4	8,277.9

Table 12.7: Summary table Chapter 12 costs

Source of VoSLY estimate	Implied PBS threshold ($)	Abelson 2008 ($)	US DoT ($)
Cost of quality of life impact on resident partners of dependent methamphetamine users	137,356,026	860,147,401	2,568,229,753
Cost of quality of life impact on resident children of dependent methamphetamine users [a]	366,076,551 to 519,368,254	2,292,435,243 to 3,252,374,639	6,844,757,531 to 9,710,946,416
Total cost to families [a]	**503,432,576 to 656,724,280**	**3,152,582,643 to 4,112,522,039**	**9,412,987,284 to 12,279,176,169**

[a] Costs are presented as a range to reflect the two estimates of the number of children resident with a methamphetamine user

12.5 Limitations and Recommendations

The scale of the quality of life impact on families (and the best approaches to ameliorating this impact) is poorly understood and as such these estimates are subject to a greater degree of uncertainty that for the other costs considered in this report. None-the-less, the nature of the impacts observed on families, and the estimated number of persons affected, suggests that to not include the impact on families would be to underestimate the cost of substance use to society.

In 2008, it was estimated that the costs to affected family members of a dependent drug user were US$25,000 (Copello et al., 2010; Orford et al., 2013) (excluding "unhappiness" caused to partners or children). Purchasing-power-parity adjusted to Australian dollars (Organisation for Economic Cooperation and Development, 2016b) gives a total of $36,975, which in 2014 terms is $42,747 (Australian Bureau of Statistics, 2016b). On this basis, our "Abelson" estimate for partners of $18,810 per partner ($860,147,401 / 45,728) and $26,911 per child ($2,292,435,243 / 85,184) appears conservative.

These estimates only include costs to families of dependent methamphetamine use; it is likely that there would be some costs to the families of regular but not dependent methamphetamine users.

These estimates do not include the costs to parents of resident children who are dependent methamphetamine users, nor do they include the quality of life impacts on non-resident family members.

It is not possible to exclude the potential for there to be some double counting between these estimates and the estimated victim of crime costs. The key unknowns are the extent to which domestic violence perpetrated by dependent methamphetamine users is captured in the ABS' Victims of Crime survey, and the extent to which these estimates of lost DALYs from being a resident family member of a dependent methamphetamine user incorporate the quality of life impacts of domestic violence.

Other impacts on families, such as the cost of relationship breakdown, and the quality of life impact of being in out of home care for children removed because (at least in part) of a parent's methamphetamine use, were not able to be quantified. As indicated, these estimates are tentative in nature and are not included in our main estimate.

CHAPTER 13: INTERNALITIES FOR METHAMPHETAMINE USERS

Steve Whetton & Rebecca McKetin

13.1 Background

As noted in Chapter 2, economic analyses do not usually include social cost harms from consumption that are borne by the user themselves. Instead, it is assumed that these harms arising from consumption have been taken into account by potential users along with the purchase price when making consumption decisions, with the satisfaction resulting from consumption outweighing all the costs.

However, this traditional model relies on the assumption that decisions are being made by rational, fully informed consumers with time consistent preferences. However, it possibly does not take into account the immediate consequences (e.g. sought after effects) and the observation that many of the adverse consequences are less immediate. If these assumptions do not hold, which is arguably the case for substances that cause dependence, it can no longer necessarily be asserted that current consumption levels will maximise the lifetime utility of use to the dependent user. As such, the costs arising from dependence can justify public policy responses to reduce consumption to its optimal level, whether by decreasing availability, increasing price, or providing information to users and potential users. As the costs to a dependent user are not strictly social costs, in that they are borne by the users themselves, they are often referred to as “internalities” or “private costs” – costs to the user that were not factored into the consumption decision.

One approach often used is to include costs to consumers related to dependent use but to disregard costs incurred by non-dependent users, as the four departures described in section 2.3 from a rational utility maximising consumer are likely to be greatest in the presence of drug dependence. In some cases, an attempt is made to identify the level of consumption (and therefore harm) that these consumers would face if they were not dependent (see, for example, the Productivity Commission’s inquiry into the social costs of gambling in Australia (Productivity Commission, 1991)). In other cases, all costs borne by dependent users are treated as internalities.

As the broader approach in this study is to use a counterfactual of no harms from methamphetamine, all costs to dependent users are potentially in-scope as internalities.

There is, however, a second potential problem in including internalities in the analysis, namely the extent to which they create the potential for double counting. For example, there is evidence that at least some of the Value of a Statistical Life represents the potential loss of future earnings (Tilling et al., 2012). As such, if the value of a statistical life is used in the social cost estimate and the lost lifetime earnings to the dependent substance user is included as an internality then there will be at least some double counting.

A similar problem potentially arises within the set of internalities, as we do not have enough information on what negative impacts fed into the DALYs lost estimates for dependent methamphetamine use (see, for example, (Degenhardt et al., 2013; Pyne et al., 2008)) to be confident that all harms that fall on the user themselves and are captured in our internalities calculation are excluded from the DALY. As such, we recommend the use of ***either*** the quality of life impact ***or*** the estimated internalities + the expenditure by dependent users on methamphetamine if the reader is interested in the cost of methamphetamine use to dependent methamphetamine users. Nevertheless, we recognise that this may underestimate the scale of the internalities.

13.2 Estimated Quality of Life Impact of Dependent Methamphetamine Use

As with other forms of intangible cost, the quality of life lost as a result of methamphetamine dependence can be measured using a disability adjusted life year (DALY) fraction lost. This represents the difference in quality of life from a year in full health. So if a condition results in a DALY of 0.1, then on average a person with that condition would be expected to have a quality of life equal to 90% of that of a person in full health.

In the case of methamphetamine dependence, the best available estimate of the DALY is from Degenhardt and colleagues who developed estimates of the DALYs arising from various forms of dependent substance use (Degenhardt et al., 2013). Their estimate of the DALY for dependent methamphetamine use was 0.353, however they adjusted this down to reflect an assessment that, over the course of a year, dependent substance users will move in and out of dependency (or at least have fewer active signs of dependence). In the case of dependent methamphetamine use, the assumption made in the analysis was that over the course of the year, 44% of the time would be spent as asymptomatic in terms of dependency, giving an estimated adjusted DALY of 0.191.

An alternative set of estimates was made by Pyne and colleagues, who estimated the QALY lost from symptomatic dependence as either 0.126 or 0.141, depending on the preference weighting structure used in the survey (Pyne et al., 2008). It should be noted that as the Pyne et al. estimates are a QALY, they are not directly comparable with those of Degenhardt et al. (2013). However, if it was assumed that a typical dependent methamphetamine user was 35 years old, and the QALY estimate from Pyne et al. was converted to a DALY using the rough conversion factor developed by Sassi (2006), then their estimate would be a DALY of between 0.179 and 0.201, which is consistent with the adjusted estimate from Degenhardt and colleagues.

As we prefer DALY based estimates of quality of life impacts in this study, and as the Degenhardt et al. estimates were developed as part of the WHO's Global Burden of Disease study, we have used them for this Chapter. Applying the adjusted DALY of 0.191 to the estimated 160,000 dependent methamphetamine users in Australia in 2013/14 (Degenhardt et al., 2016a) gives an estimate of years of life lost to disability (YLD) due to methamphetamine dependence of more than 30,000 (see Table 13.1).

Table 13.1: Estimated total years of life lost to disability due to methamphetamine dependence, 2013/14

Basis for estimate	YLD
Based on Degenhardt et al. 2013 estimate of a lost DALY of 0.191 for dependent methamphetamine use	30,560

Source: (Australian Institute of Health and Welfare, 2014a), calculations by the authors

We used the same method and assumptions as detailed in Section 12.4 and thus arrived at the same starting values for our estimates. We annualised Abelson's value of a statistical life estimate (2008) to obtain a value per DALY lost, for 2013/14 of $281,798. Similarly, as in Section 12.4, plausible bounds were placed on the value per DALY lost by using the implicit threshold value per DALY used for PBS approval of $45,000 as a lower bound (Community Affairs References Committee, 2015; Harris et al.,

2008) and the VoSLY derived from an annualisation of the value of a statistical life used by the US Department of Transport (2015) $841,393 as an upper bound.

Applying these values to the estimated YLDs lost to dependent methamphetamine use gives a total cost of between $1,375 million and $25,713 million (Table 13.2). Our central estimate is the value calculated using the Abelson VoLSY, **$8,611.7 million**.

Table 13.2: Estimated cost of DALYs lost due to the quality of life impact of dependent methamphetamine use, 2013/14 $million

Basis of VoSLY estimate	Implied PBS threshold ($000,000)	Abelson 2008 ($000,000)	US DoT ($000,000)
Based on Degenhardt et al. 2013 estimate of a lost DALY for dependent methamphetamine use (0.191)	1,375.2	8,611.7	25,713.0

Source: (Degenhardt et al., 2013)

13.3 Estimated Expenditure on Methamphetamine by Dependent Users

Spending by dependent methamphetamine users, to the extent that it is as a result of the dependence, can be thought of as an internality.

Spending on methamphetamine for dependent use was estimated from a survey of regular methamphetamine users in Sydney (McKetin et al., 2005a). Participants were asked “How much did you spend on methamphetamine in the past week?” Expenditure estimates were extracted for participants who scored 4 or greater on the Severity of Dependence Scale (score of 4+), with this corresponding closely to a diagnosis of methamphetamine dependence (Topp and Mattick, 1997). The mean spending on methamphetamine in the past week was $161.47. The distribution of spending was highly skewed with at least 25% of respondents spending nothing in the past week, and the highest spending 5% of respondents spending more than $400 in the past week.

Converting this mean weekly expenditure to an annual estimate and then applying it to the national estimate of 160,000 dependent methamphetamine users gives a central estimate of expenditure on methamphetamine by dependent users of **$1,343.4 million**. The upper and lower bounds of the 95% confidence intervals (calculated using a Poisson distribution, as the underlying responses were strongly skewed) are $1,327.6 million and $1,359.4 million respectively.

13.4 Estimated Internalities

There are a number of cost items over the course of this report that have been excluded from our central analysis as they were costs borne by the methamphetamine user themselves rather than by some other member of society, and therefore represented private rather than social costs. However, the distinction between private and social costs becomes much less clear in the case of substances that can cause dependence, as it can be argued that the consumption by the dependent user does not represent a rational weighing up of the costs and benefits of consumption, but rather is a consequence of the dependence itself (see Section 2.4). If the assumption of rational utility maximisation by the dependent consumer does not hold, then costs arising as a result of the dependence do not truly represent private costs, but nor are they strictly a social cost. Instead, these costs are best thought of as *internalities*, that is, cost borne by the dependent users themselves but which are not taken into account when the dependent users determine their optimal consumption levels.

Forms of internality that were able to be quantified as part of this project include:

- GP costs borne by the individual;
- Lost household income due to premature methamphetamine attributable mortality;
- Lost household income due to detention in the corrections system; and,
- Employee costs of methamphetamine attributable workplace injuries not reimbursed through workers' compensation schemes.

It also likely that there were some costs to the individual from methamphetamine attributable road crashes that were not compensated for through the relevant insurance schemes, however the available data did not allow these costs to be quantified. Similarly, Torok et al. reported that methamphetamine users were much more likely to be a victim of crime than average (Torok et al., 2008), but it is not possible to confidently quantify these costs as we are not able to determine the proportion of cases in which the perpetrator was also a methamphetamine user.

13.4.1 GP costs

For those individuals whose GP visits are not being bulk-billed, there will be co-payments that will be borne by the methamphetamine user. It is estimated that dependent methamphetamine users made 678,262 *excess* GP visits in 2013/14 (see Table 5.15). The estimated mean co-payment with respect to GP visits is $30.26 (Medicare Australia, 2016). This gives an estimated total internality from excess GP visits of **$20.5** million, with 95% confidence intervals of $14.8 million and $28.2 million.

13.4.2 Lost household income from premature mortality

In Chapter 6, only those costs of lost income from premature mortality borne by employers and government have been included as a social cost. The 56% of lost income that was borne by the household of the deceased worker was not included in the social cost calculation. Under the (very restricted) base case estimate, which only includes the costs incurred in 2013/14 for those who died in 2013/14, the cost to the *household* of premature mortality is estimated at **$9.7 million**. Under the upper bound calculation of premature mortality, which costs premature deaths at their present value assessed over 30 years, and also includes an estimate for premature methamphetamine attributable homicide deaths and a broader estimate of suicide/intentional self-harm deaths, gives an estimated cost to the methamphetamine user of $196.5 million.

13.4.3 Lost household income due to detention in the corrections system

In Chapter 7, only those costs of lost income from detention in the corrections system due to methamphetamine attributable crime borne by employers and government have been included as a social cost, and lost household income for methamphetamine users due to foregone benefits payments were recorded as a benefit to society. The 56% of lost income that was borne by the household of the deceased worker was not included in the social cost calculation.

The total income foregone by methamphetamine users due to detention for methamphetamine attributable crime is estimated to be **$176.2 million** under the central estimate of methamphetamine attributable crime. The lower bound estimate of the internality from lost income as a result of detention is $69.2 million, and the upper bound is $222.0 million.

13.4.4 Net costs to employees of methamphetamine attributable workplace injuries.

The estimated total costs to employees (net of any compensation payments from workers' compensation insurance schemes) of methamphetamine attributable workplace injuries is **$558.4 million**. The basis on which these costs were calculated is detailed in Chapter 10B.

Table 13.2: Summary of Chapter 13 costs, 2013/14 $million

	Central estimate ($)	Low bound ($)	High bound ($)
First approach			
Cost of quality of life impact on dependent methamphetamine users	8,611,742,373	1,375,200,000	25,712,956,846
Total first approach	**8,611,742,373**	**1,375,200,000**	**25,712,956,846**
Second approach			
Annual expenditure on methamphetamine by dependent users	1,343,430,400	1,327,589,120	1,359,423,104
GP visits	20,524,208	14,836,660	28,160,380
Lost household income from premature mortality	9,733,075	9,733,075	196,494,934
Lost household income from imprisonment	176,222,020	69,218,582	222,031,845
Employee costs of workplace injuries	558,400,000	558,400,000	558,400,000
Total second approach	**2,108,309,703**	**1,979,777,437**	**2,364,510,263**

13.5 Limitations and Recommendations

The most significant limitation in assessing the internalities experienced by dependent methamphetamine users is in identifying the extent to which the internalities excluded from individual cost items are incorporated in the DALY for dependent methamphetamine use estimated by Degenhardt and colleagues (Degenhardt et al., 2013), or to what extent they are in addition to it. As with Chapter 12, these more speculative estimations are not included in the overall costings.

CHAPTER 14: CONCLUSIONS

Robert J Tait & Steve Allsop

The objective of this project was to provide an estimate of the social cost of methamphetamine use to Australia in 2013/14. Clearly, the costs associated with crime, including policing, corrections and the costs to the victims of crime, dominate this estimate of costs even though we were unable to quantify costs for juvenile offenders. Nevertheless, methamphetamine use clearly impinges on a broad range of other areas, including health, workplace productivity and accidents. Those affected include the people who use methamphetamine, partners, children and other family members, police and emergency services as well as the broader community.

Two areas were not included in our overall social costs, but are worthy of research, policy and intervention development. These areas are the impacts of drug dependence on the individual themselves and the harms of drug dependence to others. In the latter, although we focused on the effect on resident partners and children, there are also likely to be further harms, such as the impact of methamphetamine dependent children on parents, and more widely within family groups and across close-knit communities. Also, practical issues prevented estimation of the unique costs for rural and remote areas. If estimates for these were included, they might significantly increase the overall cost of methamphetamine use beyond that estimated from the more clearly delineated, better established or readily assessable harms.

Social costs studies are predicated on the assumption that costs can be assigned to a factor and that removing that factor will remove the costs. However, with substance use, history would suggest that the possibility of switching to other drugs exists if one substance is removed from the market. For example, a previous significant reduction in heroin availability was associated with a decline in heroin use, which was at least partially offset by an increase in stimulant use (Degenhardt and Day, 2004). Degenhardt and Day (2004) observed that, when heroin use declined one and a half decades ago, while both fatal and non-fatal heroin overdoses dropped, other (largely non-fatal) overdoses increased. Also, while there were no definitive changes in crime, there was some indication of increased acquisitive crime and illicit sex work (Degenhardt and Day, 2004). Thus, it should not be assumed that removing or reducing the availability of methamphetamine in itself would automatically reduce the total economic burden associated with drug consumption.

14.1 Cost of Illness Studies

The appropriateness of cost of illness studies for substance use, the harms and costs to include, and the monetary values to assign to them, have been the subject of considerable debate (Jarl, 2010; Melberg, 2010; Nicosia et al., 2009). We took as a starting point that in addition to the clear tangible harms, we should also estimate the intangible harms both to the dependent user and also to partners and children of dependent users. Previous studies have included intangible costs to the user (Collins and Lapsley, 2008; Moore, 2007; Nicosia et al., 2009) and indeed intangible harms to others (Laslett et al., 2010). However, we are not aware of an evidence base allowing costings regarding the harms of illicit drug dependence *per se* on family members.

Deciding on an appropriate value for a statistical life associated with deaths or disability will have a major impact on the overall assessment of the cost of methamphetamine use. These, and/or the cost of a life year, were used in Chapters 6, 7, 12 and 13. At the low end of the range, although not strictly a value of a statistical life year, there is an implied value from the decisions that are made in approving new medications for PBS listing of about $45,000 (Community Affairs References Committee, 2015; Harris et al., 2008). A report on the economic impact of domestic violence used a value of $60,000 in 2003 (Access Economics, 2004). The Australian Government best practice guidelines recommended, in 2014 dollars, a level of $182,000 (Department of the Prime Minister and Cabinet, 2014). This figure was based on an analysis by Abelson, which in 2007 terms provided a figure of $151,000. However, rather than using the CPI increase since 2007, the value we used was the growth rate of nominal GDP (e.g. we assumed that society would be willing to spend a consistent share of its resources to avert one lost life year). This gave a value of $281,798, which is still lower than international comparisons that derive values from meta-analyses of wage premium studies (e.g. $841,393) (US Department of Transportation, 2015).

14.2 Comparability with Previous Studies

An earlier social cost study estimated that in 2004 the use of amphetamine cost Australia $3,731 million, divided into costs for dependent and non-dependent users (Moore, 2007). This included $3,039 million in crime costs and $341.5 million in health costs. Adjusting for CPI (Australian Bureau of Statistics, 2016b) in 2013/14, the same number of dependent and non-dependent consumers would cost **$4,851.0** million (Table 14.1). Substituting the current number of dependent users (160,000) and regular non-dependent users (108,000) results in an estimated total cost of **$9,422.0** million (Table 14.2). Another study in 2004/05 estimated that the social cost of all illicit drugs was $8,189.8 million (Collins and Lapsley, 2008). CPI adjusted to 2013/14, this gives a total of $10,531.2 million for all types of illicit drugs (Australian Bureau of Statistics, 2016b).

While comparisons between cost of illness studies over time are problematic, international comparisons are subject to even greater levels of uncertainly due to differences in the cost structures between countries, prevalence of use, legal sanctions and so forth (Jarl, 2010). Noting this critical caveat, in 2005, the social cost of methamphetamine use in the US was estimated at US$23,384.4 million, comprising tangible costs of US$10,787 million and intangible costs of US$12,597 million. These figures were converted to 2005 Australian dollars using data on the average purchasing-power-parities exchange rate between USD and AUD for 2005 (Organisation for Economic Cooperation and Development, 2016b). These were then CPI adjusted to June 2014 values (Australian Bureau of Statistics, 2016c). This equated to an overall cost of $41,445.92 million comprising tangible social costs of $19,022.66 million plus intangible costs (internalities) of $22,423.26 million.

In terms of 2014 Australian dollars, the overall cost per dependent user (n=314,273) (Nicosia et al., 2009) equated to $131,879 or $60,529 in tangible costs. In comparison, using the total updated costs from Moore (2007) in Table 14.2, the cost per dependent user was $58,888. Considered against the current study with a total cost of $5,023.8 million, the figure is $31,399 for each dependent user. Overall, the total cost of $5,023.8 million is just over 50% of the CPI adjusted figure for the Moore study (2007) applied to the current population of methamphetamine users. However, the objective of this study was to ascertain the costs for a single year, except those relating to premature mortality, rather than the lifetime costs arising from a single year. Thus, it is unsurprising that the estimate for the current report is substantially lower than the updated/adjusted estimated from 2005.

Table 14.1: Social costs for Moore (2007) CPI adjusted to 2013/14 costs

	2004 users	2004 cost $	2004 CPI adjusted cost to 2013/14 $	Number of 2004 users at 2013/14 cost ($000,000)
Non-dependent user	495,500 [a]	926	1,204	596.6
Dependent user	73,257	44,665	58,075	4,254.4
Total				**4,851.0**

[a] Derived from the relevant NDSHS of last 12 month use of amphetamine minus the estimated dependent users not identified by the survey (36,500)

Table 14.2: Social costs for Moore (2007) CPI adjusted to 2013/14 and applied to 2013/14 estimated users

	2013/14 users	2004 CPI adjusted cost to 2013/14 $	2013/14 cost ($000,000)
Regular non-dependent user	108,000	1,204	130.0
Dependent user	160,000	58,075	9,292.0
Total [a]	**268,000**		[b] **9,422.0**

[a] Inclusion of the 240,995 occasional users adds $290.2 million: total $9712.2; [b] Overall cost per dependent user = $58,888

14.3 Known Unknowns and Unknown Unknowns

There are areas where we know that costs exist but were unable to obtain the necessary information to attach a value. For example, there are clear costs to maintaining our international borders and the flow of goods across them. However, we were unable to identify confidently the proportion of the Border Force budget that was involved in the control of methamphetamine or, for that matter, the control of all illicit drugs (although an estimate is included in the upper bound estimate of crime related costs). Our estimates of methamphetamine attributable mortality are also likely to understate the costs, as at the time of writing a substantial proportion of cases in the NCIS dataset were yet to be finalised. There are also likely to be costs we are simply unaware of. Our limited knowledge concerning the use and harms of methamphetamine, means there are potential future costs we may only become cognisant at some later stage. Therefore, the values reported here cannot be regarded as definitive or necessarily comprehensive.

Many of the known knowns in this field are subject to high levels of uncertainly or imprecision over the estimates of the costs associated with them (Table 14.3). For example, the estimation of treatment costs were based on limited cost information, the estimated police costs relied on a range of assumptions, and the court costs were based on DUMA attributable fractions associated with the offender's most serious offence and, as such, were a distal measure of the time and resources required to complete a court case. Nevertheless, we attempted to identify the best data available and the most appropriate means of estimating the applicable costs. This has required the use of numerous different datasets, each of which will have unique caveats concerning its limitations and interpretation, in particular regarding the comprehensiveness of the data and the precision with which methamphetamine events can be identified. We were consistently mindful not to create pretence of precision where none was possible, and maintained a conservative approach to our data and analyses, with the exception of Chapter 12, which is more speculative.

Table 14.3: Summary of methamphetamine attributable costs

Domain	Best estimate ($000,000)	Low bound	High bound
Prevention, harm reduction & treatment	110.7	102.8	156.3
Health care (e.g. hospitals, GPs ambulance)	200.1	178.8	237.0
Premature mortality	781.8	[a] 781.8	[b] 1,404.1
Crime (including police, courts, prisons & victims)	[c] 3,244.5	[c] 1,547.3	4,314.6
Child maltreatment & protection [d]	260.4	229.1	291.7
Clandestine laboratories & production	11.7	4.3	[f] 11.7
Road crash costs	125.2	30.5	281.9
Workplace accidents & absenteeism	289.4	259.5	319.5
Total	[e] **5,023.8**	**3,134.1**	**7,016.8**

[a] No lower bound estimated – see Chapter 6 for details; [b] if the Abelson (2008) value of a statistical life is used, if the US Department of Transport (2015) VoSL is used then the upper bound is $3,750.3; [c] costs relating to border protection, and AFP activities excluding community policing in the ACT are not included in the best estimate due to uncertainty about their level, an estimate is included in the upper bound cost estimate; [d] intangible costs related to child maltreatment and neglect are not included in the main estimates, they are however included in the experimental estimates of costs to others, see Section 14.4; [e] without rounding $5,023,795,786: [f] High bound estimate – duplicated central estimate see Chapter 9 for details

14.4 Data Availability and Quality

In summarising the costs captured by the analysis, it is also important to remember what is not in this apparently compressive list (Table 14.3) in addition to the caveats in the footnotes. In conducting a systematic search (Appendix 1), data from the US showed that the presence of clandestine laboratories impact on neighbouring property prices, but we were unable to identify any information with which to apply this to Australian real estate prices. In Chapter 5, a range of health conditions were identified where methamphetamine use is likely to be a contributory cause (e.g. bacterial endocarditis) but where we were unable to obtain an AF to enable these cases to be apportioned correctly; as a result they were excluded. Similarly, in Chapter 7, we were unable to assign a fraction of juvenile crime costs to methamphetamine use due to the limitations of the data.

We captured road crashes and work related injuries but other accidents or injuries were not identified. There are also other work related costs in terms of reduced productivity for methamphetamine users in employment, and apparent much lower employment rates for regular and dependent users. There are also internal costs though reduced employability for those with criminal records. Finally, it should be reiterated that other than premature mortality, these costs relate to a single year and do not address the long-term consequences such as post-injury care/rehabilitation or future impacts of childhood neglect. These selected examples illustrate the breadth of areas effected by methamphetamine use where costs were not assigned but may become possible in future studies.

Across all areas of the report, access to valid and precise data was identified as a major impediment to estimating the cost of methamphetamine use. Some areas, such a hospital codes that use international classification schemes, are likely to be impervious to the changes required to improve our estimates. Other areas are more amenable to change. For example, minimum data requirements could be used to modify the data reported from child protection cases to provide greater clarify on the role of methamphetamine or other drug use. As noted in Chapter 9, in the US the Hazardous Substance Emergency Events Surveillance system and the Toxic Substance and Disease Registry provide a way of identifying toxic hazards – in this instance relating to clandestine laboratories – but with broader potential around other contaminated sites in Australia. Therefore, there is the possibility of improving the data to increase the precision of cost estimates of substance use.

Among illicit drug consumers, poly-drug use is ubiquitous, which may including the traditional licit substances (e.g. tobacco, alcohol), misuse of medications (e.g. benzodiazepines) or other illicit drugs. This complexity creates challenges in providing accurate estimates of the harms arising from a particular substance. Furthermore, even if data were available on a cohort who solely used methamphetamine, the extent to which findings would generalise to the wider methamphetamine using population would be questionable. Based on our experience of undertaking this research, we believe there is a strong case for any future studies into the social costs of illicit substances to consider them all jointly, as by doing so the risk of either double counting harms due to polysubstance use, or missing harms, would be reduced.

14.5 Rural and Remote

The prevalence of methamphetamine use may be higher, at least in some, in rural and remote areas than in metropolitan Australia (Australian Institute of Health and Welfare, 2014a; Roche and McEntee, 2016), although limited data and likely large differences between communities make definitive statements problematic. Thus, we were unable to undertake an estimation of the specific additional costs that those living in these areas are likely to incur, for example, the additional costs in accessing treatment or other health services. Nevertheless, we did conduct qualitative interviews with service agencies and other stakeholders in two locations as a guide to future work. Even within single sites, there were marked disparities in the extent to which methamphetamine was seen as a problem, varying from virtually non-existent through to widespread significant impacts. Unsurprisingly, barriers to treatment were a common theme. While geographic isolation and the lack of specialist resources were expected, the issues of shame, privacy and stigma in accessing resources within the panopticon of a small community may be harder to address.

About 8% to 20% of the resident populations in the two qualitative research sites were Aboriginal Australians and both sites acted as service centres for outlying communities. Yet the project was not resourced to conduct culturally sensitive research across a broad range of Aboriginal Australian communities, therefore we have not speculated about the additional costs compared with non-Aboriginal Australians. The lack of quantified data on rural and remote areas is a clear limitation that requires addressing.

14.6 Tentative Costings and Internalities

As set out explicitly in Chapter 12, we undertook experimental costings on the harms that dependent use *per se* causes to partners and children living with a methamphetamine user, with the estimate ranging from $503.4 million to $12,279.2 million. Notably, this does not include other family members who could be impacted. Due to the uncertainty surrounding these estimates, they have not been included in the final total. There was also a concern that there is potential double counting within these figures – for example in the costs attributed to victims of sexual or other assault (see Chapter 7.7). Nevertheless, given the substantial harms and costs incurred by family members, this is a critical area for further research to develop sound methodological approaches, with clear application to other substance use disorders.

Chapter 13 provided two approaches to the estimation of the internalities of methamphetamine use: one based on the diminished quality of life suffered by dependent drug users ($8,611.7 million) and the other on the projected additional costs to dependent users ($2,173.1 million). While there is an argument that dependence on drugs can fall outside a rational decision making process that would allow all costs to the user to be offset by the perceived benefits, how those costs should be quantified remains open to debate. For example, in the second method, we included the cost of methamphetamine that others would exclude (Jarl, 2010) and we also did not include an offset for benefits or sought after effects to the user. Thus, it was deemed prudent to exclude internalities from the total costs.

14.7 Conclusions

Cost of illness studies such as this one do not provide evidence of what interventions should be deployed, for which intervention cost-effectiveness studies are more appropriate. They do, however, give an estimate of the magnitude of the costs associated with a factor. Our best estimate is that methamphetamine use cost Australia over $5,000 million in 2013/14, with a range of approximately $3,000 million to $7,000 million. We also provide preliminary estimates of a further $500 million to $12,000 million in costs to partners and children plus potentially $2,100 to $8,600 million in internal costs to methamphetamine users. Clearly, from the range of these estimates, there is considerable uncertainty as to the exact cost. Regardless of the precise figure, it is apparent that the harms and resultant costs of methamphetamine burden the social and economic fabric of Australia.

ABBREVIATIONS

ABS = Australian Bureau of Statistics
ADSS = Alcohol and Drug Services Study
AF = Aetiological Fraction
AFP = Australian Federal Police
AIC = Australian Institute of Criminology
AIHW = Australian Institute of Health and Welfare
AIVL = Australian Injecting and Illicit Drug Users League
AOD = Alcohol or other drug
AODTS NMDS = Alcohol and Other Drug Treatment Services National Minimum Data Set
AR-DRG= Australian Refined Diagnosis Related Groups
BBV = Blood Borne Viruses
BEACH = Bettering the Evaluation and Care of Health
BITRE = Bureau of Infrastructure, Transport and Region Economics
BOSCAR = Bureau of Crime Statistics and Research
CD4 = T lymphocytes cells
CPI = Consumer Price Index
DALY = Disability Adjusted Life Years
DATCAP = Drug Abuse Treatment Cost Analysis Program
DPP = Department of Public Prosecutions
DRG = Diagnosis Related Groups
DUCO = Drug Use Careers of Offenders survey collected by the AIC
DUI = Driving Under the Influence
DUMA = Drug Use Monitoring in Australia survey collected by the AIC
ED = Emergency Department
EHO = Environmental Health Officer
GBD = Global Burden of Disease
GDP = Gross Domestic Product
HIV = Human Immunodeficiency Virus
HVC = Hepatitis C Virus
ICD-()CM = International Classification of Mental and Behavioural Disorders (version number) – Clinical Modification
ICD-()AM = International Classification of Mental and Behavioural Disorders (version number) – Australian Modification
IDDR = Illicit Drug Data Report
MA = Methamphetamine
MATES = Methamphetamine treatment evaluation study
MDMA = 3,4-methylenedioxy-methamphetamine
MVA = Motor Vehicle Accident
NAPECDC = National non-admitted patient emergency department care
NCIS = National Coronial Information System
NHMD = National Hospital Morbidity Database
NDS = National Dataset for Compensation-based Statistics
NDSHS = National Drug Strategy Household Survey
NPV = Net Present Value

NSP = Needle and Syringe Programs
OECD = Organisation for Economic Co-operation and Development
PBS = Pharmaceutical Benefits Scheme
PGoA = Pharmacy Guild of Australia
PPY = Per Person Year
QALY = Quality Adjusted Life Years
RAND = RAND report 2009 (Nicosia et al., 2009)
Real = Rate of change after adjusting for the rate of inflation
RoGS = Report on Government Services, published annually by the Productivity Commission
RR = Relative Risk
SATCATT = Substance Abuse Treatment Cost Analysis Allocations Template
VoSL = Value of a Statistical Life
VoSLY = Value of a Statistical Life Year
WHO = World Health Organization
WTP = Willingness To Pay
YLL = Years of Life Lost

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APPENDIX 1 Chapter 2

Present Value (PV)

Where a cost is incurred at some point in the future, conventional practice is to discount it relative to a cost in the study year. This is done for several reasons. First, research consistently indicates that an average individual values a benefit received in the present more highly than one with an identical inflation adjusted value received in the future (this is known as the social rate of time preference). So, assuming a 1.5% interest rate, a typical individual would prefer $100 today to $101.50 in a year's time, even though their real value is identical. Second, as average real incomes are expected to grow into the future, benefits (or costs) that are identical in inflation adjusted terms will be less valuable in the future as they will represent a smaller impact on income. Finally, some jurisdictions (including Australia, but not the UK) build in an additional allowance in the discount rate to account for the inherent risk of any future benefit or cost actually being realised.

The present value of a benefit (cost) incurred in a particular year is calculated as the real value of the benefit (cost) divided by one plus the discount rate to the power of the number of years in the future the benefit is expected to be realised, i.e.:

$$PV_{y=n} = \frac{Benefit}{(1+r)^n}$$

Where the benefit (cost) will occur for a number of years, the PV for each individual year is summed together.

For Australian policy analysis, an annual real discount rate of 7% is recommended by the Commonwealth Department of Finance (Department of Finance and Administration 2006). The impact of a applying this 7% real discount rate for hypothetical benefits incurred in the future (in this case 5, 10, 15, 20, 25 and 30 years in the future from 2013/14) that have a constant real (inflation adjusted) value is illustrated in Table 1 below.

Causal Factors and Potentially Causal Factors

- Amphetamine intoxication
- Harmful use of amphetamines
- Amphetamine dependence syndrome
- Amphetamine withdrawal state
- Amphetamine withdrawal state with delirium
- Amphetamine psychotic disorder
- Amphetamine amnesic syndrome
- Residual and late-onset psychotic disorder attributed to amphetamine intoxication and withdrawal
- Other mental and behavioural disorder attributed to amphetamine intoxication and withdrawal

- Unspecified mental and behavioural disorder attributed to amphetamine intoxication and withdrawal
- Psychostimulant poisoning (the relevant ICD-10 code includes ecstasy as well as amphetamines).

Conditions linked to methamphetamine use through case studies and/or animal models include (Darke et al., 2008; English et al., 1995; Ridolfo and Stevenson, 2001):

- Cardiac arrhythmia*
- Cardio-toxicity*
- Ischaemic heart failure
- Respiratory failure*
- Seizures*
- Coronary artery disease*
- Tachycardia*
- Ischaemic stroke
- Haemorrhagic stroke
- Hypertension*
- Chest pains*
- Hepatitis A*, B* & C (risk caused by injecting drug use)
- Hepatitis A*, B* & C* (risk caused by increased rates of unprotected sex)
- HIV/AIDS (risk caused by injecting drug use and by increased rates of unprotected sex; in addition, there is also evidence that the use of methamphetamine increases the chance of seroconversion for a given level of exposure to the virus (Plankey et al., 2007))
- HIV/AIDS (risk caused by increased rates of unprotected sex)*
- STDs (risk caused by increased rates of unprotected sex)*
- Suicide/self-harm
- Depression
- Anxiety
- Neurotoxicity*
- Significant tooth decay "meth mouth"*
- Schizophrenia
- Road crash injuries/deaths
- Assaults/child abuse
- Infective endocarditis (risk caused by injecting drug use)*.

*** Not included in current analyses**

Systematic Search

Robert J Tait

The objective of this search was to update the evidence on the societal costs arising from the use of methamphetamine published since the RAND review's target year of 2005 (Nicosia et al., 2009) and to potentially identify new costs not previously included in the estimation. Updating the information is also important given the changes in the type of ATS available and, in particular, the consumption of the crystalline form of methamphetamine in Australia (Australian Institute of Health and Welfare, 2014a). Therefore, the review covers the period since the major RAND analysis of costs in 2005. However, the subsequent cost estimation will not be limited to these new data.

Method

In August 2015, we conducted a systematic search of the following electronic databases: Ovid SP (CAB Abstracts, Embase, Global Health, Medline 1996 to present, PsycINFO) and EBSCOhost (CINAHL, EconLit, Index to Legal periodicals and Books) using the search terms "Methamphetamine AND (cost of illness OR social cost$ OR economic cost$ OR economics, behavioural OR economic$ OR cost$ of crime OR crime cost$). The search was limited to 2006 onwards; there was no language restriction. We also used Google Scholar to search for "methamphetamine and economic costs" for the period 2006-current. From more than 10,900 results, the first 100 were inspected. We also hand searched references: additional papers or reports.

To be eligible, papers had to report on the social costs of methamphetamine use (e.g. not the cost to the user in obtaining drugs) and include internalities arising from dependent drug use. All study designs were eligible and we included 'grey' literature, such as government reports. As the objective was to update costs since the RAND report, the systematic search was for publication from 2006 onwards but hand searching also included reports pre-dating 2006 if they had not been cited in the RAND report (Nicosia et al., 2009).

Results

The search retrieved 177 non-duplicate items. After an initial inspection of the titles and abstracts, 137 were excluded (drug screening methods, ethnographic studies, animal studies) leaving 40 for full text inspection. Of these, 25 were excluded as not containing eligible cost data (Appendix 1). These exclusions included the full RAND report and the subsequent summary report (Nicosia et al., 2009; Steinberg et al., 2009). Of the remaining 15 studies, 12 studies were based on data from the US and three from Australia. The reports covered the cost of treating methamphetamine users (Ciketic et al., 2015; Shearer et al., 2010), costs of treating specific injuries (Danks et al., 2004; Hendrickson et al., 2008; London et al., 2009; Santos et al., 2005; Sullivan, 2006) and costs of cleaning up clandestine laboratories (Snyder, 2005; US Department of Justice, 2005, 2010). There were two reports covering multiple factors. The remaining studies addressed the benefits to employers of preventing methamphetamine use in the community (Guyll et al., 2011), the impact of clandestine laboratories on neighbouring house prices (Congdon-Hohman, 2013) and the cost of drug law enforcement (Ritter et al., 2012) (Table 2.1). Eleven of the studies were published in 2006 or more recently, with four studies pre-dating this time.

Summary

The systematic review identified some reports that pre-dated, and had not been included in, the RAND estimation of costs in 2005, and more recent information that will inform the current estimation (Table

2.1). The only new type of cost attributable to methamphetamine use that our review identified was the impact of clandestine laboratories on house prices in the immediate vicinity (Congdon-Hohman, 2013).

Appendix 1 Table 1: Studies with cost information

Author (reference)/Country	**Comment**
Ciketic (Ciketic et al., 2015)/Australia	MATES study costs of treatment ($301), crime ($43.5k) and health service use ($11.5k/person)
Congdon-Hohman (Congdon-Hohman, 2013)/US	Reduction in house values one year after lab discovery: US$2m for sales within 1/8 mile of drug laboratory
Danks (Danks et al., 2004)/US	Burns injury from MA manufacture: hospital costs mean US$77,580
Guyll (Guyll et al., 2011)/US	Cost to employer of MA use: US$97.5k in 2006 over a career (18-65 years)
Hendrickson (Hendrickson et al., 2008) /US	Cost of MA use on ED visits: US$6.9m at one hospital
London (London et al., 2009)/US	Cost of MA use on minimally injured trauma patients: US$2,998 v $2,667 non-MA user
MT Dept. of Justice (Montana Department of Justice and the Montana Meth Project, 2009)/US	MA costs in Montana: US$208.3m in 2008 (health $48.8m, foster care $11.9m, clandestine labs $54k, crime/justice $76.7m, productivity $65m)
Prah (Prah, 2005)/US	Wide range of US costs cited including clean-up, justice, child welfare and Drug Enforcement Authority (2004 $145m)
Ritter (Ritter et al., 2012)/Australia	Costs of drug law enforcement methods in terms of loss to drug enterprises
Santos (Santos et al., 2005)/US	Burns injury for MA manufacture v controls (non-MA related burns) (US$153,933)
Shearer (Shearer et al., 2010)/Australia	Cost estimates for providing Modafinil treatment to MA users ($960/person for 10-week period)
Snyder (Snyder, 2005)/US	(Newspaper) Clean-up: $3,500 to clear chemicals, $17,000 to clean house
Sullivan (Sullivan, 2006)/US	(Newspaper) US$5m/year on MA teeth, Department of Corrections
US Dept. Justice (US Department of Justice, 2005)/US	Cost to clean up clandestine labs: US$16.2m 2003
US Dept. Justice (US Department of Justice, 2010)/US	Cost to clean up clandestine labs: US$3,349/site in 2009

ED = Emergency Department; MA = methamphetamine; MT = Montana; MATES = Methamphetamine Treatment Evaluation Study

Approach to Cost Estimation

Sources of cost

There are many ways methamphetamine use can potentially impose costs on the broader society:

- Premature deaths attributable to methamphetamine (which in turn lead to tangible costs such as reduced economic output and costs to business of recruiting replacement members of staff as well as the intangible costs of death (measured through the value of a statistical life));
- Cases of morbidity attributable to methamphetamine (which impose healthcare costs on society through both increased rates of hospital separations as well as other healthcare costs borne by society, reduced economic output through absenteeism, and reduced contribution to household labour; and, to the extent that the morbidity affects someone other than the user or affects a dependent user, intangible costs of illness and injury);
- Crime attributable to methamphetamine use (which increases police costs, court system costs, and correction system costs; imposes tangible and intangible costs on the victims of the crime; and reduces economic output due to the reduction in the labour force due to detention and lower lifetime employment probabilities of convicted offenders);
- Cost of cleaning up (including removing hazardous waste) properties used for clandestine methamphetamine laboratories;
- Cost of controlling access to drug precursors (administrative costs, additional security measures for pharmacies, reduction in treatment options for certain minor conditions);
- Road crashes attributable to methamphetamine use (which increases mortality and morbidity with the range of associated costs, as well as imposing costs due to property damage and the cost of emergency services response);
- Child abuse and neglect attributable to methamphetamine use (this imposes a substantial intangible cost on the victims, increases child protection system costs including out of home care, and imposes hospital and other medical costs);
- Intangible costs of drug dependence to the individual's family members (particularly to those resident in the same household); and,
- Intangible costs of drug dependence to the drug consumer.

An important task of the research will be to identify and assess the quality of potential sources of data for the scale of harm attributable to methamphetamine use, and to value the unit costs of the various forms of harm. In many cases, data limitations may mean that it is not possible to quantify a specific form of harm attributable to methamphetamine.

Other elements of approach

The study will take a prevalence rather than an incidence approach. The prevalence approach is considered more appropriate for determining the current economic cost of disease and covers both new and pre-existing disease in the year under assessment. The incident approach is more appropriate when the objective is to determine the impact of a disease in the future and only evaluates new cases (World Health Organization, 2009).

The study will be based on the costs arising from methamphetamine use in ***a specific study year***, although in some cases, such as premature mortality, those costs will be the Net Present Value (NPV) over a number of years of costs stemming from an adverse outcome in the study year.

The choice of year will be dictated by the availability of key data on prevalence of use (particularly dependent use), hospital separations, mortality, etc., but will be as close to the present as possible. It is recognised that some data may not be available in the study year and so we will identify robust approaches to extrapolate such data to the study year where necessary. Initial assessments of data availability suggest that 2013/14 offers the best balance of being as near as possible to the present, whilst having good data availability.

Whilst the study is on the costs of methamphetamine, we recognise that in some cases data on harms, or on aetiological fractions, may only be available for amphetamine (or even stimulants) as a whole.

The study approach will be one that can be extended to other drugs in the future. An important part of the process is consideration on what forms of cost are available and those that would be included should the ideal dataset exist. We recognise that limitations with respect to the available data on the scale of harms arising from methamphetamine mean that many of the forms of harm that are in-scope will not be able to be quantified. However, we believe that improving understanding on the limits of the evidence base with respect to the harms of methamphetamine is a potentially valuable output of the research. A list of forms of cost that are potentially in scope for the study, together with initial assessments of potential data sources, is provided in Table 1.1.

For some forms of harm (e.g. crime, child abuse/neglect), the issue of joint causation by two or more drugs is likely to be significant. One of the objectives of the project will be to develop a robust approach to dealing with this situation to ensure that the estimated costs of harmful drugs are comparable with one another and will not each be counting some of the same costs (or all ignoring the jointly caused costs).

The study will use average rather than marginal costs.

The level of analysis will be the individual, and so any costs on the families/households of the users will be in-scope (although some of these may not be able to be quantified). There may also be a few areas of cost where it is not possible to isolate the costs to users from the costs as a whole (this may well be the case with road crash costs), in which case we will include the total cost.

Finally, in terms of the definition of social cost that will be used, the core estimates of the study will define social costs relatively narrowly, excluding all costs borne solely by the user except for the costs arising from premature mortality (on the basis that this is not anticipated by users), or where it is not possible to distinguish costs to the user from costs to others.

However the study will also assess, where feasible, the costs to users arising from dependence (e.g. the internalities), with these costs presented separately.

Approach to Economic Analysis

Whilst the general case for excluding private costs and benefits is established, there is considerable debate on how to treat costs incurred by users with a drug dependence, as this situation does not necessarily meet the criteria of a rational, fully informed consumer with time consistent preferences and therefore is not necessarily best analysed as a purely private cost. A good survey of the literature on this issue is included in Cawley and Ruhm (Cawley and Ruhm, 2011), and the discussion in this section draws on their work.

Some economists maintain that, even for those drugs that have the potential to cause dependence, harms to the users themselves should not be considered in assessing public policy responses as they would have been fully internalised by the users in their consumption decisions. This contention rests on two key assumptions:

1) that users would have anticipated the possibility of a dependence developing and have internalised the probability of a dependence given their chosen use of the drug as well as factoring in the expected value of any costs of dependence into their consumption decision, e.g. they will have fully internalised the costs; and

2) that dependent users are best characterised as normal consumers who, because of the dependence happen to have much higher utility from their use as they gain utility not just from current consumption of the product on which they are dependent but also on the stock of previous consumption (in part because by continuing to use they are avoiding the very large dis-benefits of withdrawal symptoms through ceasing use).

This is what is known as the rational addiction hypothesis, which was first set out in Becker and Murphy (Becker and Murphy, 1988) [30], and is supported by a considerable body of empirical work (c.f. (Becker et al., 2008; Chaloupka, 1991)). Some conclusions from this theoretical framework are not controversial, for example, the conclusion that the dependent user will still respond to price signals, not only in the present but also to anticipated future price signals. However, two of the implications

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[30] More formally the hypothesis postulates that the consumer maximises lifetime utility (U) at time t=0 subject to an expected budget constraint in a way that can be characterised by the following utility function:

$$U(0) = \int_0^T e^{-\sigma t} U[Y(t), C(t), S(t)]dt$$

where σ is a constant rate of time preference; t is the period of time, from t=0 (the present) to t=T (expected years of life remaining); C (t) is the consumption of the addictive good at time t; Y (t) is the consumption of all other goods at time t; and S (t) is the current "stock" of past consumption of the addictive good at time t.

The stock of past consumption evolves over time according to:

$$\dot{S}(t) = C(t) - \delta S(t) - h[D(t)]$$

where C (t) is the consumption of the addictive good at time t; δ is the depreciation rate in the addictive stock and D (t) is expenditure on the endogenous depreciation (appreciation) of the stock of the addictive good. Becker and Murphy (1988) of the hypothesis are controversial, namely that dependent users' current consumption is optimal for them, and that dependent consumers will be *more* responsive to permanent increases in price than non-dependent users. So in a rational framework, ***none*** of the costs to the user are included as social cost or externalities.

Other economists, whilst conceding the rational addiction hypothesis can provide a useful framework for modelling responses to the price (and non-price costs) of the addictive good, believe that the weight of the evidence from behavioural studies means that some of the critical underpinning assumptions of the hypothesis are not fulfilled. These critical assumptions of the rational addiction hypothesis that are in doubt are that consumers generally:

- Underestimate the probability that their particular consumption paths will lead to dependence, or either hold incomplete information on the potential health impacts of consuming the drug in question;
- Underestimate the potential impacts on themselves (Gruber and Köszegi, 2001; Kenkel, 1991; Khwaja et al., 2007; Smith et al., 2008; US Department of Health and Human Services, 1994);
- Have time inconsistent preferences (Angeletos et al., 2001; Gruber and Köszegi, 2001; Laibson, 2001); and,
- Engage in optimisation behaviours that can be characterised by 'bounded rationality', that is using 'rules of thumb' to make decisions or optimising using an incomplete information set (Akerlof, 1991; Suranovic et al., 1999).

If any of the four departures from rational, fully informed consumers listed above do hold with respect to a product with the potential for dependence then, whilst the rational addiction hypothesis still has considerable 'positive' value (that is in predicting behavioural responses to policy changes), it can no longer be asserted that current consumption levels of the addictive good will maximise the lifetime utility of use to the dependent user. As such, the costs arising from dependence can justify public policy responses to reduce consumption to its optimal level, whether by decreasing availability, increasing price, or providing information to users and potential users. As the costs to a dependent user are not strictly social costs, in that they are borne by the users themselves, they are often referred to as 'internalities'; costs to the user that were not factored into the consumption decision.

The question then arises as to how these costs should be included in a social cost study.

One approach often used is to include costs to consumers related to dependent use (including their expenditure induced by dependence) but to disregard costs incurred by non-dependent users as the four departures from a rational utility maximising consumer are greatest in the presence of drug dependence. In some cases, an attempt is made to identify the level of consumption (and therefore harm) that these consumers would face if they were not dependent (see, for example, the Productivity Commission's inquiry into the social costs of gambling in Australia (Productivity Commission, 1991)). In other cases, all costs borne by dependent users are treated as internalities.

More controversially, the evidence that few individuals understand the long-run health impacts of their drug consumption decisions (imperfect information) or they do not perceive the subjective relevance, combined with the fact that we know from behavioural economics that time-consistent preferences are relatively uncommon (even amongst the economics undergraduates who are the usual participants in these studies), creates an arguable case that health impacts that either have a long lead time (e.g. liver cancer from alcohol consumption) or for which the link between consumption and the health impact is not widely known, should be treated as ***social*** costs as they have not been taken into account in the consumption decision. This was the approach taken in Collins and Lapsley (Collins and Lapsley, 2008).

Another area of debate is where to draw the boundary between "private" and "social" costs. It is not uncommon for studies to argue that costs to the entire household of the user should be thought of as private costs and therefore excluded from a social cost study. Others would argue that a more consistent approach is to treat the unit of study as the individual (and that conflating the costs to the user's household with costs to the user are rooted in extremely patriarchal models of family relations), and so any costs imposed on other members of the user's household are social costs.

As summarised in Section 1, our conclusion is that the weight of evidence is such that costs to the dependent user should be assessed as it is unlikely that they have been fully integrated into the decision making process of the dependent user. As these costs are not, strictly speaking, social costs they will be reported separately.

Appendix 1 Table 2: Present value of a future benefit in 2013/14 values, 7% real discount rate

Year	2013/14	2018/19	2023/24	2028/29	2033/34	2038/39	2043/44
Real (inflation adjusted) benefit	100.0	100.0	100.0	100.0	100.0	100.0	100.0
NPV of benefit in 2013/14 values	100.0	71.3	50.8	36.2	25.8	18.4	13.1

Aetiological fractions

The preferred approach is to assess the causal relationship on a condition by condition basis using what are called aetiological fractions (e.g. the proportion of deaths or cases of the condition caused by methamphetamine). Aetiological fractions can be derived using direct or indirect methods.

The indirect method, considered to be more robust, requires two sets of information: the relative risk, derived from analysis of case control or cohort studies, of developing the condition of interest (or dying from a particular cause) for those who consume methamphetamine; and the proportion of the population by age category and gender who consume methamphetamine, based on self-report surveys of consumption. Given the substantially greater costs arising from dependent use, if possible the costs will be presented separately for dependent and non-dependent use (Moore, 2007).

The method for calculating aetiological fractions from relative risks was described by English et al. in 1995 and is still used today (English et al., 1995). The formula used to calculate the aetiological fraction (AF) for a condition with respect to a particular population where the risk varies by consumption is (World Health Organization, 2000):

$$AF = \frac{\sum_{i=1}^{n} P_i (RR_i - 1)}{\sum_{i=1}^{n} P_i (RR_i - 1) + 1}$$

where i represents the consumption categories used (for methamphetamine recreational and dependent use); Pi is the proportion of the population of interest who are in the particular consumption category i; and RRi is the relative risk of a person in consumption category i acquiring the condition.

The alternative, the direct method of calculating aetiological fractions, is based on a study(ies) making a direct attribution on a case by case basis of the contribution of alcohol to the condition or injury. For example, a study could analyse hospital admissions data to identify the proportion of psychotic episodes where amphetamine type stimulants were identified as the cause. 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 it is being applied to. It also reflects the consumption patterns at the time and place of the original study (although established methods exist to adjust AFs 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.

A similar approach to deriving aetiological fractions using direct methods is taken in assessing the incidence of crime attributable to methamphetamine, with data from the Drug Use Monitoring Australia data collection (undertaken by the Australian Institute of Criminology) used to calculate aetiological fractions for crime by the most serious offence category.

Where data limitations mean that the harms arising from a particular drug cannot be estimated though aetiological fractions, an alternative approach is to undertake statistical analysis comparing the mortality and morbidity rates of a population of users of the drug(s) in question with the rates observed in a control population who have similar demographic and socio-economic characteristics but do not consume the drug. Any *excess* mortality or morbidity after other factors have been controlled for can be attributed to the drug use. This approach has an important limitation in that it will not capture harm to non-users (e.g. victims of assaults or road crashes caused by a user of the drug), and it is likely to significantly understate harms with long lead times (such as cancer) or long average delays to diagnosis (e.g. blood borne diseases or STDs).

Having undertaken a preliminary assessment of the epidemiological evidence base, it is likely that aetiological fractions will only be available for a few of the conditions partially caused by methamphetamine. As such, it is likely the study will focus on the latter approach of estimating excess mortality and morbidity between dependent methamphetamine users and the broader population, supplemented where possible (and where it will not create the risk of double counting) by identifying the specific harms for those conditions where aetiological fractions are available.

APPENDIX 2: Chapter 5

Appendix 2 Table 1: Hospital separations where methamphetamine is given as the principal reason for the hospital stay

Code	DRG Description	Frequency	Case weight	Costs
V61Z	Drug intoxication & withdrawal	3816	1.47	$28,640,621
V64Z	Other drug use disorders & dependence	2807	0.97	$13,840,917
X62B	Poisoning/toxic effect drugs - cscc	935	0.59	$2,807,739
X62A	Poisoning/toxic effect drugs + cscc	216	1.68	$1,848,397
X40Z	Injury, poisoning, toxic effect drug with ventilator support	25	4.28	$545,994
B64B*	Delirium - ccc	11	1.40	$78,474
A06B*	Tracheotomy & ventilator - ccc or tracheotomy & ventilator + ccc	8	18.95	$773,092
B63Z*	Dementia & other chronic disturbances of cerebral function	6	2.70	$82,586
X06A*	Other procedures for other injuries + cscc	3	2.94	$45,019
B64A*	Delirium + ccc	2	2.83	$28,850
A06A*	Tracheostomy w ventilator support >95 hours + ccc	1	44.96	$229,299
X05A*	Other procedures for injuries to hand + cc	1	1.78	$9,077
X07A*	Skin graft injuries – hand + microvascular tissue transfer/+ cscc	1	5.08	$25,931
	Total	**7,832**		**$48,955,996**

+/- cscc = with or without catastrophic or severe complications and or comorbidities
+/- ccc = with or without catastrophic complications and or comorbidities

For those where DRG is not drug Intox, drug use disorder, injury or poisoning, we checked each case and they have an F15 or T43.6 as primary code

APPENDIX 3: Chapter 7

Lower bound estimates

The cost of household crime to victims under the lower bound estimate of methamphetamine attribution is shown in Table 1. The lower bound of the AF for violent crime is zero and so *there are no methamphetamine attributable personal crime costs.* Total estimated costs to victims of crime in the lower bound are therefore $585.9 million.

Appendix 3 Table 1: Lower bound estimate of total costs to victims of household crimes in Australia by offence type and severity, 2013/14

Offence	Number of MA attributable cases	Costs of property loss & property damage	Cost of lost output	Intangible costs	Total Costs
Burglary					
Completed	44,636	83.2	3.8	50.1	137.1
Attempted	33,306	7.6	1.9	24.9	34.4
Total burglaries	77,942	90.8	5.7	74.9	171.5
Motor vehicle theft	10,608	44.9	1.8	25.9	72.7
Theft from a vehicle	50,466	55.9	3.1	41.0	100.0
Malicious property damage	103,136	62.4	4.7	137.3	204.4
Other theft	46,566	25.4	0.4	11.5	37.4
Total	**288,717**	**279.4**	**15.9**	**290.6**	**585.9**

Upper bound estimates

Under the upper bound estimate of methamphetamine attribution the estimated total costs to victims of crime of personal crimes increases to $768.6 million, and that of household crime to $775.2 million (see Tables 2 and 3 respectively). This gives a total upper bound estimate of the cost to victims of crime of **$1,543.8 million**.

Appendix 3 Table 2: Upper bound estimate of total costs to victims of personal crimes in Australia by offence type and severity, 2013/14

Offence	No. of MA attributable victims	Medical costs ($'million)	Lost output ($'million)	Intangible costs ($'million)	Total Costs ($'million)
Assault					
Hospitalised	3,029	37.5	104.7	42.5	184.7
Injured, treatment other than hospital	26,185	19.3	75.7	78.5	173.4
injured no treatment	45,038	0.0	32.3	32.3	64.6
no injury	91,252	0.0	3.9	39.1	43.0
Total	165,504	56.8	216.6	192.3	465.7
Sexual assault	.	.	.	.	.
Injury	4,100	4.2	28.1	168.9	201.2
No injury	5,125	0.0	0.3	56.2	56.5
Total	9,225	4.2	28.4	225.1	257.7
Robbery	.	.	.	.	.
Hospitalised	439	5.4	15.2	6.1	26.7
Injured, treatment other than hospital	1,710	1.3	4.9	5.2	11.4
injured no treatment	2,237	0.0	1.6	1.6	3.2
no injury	8,144	0.0	0.3	3.5	3.8
Total	12,530	6.7	22.1	16.3	45.1
All Personal Crime	.	.	.	.	.
Total	**187,259**	**67.6**	**267.0**	**433.7**	**768.5**

Sources: (Australian Bureau of Statistics, 2016a, c; Smith et al., 2014), calculations by the authors

Appendix 3 Table 3: Upper bound estimate of total costs to victims of household crimes in Australia by offence type and severity, 2013/14

Offence	Number of MA attributable cases	Costs of property loss & property damage	Cost of lost output	Intangible costs	Total Costs
Burglary					
Completed	59,056	110.1	5.1	66.2	181.4
Attempted	44,066	10.1	2.5	32.9	45.5
Total burglaries	103,123	120.1	7.6	99.2	226.9
Motor vehicle theft	14,035	59.5	2.4	34.3	96.2
Theft from a vehicle	66,770	73.9	4.1	54.2	132.3
Malicious property damage	136,456	82.6	6.3	181.6	270.5
Other theft	61,610	33.6	0.6	15.2	49.4
Total	**381,995**	**369.7**	**21.0**	**384.5**	**775.2**

Sources: (Australian Bureau of Statistics, 2016a, c; Smith et al., 2014), calculations by the authors

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