

**Injury and
Other Harms
Associated with
Methamphetamine
Use:
A Review of the
Literature**

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1.0 Introduction

Methamphetamine is not a new drug, nor is its non-medical use a recent phenomenon internationally. Methamphetamine first appeared on the licit market in nasal decongestant preparations during the 1930s. Non-medical uses have been noted wherever it has been readily available (Bialer, 2002). In the United States (US) a commercially available product was frequently used for weight loss and to fight fatigue (Bialer, 2002). Suwaki (1991) documents a post-World War II epidemic of methamphetamine abuse occurring in Japan as a result of wartime use by military personnel and the post-war release of stockpiles of pharmaceutical methamphetamine to the general public. In the 1970's the US Drug Enforcement Administration began focusing enforcement efforts on the distribution of methamphetamine and it was listed as a Schedule II¹ drug (Bialer, 2002). One result of this was the emergence of a lucrative business in clandestine manufacture (Murray, 1998). A resurgence in methamphetamine misuse in the US was identified in the 1980s (Miller & Kozel, 1991), and in recent years illicit manufacture and use has also become a particular concern in the Asia Pacific region (Cho, 1991; Farrell, Marsden, Ali, & Ling, 2002; Sattah et al., 2002), Australia (Topp, 2002) and in New Zealand (Ministerial Action Group on Drugs, 2003).

A consideration of harms arising from the use of methamphetamine in New Zealand needs to be framed not only by the identification of factors such as the physical and biochemical properties of the drug and its pharmacological effects, but also by specific local characteristics of the 'user' population, and national as well as broader international factors related to the manufacturing, marketing and distribution of the drug.

¹ The US Controlled Substances Act places all substances that are regulated under federal law into one of five schedules. This placement is based upon the substance's medicinal value, harmfulness, and potential for abuse or addiction. Schedule I is reserved for the most dangerous drugs that have no recognized medical use, while Schedule V is the classification used for the least dangerous drugs.

1.1 Properties of methamphetamine

Methamphetamine is a powerful psychostimulant which has a high dependence liability (Wolkoff, 1997; Murray, 1998). Methamphetamine can be manufactured from a relatively readily available precursor pseudoephedrine – a common ingredient of ‘over the counter’ cold remedies (Topp, Degenhardt, Kaye, & Darke, 2002); (Ministerial Action Group on Drugs, 2003). Methamphetamine can be smoked, snorted, injected or swallowed. Immediate effects include euphoria, increased energy and confidence, and decreased appetite and effects can last up to 12 hours. High doses, chronic use and bingeing are associated with irritability, hostility, paranoia and hallucinations. Typical after-effects include depression, fatigue, sleep disturbance, headaches and craving (Bialer, 2002).

There is variability and inconsistency among the ‘street’ names used to refer to methamphetamine in its various forms. In New Zealand, methamphetamine is generally available as powder or crystals known as ‘P’ or ‘Pure’, although both these terms are loosely used to cover all forms of methamphetamine, at least in the media and in police reports, and detailed descriptions have not been undertaken. It is generally locally produced in clandestine laboratories, although there have been reports of more potent forms of the drug being imported (Ministerial Action Group on Drugs, 2003). Local users may, make distinctions reflecting quality, source and suitability for various methods of administration.

In Australia, the base and crystalline forms are more potent forms of methamphetamine. Base tends to be the result of local manufacturers attempts to purify an oily methamphetamine base into methamphetamine hydrochloride. Base is a sticky, gluggy, waxy, oily form of damp paste or crystal that often has a yellowish or brownish hue (Topp et al., 2002). Incomplete conversion and purification in the ‘cooking’ process prevents the substance from completely forming into the large translucent crystals typical of crystal methamphetamine and so the appearance of these two forms is quite different. The clear crystalline form of high purity methamphetamine is imported from Asian countries (Topp et al, 2002).

In Sydney, the methamphetamine powder available is typically manufactured in Australia. As a result of different methods of manufacture and the expertise of the ‘chemist’, the product has a range of presentations. Colour varies from white to

yellow, orange brown or pink. Most of those in Sydney who use powder, snort or inject it (Topp et al., 2002).

One Sydney study investigated local variations and distinguished between the locally manufactured and imported variety of two potent (that is – more concentrated or pure) forms of methamphetamine that have become popular relatively recently in Australia (Topp et al., 2002). Topp and colleagues suggest there are three distinct commodities on the Sydney market, readily recognisable to users by appearance: methamphetamine powder (speed), base methamphetamine (base) and crystalline methamphetamine (ice, shabu or crystal). 

1.2 Effects of methamphetamine

The desired effects from the use of illicit methamphetamine include euphoria, decreased need for sleep, increased mental alertness and energy levels, disinhibition, sense of wellbeing, increased confidence and decreased appetite (Bialer, 2002). Effects are dose-dependent and onset ranges from 20-40 minutes if swallowed, 3-5 minutes when snorted, and immediately if smoked or taken intravenously. Smoking and injecting users report an intensely pleasurable wave of sensation or 'rush' (National Institute on Drug Abuse, 1998).

Repeated and chronic use of methamphetamine may result in undesirable and dangerous effects. Reported methamphetamine-related side-effects include psychotic symptoms such as severe paranoia, hallucinations and delusions of persecution, anxiety symptoms and agitation, and affective symptoms such as depression and mood swings (Buffenstein, Heaster, & Ko, 1999; Degenhardt & Topp, 2003; Topp et al., 2002). Other reported effects of chronic use include insomnia, malnutrition, involuntary movements, increased psychomotor activity, tachycardia and elevated blood pressure sometimes resulting in myocardial infarction or stroke (Farnsworth, Brugger, & Malters, 1997; Kolecki, 1998; Perez, Arsura, & Strategos, 1999; Shaiberger, Kennedy, Miller, Gal, & Petty, 1993). Continued use can also result in dependence (Ministerial Action Group on Drugs, 2003).

The most common symptom of withdrawal from use is depression (Murray, 1998; Kalechstein et al., 2000). Discontinuation usually results in fatigue, restlessness,

nervousness, feelings of alienation and irritation, and craving for more methamphetamine (Karch, Stephens, & Ho, 1999); (Anglin, Burke, Perrochet, Stamper, & Dawud-Noursi, 2000); (Ernst, Chang, Leonido-Yee, & Speck, 2000). The physical effects of withdrawal can include tremor, sweating, headaches, dizziness, dry mouth and gastrointestinal problems. Withdrawal effects can also include severe paranoia, hallucinations, depression and delusions. Severity of withdrawal depends on length and magnitude of use (Bialer, 2002) and will be compounded by any pre-existing mental health problems (Chen et al., 2003). Dependence is also associated with poorer health and social problems generally and with family and relationship breakdown (Farrell et al., 2002; Topp et al., 2002).

1.3 Patterns of use: users, methods and motivations

1.3.1 User profile

According to the New Zealand National Drug Survey stimulant use increased overall between 1998 and 2001, particularly among young people and males, moving from being the third most popular illicit drug group in 1998, to the second most popular in 2001. The use of the more potent crystalline form of methamphetamine increased from 0.1% to 0.9% between 1998 and 2001 (Wilkins, Bhatta, & Casswell, 2002). A survey of recreational drug use among first year Auckland University students found that while use of most drugs had changed only modestly between 1977 and today, stimulant use had more than doubled (from 4.9% to 12.2%). European males were the principle users of stimulants among this group of students (O'Grady, Petit, Ng, & Frith, 2003). A recent survey of frequent methamphetamine users² in the Auckland area captured a similar demographic (Wilkins, Reilly et al., 2004). (Fifty-three percent of the sample was 20-24 years old, 74% were male and 75% were European. Sixty-two percent were in paid employment and 27% were tertiary students).

Recent key informant interviews with drug enforcement and drug treatment workers and users, report perceptions of an increase in the diversity of social groups who use methamphetamine, with younger and more middle class groups and more females using methamphetamine (Wilkins, Reilly et al., 2004). Law enforcement and

² Defined as at least monthly in the last 6 months and resident in the Auckland region for at least the last 6 months.

drug treatment key informants reported perceptions an increase in tinny house³ and gang involvement in the sale of methamphetamine, along with more of a cross section of society selling methamphetamine. However, the methamphetamine user participants were more likely to report less gang  (Wilkins, Reilly et al., 2004).

These observations are consistent with US literature, which notes shifting demographic characteristics among users who appear to be becoming more diverse in terms of employment, marital status, age, and ethnicity (Murray, 1998). In areas of the US where use is higher, a more heterogeneous user population has been noticed (Leamon, Canning, & Benjamin, 2000).

1.3.2 Routes of administration

While a high rate of intravenous use has been reported in Australia (Topp et al, 2002), in New Zealand methamphetamine is most often smoked; however recent evidence also suggests the emergence of intravenous use (Wilkins, Reilly et al, 2004). Smoking is a highly efficient route of administration, resulting in rapid onset of effect with large amounts of drug delivered to the brain (Cook, 1991). The effects of snorting or ingesting are slower and do not provide the same 'rush'.

The rapid and intense psychoactive effect of smoking serves to reinforce use and, combined with a rapid dissipation of the most intense pleasurable effects, has major implications for the repetitive smoking of methamphetamine and for addiction (Cook, 1991; National Institute on Drug Abuse, 1998). As the initial rush passes quickly, there is a strong motivation to repeat it, however methamphetamine has a long plateau effect and is eliminated from the body slowly. Repeated smoking is likely to increase the plasma concentration of the drug in the blood, even if repeated with fairly long intervals between doses (Murray, 1998).

Smoking is by far the preferred method of using methamphetamine in Hawaii (preferred by 96% of users), (National Institute on Drug Abuse, 1998) - unlike other parts of the US with high methamphetamine use. Wolkoff (1997) considers this signals a different epidemic to that in mainland US, noting a different user profile overall. In contrast to Hawaii where the majority of users smoke methamphetamine, in San Diego and San Francisco less than 10% of users smoke it (Center for

³ Suburban houses from which illicit drugs are sold in small amounts – the name comes from the custom of dispensing bullet sized packages of marijuana wrapped in tin foil.

Substance Abuse Prevention, 2000). Users in Honolulu are significantly more likely to be younger, less educated, and more likely to come from a family in which parents used marijuana or cocaine. Methamphetamine users in Honolulu were also more prone to violence, assaults, shoplifting, money problems and weight loss (Wolkoff, 1997). It has also been suggested that the increased enforcement focus on marijuana production and sale have contributed to the boom in methamphetamine use in Hawaii due to the reduced availability of marijuana and other drugs (Wolkoff, 1997).

A number of authors describe a 'binge and crash' pattern of problematic methamphetamine use, where drug intoxication is maintained for consecutive days, followed by a period of severe withdrawal effects (Cook, 1991; (Australasian Centre for Policing Research, 2003). This pattern of use is considered to be particularly problematic and associated with the more psychotic side effects (Australasian Centre for Policing Research, 2003). It is generally associated with injecting drug use, but repetitive smoking is also conducive to binge use because, as with intravenous use, there is the constant enticement to repeat the 'rush' (Australasian Centre for Policing Research, 2003); (Cook, 1991; Simon, Richardson, & Dacey, 2002).

1.3.3 Motivations to use

Australian studies suggest that more potent forms of methamphetamine appeal not only to people who inject drugs such as cocaine and heroin, but also to 'party drug' users and those who regularly use ecstasy (Topp et al, 2002). However the use of amphetamines by students, truck drivers and others to enhance performance and endurance and to sustain their ability to work has also been documented internationally (Anglin et al., 2000; Klee, 1997; Rawson, Anglin, & Ling, 2002; Simon et al., 2002). A US comparison of the patterns of methamphetamine and cocaine use shows that while cocaine use of the participants fitted a pattern of recreational use, the all-day-most-day patterns of methamphetamine use did not (Simon et al., 2002).

A study of methamphetamine users admitted to treatment facilities in Los Angeles outlines a number of motivations for use, including using methamphetamine as a substitute for other stimulants, for coping with mental distress, to aid staying awake,

to enhance sexual experience and to lose weight (von Mayrhauser, Brecht, & Anglin, 2002). Studies of the motivations for use among men who have sex with men (MSM) report that crystal methamphetamine is used to initiate, enhance, and prolong sexual encounters and that it is associated with high risk sexual practices (Halkitis, Parsons, & Stirratt, 2001; Halkitis, Parsons, & Wilton, 2003; Mansergh et al., 2001; Shoptaw, Reback, & Freese, 2002). Semple, Patterson and Grant (2002) also identify the use of crystal methamphetamine as a self-medication of negative feelings about HIV positive serostatus.

Rawson, Anglin and Ling (2002) report that the initial attraction of methamphetamine has been related to people's need to work long hours in tedious and physically demanding jobs and to lose weight quickly (primarily among women). Reducing fatigue, sustaining work and weight reduction are not only socially acceptable, but socially rewarded functions of the drug.

In public discourse in New Zealand, the image of an anti-social counter-culture composed of gangs, criminals and intravenous drug users tends to be associated with the use of methamphetamine (see e.g., (New Zealand Herald, 2002, 2003a, 2003b, 2003c, 2003d, 2004b, 2004c). However, New Zealand key informants report increased methamphetamine use among individuals who do not easily fit the typical image of a 'counterculture' or criminal individual. In summary, distinctive mainstream society users can be identified with the following motivations: a social party drug (among the youth rave/club scene, as well as a gay club/dance scene); a study and other performance aid (among students, high achievers and drivers); a weight loss aid (particularly among women), (Rawson, Anglin et al., 2002; Simon et al., 2002; Topp et al., 2002).

2.0 Injury and Harms Associated with Methamphetamine Use

Methamphetamine use has been associated with harms in a number of areas, most notably mental health (Chen et al., 2003; Yui et al., 2001) and also with physical, social, financial and legal problems (Joe-Laidler & Morgan, 1997; Morgan & Beck, 1997; Pennell, Ellett, Rienick, & Grimes, 1999). In the 2001 New Zealand National Drug survey, respondents indicated that their 'energy and vitality' and 'financial' issues were most likely to have been harmfully affected by the use of stimulants (Wilkins et al., 2002). Wilkins, Reilly and colleagues (2004) found the most serious problems, reported by methamphetamine users they interviewed, were psychological rather than physical. However many users reported experiencing mental health problems, including depression, paranoia, and suicidal ideation, before having used methamphetamine (Wilkins, Reilly et al., 2004).

Methamphetamine is known to exert a more powerful effect on the central nervous system than amphetamine (Murray, 1998). Australian studies have concluded that use of the more potent forms - the base and crystalline forms – tends to be associated with greater psychological and physical damage, and both psychological and physical health declines tend to be more rapid compared with users of methamphetamine powder (Degenhardt & Topp, 2003; Topp et al., 2002). Users of more potent forms have been described as more chaotic, paranoid, aggressive, agitated, damaged, harder to engage and generally harder to deal with than users of methamphetamine powder (Topp et al., 2002).

A New Zealand survey of frequent methamphetamine users reported that the physical problems most commonly experienced after using methamphetamine were trouble sleeping, loss of energy, skin problems and poor concentration. Physical problems most clearly identified as being caused by methamphetamine use were fits and seizures, heart palpitations and poor appetite (Wilkins, Reilly et al., 2004).

2.1 Specific group-identified risks

The international literature has focused on a number of specific methamphetamine user groups and has identified certain risks associated with these groups, although the direction of the association has not been established. In particular, methamphetamine has been associated with unsafe sex practices, multiple sex

partners and other risk-taking behaviour (Farrell et al., 2002; Halkitis et al., 2003; Nemoto, Operario, & Soma, 2002; Patterson & Semple, 2003; Sattah et al., 2002; Semple et al., 2002; Shoptaw et al., 2002) including those related to unsafe injecting practices (Molitor et al., 1999).

Studies focusing on injecting drug users and methamphetamine use among MSM have associated an increased HIV risk with methamphetamine use. Poly-drug use, sexual risk behaviour and family dysfunction have also been identified as correlates of methamphetamine use among young people (Dakof, 2000; Hawke, Jainchill, & De Leon, 2000; Molitor et al., 1999; Sattah et al., 2002).

2.1.1 Young drug users

Global trends in youth culture have shown a burgeoning use of 'party drugs' such as ecstasy, gamma hydroxy butyrate (GHB) and methamphetamine (Topp et al., 2002; United Nations Office on Drugs and Crime, 2003). Methamphetamine is thought to be the most common drug used by secondary school students in Thailand (Sattah et al., 2002). As previously noted, stimulant use among Auckland University students was at a much higher rate (22.2%) than that reported in the 2001 New Zealand National Drug Survey (5 %) – particularly among European male students (O'Grady et al., 2003).  average age of participants in a recent survey of methamphetamine users in Auckland was 26 years, and the perceptions of key informant groups suggest a trend towards younger users (Wilkins, Reilly et al., 2004).

The incidence of health problems in young methamphetamine users has been related to length of use (Greenwell & Brecht, 2003). Specific medical conditions associated with methamphetamine use include heart and circulatory problems, bone and muscle problems and genito-urinary problems (Greenwell & Brecht, 2003). A study of crystal methamphetamine use among poly-drug users in Sydney's dance party subculture found that negative side-effects appear quickly after beginning use of methamphetamine, methamphetamine users were more likely to develop problems than users of other party drugs, and that methamphetamine psychosis lasts longer than amphetamine psychosis (Degenhardt & Topp, 2003).

Degenhardt and Topp (2003) also describe significant proportions of 'party drug' users who reported using other drugs to come down from crystal methamphetamine and this stimulant-depressant cycle carries risk of greater harm than stimulant use alone.

2.1.2 Injecting drug users

The injection of methamphetamine exposes the user to a variety of risks that are not associated with other routes of administration. Injecting users risk transmission of blood borne infections such as Hepatitis C and HIV and they also risk vascular damage due to the injection of oily base and other impurities (Norton, Burton, & McGirr, 1996; Topp et al., 2002).

Domier and colleagues (2000) found that injecting methamphetamine users in a California drug treatment programme were more likely to report being HIV positive than other users. Zule and Desmond's (1999) ethnographic study of a 'street' population of injecting drug users showed a lower awareness of HIV risk among methamphetamine users than other injecting drug users. Guided by these findings, Zule and Desmond argue for increased efforts to promote safer injecting practices aimed at injecting users of methamphetamine, as this group appears to be underserved by risk reduction messages and requires less sweeping behaviour changes to reduce needle risk, in comparison to injecting heroin users (Zule & Desmond, 1999).

Injecting methamphetamine users in the US, compared to those who snort methamphetamine, were more likely to be unemployed. They reported more experiences of psychotic states, more depression, more suicidal ideation, more sexual dysfunction, more frequent episodes of losing consciousness, more felonies, and were more likely to report being HIV positive than those who used other routes of administration (Domier et al., 2000). It should be noted that this study compared IV use with a predominantly 'snorting' rather than 'smoking' non-injecting group. However, in contrast, a Japanese study that compared methamphetamine smokers and injectors, found that smokers were more likely to lose control, to use more frequently, and to show psychotic episodes sooner after starting to use than injectors (Matsumoto et al., 2002).

2.1.3 Methamphetamine use among men who have sex with men (MSM)

Due to a prominent profile in the HIV/AIDS epidemic in the West, the sexual behaviours of MSM have been intensely studied and documented. The international literature, primarily informed by Australian and US research, identifies extensive methamphetamine use among sectors of the MSM community and associates this use with high risk sexual behaviours which are a major factor in the transmission of HIV (Domier et al., 2000; Frosch, Shoptaw, Huber, Rawson, & Ling, 1996; Gorman, Morgan, & Lamberts, 1995; Gorman, 1998; Halkitis et al., 2001; Halkitis et al., 2003; Mansergh et al., 2001; Morgan & Beck, 1997; Reback, 1997; Shoptaw et al., 2002).

Semple and colleagues (2002) found that HIV positive MSM who binge-used methamphetamine reported significantly more social, mental and physical problems as well as more sexual risk behaviour compared with non binge users (Semple, Patterson, & Grant, 2003). Most recently, the potential for fatal interactions between methamphetamine and HIV treatment drugs are discussed by (Urbina & Jones, 2004) with reference to an Australian case report of a patient receiving antiretroviral who died after injecting methamphetamine. Currently in Australia a debate about the possible relationship between a recent rise in the rate of new HIV infections among MSM and use of crystal methamphetamine is taking place (Rawstorne et al., 2004).

2.1.4 Pregnant drug users

Specific data for prenatal methamphetamine exposure is patchy; however US research indicates that methamphetamine abuse during pregnancy may result in prenatal complications, and altered neonatal behavioural patterns (National Institute on Drug Abuse, 1998). Methamphetamine use during pregnancy is associated with foetal loss and developmental defects (Smith et al., 2003). Other potential effects of prenatal exposure on a child include variations in IQ, thought disorders and problems with aggression and attention (Cretzmeyer, Sarrazin, Huber, Block, & Hall, 2003).

2.2 Physical harms to the user

General physical health declines have been noted among users (Topp et al., 2002). High doses can elevate body temperatures to dangerous - sometimes lethal - levels as well as cause convulsions. Other physical harms include hypertension, stroke

and damage to cardiac and vascular systems (National Institute on Drug Abuse, 1998). Specific health problems reported by young users also include bone and muscle problems and genito-urinary problems (Greenwell & Brecht, 2003).

An investigation of the role of drugs in death from acute aortic dissection found that while hypertension was the most common risk factor, methamphetamine use was surprisingly the second most common risk factor (Swalwell & Davis, 1999). The findings of a US review of Emergency Department patients presenting with chest pain after methamphetamine use suggest that acute coronary syndrome is common in patients hospitalised for chest pain after methamphetamine use, and that the frequency of other potentially life threatening cardiac complications is not negligible (Turnipseed, Richards, Kirk, Diercks, & Amsterdam, 2003).

Descriptive case reports outline four incidents of methamphetamine-related deaths by stroke and three showed the existence of previous hypertension (Perez et al., 1999). Corneal ulceration is also attributed to methamphetamine use in a summary report of four cases by Poulsen and others (1996). Shaiberger and colleagues (1993) describe a case of pulmonary hypertension in a 33 year-old truck driver as a consequence of methamphetamine use over 10 years.

Logan, Fligner and Haddix's (1998) review of Washington State deaths in which methamphetamine was detected in the blood of the deceased found the direct toxic effects of the drug caused or contributed to over a third of the deaths, with most of the methamphetamine deaths occurring at high blood concentrations of more than 0.5mg/L (but can occur with concentrations as low as 0.05mg/L – although usually in conjunction with other drugs or significant natural disease). A large proportion of the deaths also resulted from homicidal (27%) or suicidal (15%) violence (Logan et al., 1998).

An examination of methamphetamine related deaths in Taiwan assigned 59% to accidental causes (including unintended overdose), with 14% homicidal and 11% suicidal and 13% natural causes (in presence of a pathological illness). The majority of the fatalities were aged between 20-40 years and were predominantly male (Shaw, 1999).

A comparison of patients with positive toxicology screens for methamphetamine utilising an emergency department and the general population of patients presenting at that emergency department found a significant association between methamphetamine use and injury from trauma among methamphetamine positive patients (Richards, Bretz et al., 1999). The majority of methamphetamine-positive patients with blunt trauma injuries were involved in motor vehicle accidents. Other injuries involved interpersonal trauma resulting from gunshot wounds, stabbings and assaults. In a study in Hawaii, of length of stay in hospital of injury patients, those testing positive to amphetamine or methamphetamine were more likely to have “intentional self-inflicted injury or intentional assaults”, to stay in hospital for a significantly longer period and a significantly longer hospital stay, and were more likely to be admitted to hospital (Tominaga, Garcia, Dzierba, & Wong, 2004).

US evidence indicates that while methamphetamine use by trauma patients increased markedly over the period 1989-1994, alcohol rates decreased and cocaine rates remained constant (Schermer & Wisner, 1999). Methamphetamine was most commonly associated with vehicular trauma, while cocaine positivity correlated with interpersonal violence. Furthermore, the mechanisms of injury associated with methamphetamine use in trauma patients resembled those associated with alcohol.

Much of the study data on methamphetamine-related harms is derived from blood testing of emergency department users and the deceased. While positive methamphetamine toxicology has been associated with homicide and suicide in some studies, those studies that compare cases of methamphetamine presence in the blood with cases showing the presence of other drugs, point to an association between methamphetamine use and vehicle accident injuries in particular.

 Schermer and Wisner's (1999) study noted a significant testing bias with men, minorities, motorcycle crash patients and victims of interpersonal violence being more likely to be tested, and this situation is unlikely to be an exception.

2.3 Mental health issues for users

Methamphetamine use has been associated with psychiatric harms including psychosis, and the psychiatric effects arising both from chronic use and from withdrawal will be compounded by any pre-existing mental disorder (Chen et al.,

2003; Farrell et al., 2002; Kalechstein et al., 2000; Matsumoto et al., 2002; Yui et al., 2001). Both pre-morbid vulnerability and dose-related toxicity are factors associated with methamphetamine-induced psychotic episodes (Chen et al., 2003) which may be difficult to distinguish from acute schizophrenia (Rawson, Gonzales, & Brethen, 2002).

Chen and colleagues (2003) report that while users in Taiwan with psychosis are more likely to have major depressive disorder, alcohol dependence or antisocial personality disorder than those without psychosis, the direction of the relationship between these problems and methamphetamine psychosis is unclear. However, the combined use of alcohol and methamphetamine has been reported to aggravate somatic and mental disorders, increase toxicity and increase the risk of psychosis (Chen et al., 2003). Matsumoto and colleagues (2002) suggest that methamphetamine smokers in Japan are more likely to show psychotic episodes sooner after commencing methamphetamine use than those who inject methamphetamine.

There is evidence to suggest that methamphetamine causes damage to dopamine and serotonin neurons in the brain (Seiden, 1991; Volkow et al., 2001), with subsequent impairment of the ability to feel pleasure. A sample of arrestees in a Californian study showed that methamphetamine-dependent individuals, especially women, were more likely to report depression and suicidal ideation than others under arrest (Kalechstein et al., 2000).

A Japanese comparative study of patients with eating disorders and those with drug use disorders found that repetitive self-mutilation was less prevalent among methamphetamine users than among eating and other drug use disorder patients (Nagata, Oshima, Wada, Yamada, & Kiriike, 2003).

2.4 Injury and death involving others

In news reports and public discussion both in New Zealand and internationally, methamphetamine use has been regularly implicated in deaths and injuries arising from violent crime, homicide and suicide, and police car chases (Australasian Centre for Policing Research, 2003; New Zealand Herald, 2003e, 2003f, 2003g, 2003h, 2003i). Much of this association is speculative, based on what is known

about the effect of the drug on the body, the effect of the drug on behaviour and the conditions of manufacture of the drug, (see (Australasian Centre for Policing Research, 2003; Logan, 2001). Despite the circumstantial and anecdotal implications, the contributing relationship between methamphetamine and violence is not well understood (Cretzmeyer et al., 2003), and the literature reveals a lack of data on the type and rate of trauma injury and criminal harms associated with methamphetamine use.

2.4.1 Driving offences leading to injury

The same propensities for risk-taking as well as those for paranoia, fearlessness and aggression that could lead to violent behaviours in general, might also be expected to have an adverse effect on driving behaviours (Australasian Centre for Policing Research, 2003; Austroads, 2000). Certainly, studies comparing emergency department patients who test positive for methamphetamine with all other patients, indicate that to some extent methamphetamine presence is associated with blunt trauma injuries that are predominantly the result of car or other vehicle crashes (Richards, Bretz et al., 1999; Schermer & Wisner, 1999). However, overall the evidence base concerning the impact of amphetamine-type stimulants on driving is equivocal, largely because research from which firm conclusions can be drawn is lacking (Australasian Centre for Policing Research, 2003). While there is also evidence that, at low doses in fatigued subjects, methamphetamine improves motor skills relevant to driving (see Australasian Centre for Policing Research, (2003) and Baselt, (2001). A 1996 study of 28 cases of drivers arrested or killed in traffic accidents who had tested positive for methamphetamine, concluded that methamphetamine at any concentration is likely to produce symptoms that are inconsistent with safe driving (Logan, 1996).

An Australian investigation into the incidence of alcohol and drugs in fatally injured drivers found that while alcohol was the drug involved most often in road crashes, its presence had decreased over the decade while cannabinoids and opiates had increased. Stimulants, mainly methamphetamine, had a much larger presence in the blood of truck drivers, than in car drivers or motorcyclists, who had been fatally injured (Hunter, Lokan, Longo, White, & White, 1998).

Another Australian study of drug driving among traffic offence detainees found that poly drug use was very common among their sample and nearly a quarter tested positive to amphetamines (almost exclusively methamphetamine). Twenty percent tested positive to amphetamines plus another drug, and that other drug was most frequently cannabis (Poyser, Makkai, Norman, & Mills, 2002). As concomitant use of other drugs is likely to further affect judgement and ability to drive, the potential for drivers to be affected by other drugs such as alcohol and cannabis in addition to amphetamines is considered to be a key issue by Australian Police (Australasian Centre for Policing Research, 2003).

The detection of drug-impaired drivers is far more difficult and complex than the detection of alcohol impaired drivers (Australasian Centre for Policing Research, 2003). The blood concentration of methamphetamine is not a good measure of its effect on driving performance - given that drug withdrawal is as much a problem as drug intoxication (Davey, Williams, & Davies, 2001; Logan, 1996). Indeed, Logan (1996) describes a US case study of accidents involving methamphetamine-positive drivers where the drivers' behaviours leading to the accident were more consistent with methamphetamine withdrawal than methamphetamine intoxication.

One of the primary effects of methamphetamine is the forestalling of fatigue and Australian police are well aware of the use of amphetamines in general by some long distance truck drivers (Australasian Centre for Policing Research, 2003). The extent to which use of such substances contributes to crashes is unclear (Australasian Centre for Policing Research, 2003). While higher methamphetamine blood concentrations may have harmful effects on self-perception, critical judgement, attention, risk taking, mood and motor restlessness, small amounts of amphetamines may improve driving performance in tired drivers (Logan, 1996).

The period following methamphetamine intoxication, when the direct effect is reducing, is a period associated with fatigue, anxiety, irritability and 'microsleeps' (Logan, 1996). This time may be dangerous for driving (Logan, 1996) and may be a mechanism of crash causation (Hunter et al., 1998). In the case of methamphetamine, this phase has the potential to be more dangerous than the use of other amphetamine-type substances, as major symptoms of methamphetamine

withdrawal include not only fatigue, but irritability, aggression and depression, and in chronic cases, delusion, hallucination and suicidal ideation (Hunter et al., 1998).

In a number of recent high profile New Zealand cases of injury and death as a result of high-speed police pursuit, the media have reported the driver's use of methamphetamine (see New Zealand Herald (2003e; 2004a). With regard to injury or loss of life, high-speed car chases are among the riskiest of policing activities (Australasian Centre for Policing Research, 2003). However in New Zealand, as in Australia, despite considerable anecdotal evidence, there is currently no research evidence to indicate that offender use of methamphetamine is a significant factor in such pursuits.

A discussion paper prepared for the Australasian Centre for Policing Research offers circumstantial evidence, presenting the known effects of amphetamine-type stimulants on behaviour (Australasian Centre for Policing Research, 2003). Aitken, Kerger and Crofts (2000) describe the use of amphetamine-type substances specifically to enhance the thrill of aggressive driving and the perception of some drivers that their driving performance was improved. Aitken and colleagues (2000; 2004a) also reported that methamphetamine users were very likely to link their drug use with driving – often driving for the 'thrill' of it. Evidence suggests some of the motivations for methamphetamine use – such as thrill seeking and the need for excitement - as well as the effects of amphetamine intoxication may be both more conducive to engagement in a chase, and to other driving behaviours and 'more exciting' types of criminal activities. These behaviours may contribute to offenders being more visible to police and therefore more likely to be pursued (Australasian Centre for Policing Research, 2003).

The New Zealand Ministerial Action Group on Drugs (2003) recognises that these concerns for driving would also extend to the use of other machinery either in the workplace or at home. This has a particular relevance to workplace accidents if methamphetamine is being used, as US and other reports suggest, to increase performance and endurance at work (Rawson, Anglin et al., 2002; Simon et al., 2002; United Nations Office on Drugs and Crime Prevention, 2001). 

2.4.2 Violent offences leading to injury

Substance use is a major correlate of violent offending, both for people who experience mental disorder and for those who do not (Johns, 1997). Johns' (1997) study found that the co-occurrence of substance misuse and major psychiatric illness is a statistically significant predictor of violence. A review of epidemiological studies similarly shows that substance misuse by people with schizophrenia increases the risk for violence and aggression significantly, and that this cannot be interpreted simply as a result of poorer social integration (Soyka, 2000). The consistent association of methamphetamine use with psychiatric disturbance, paranoia, increased aggression, irrational behaviour and disinhibition gives rise to special concerns about the propensity of methamphetamine use to give rise to violence (Domier et al., 2000; National Institute on Drug Abuse, 1998). Other research on methamphetamine use asserts that the interaction of methamphetamine's behavioural and psychological effects combined with personality factors and the social context contributes to the occurrence of violence (Miller & Kozel, 1991).

The combination of drugs and alcohol in general has long been regarded as a major risk factor for violence and crime, and extent of drug use has been found to be a predictor of criminal activity (Klee & Morris, 1994). Violence is not a psychopharmacological attribute of methamphetamine use, but as states of intoxication and withdrawal are often accompanied by disinhibition, agitation, paranoia, and delusions (Bialer, 2002), these may lead to hostile feelings and violent behaviour (Cretzmeyer et al., 2003; Wolkoff, 1997). In light of this, there are many aspects of the effects and patterns of methamphetamine use and the context of its manufacture that give rise to concerns about this particular drug's potential relationship to violent crime.

These concerns are expressed in New Zealand's Methamphetamine Action Plan which asserts that, *"while there is no explicit relationship between the use of methamphetamine and violent behaviour (1999), it could be anticipated that the effects of the use of the more potent methamphetamine – or the withdrawal from them - such as aggression, paranoia and panic attacks, will ultimately spill over into a range of criminal and public disorder offences"* (Ministerial Action Group on Drugs, 2003, p.15). The Methamphetamine Action Plan also notes that in New Zealand,

organised crime groups and gangs control many facets of the methamphetamine market and are typically associated with antisocial behaviour, often in the form of violent offending. There are concerns among government officials that such offending could become more pronounced by any development of 'turf wars' over the supply of the drug. Furthermore, as gross methamphetamine intoxication can result in symptoms of psychosis, this may lead to a different profile of offending to that committed by other substance-using populations (Ministerial Action Group on Drugs, 2003).

Current concerns among New Zealand and Australian law enforcement and health agency officials are likely to reflect an awareness of US literature on amphetamine and other stimulant-related crimes. US law enforcement agencies have associated use of the potent forms of methamphetamine with levels of criminal violence far exceeding those experienced in relation to any other drug use and have suggested a potential relationship between methamphetamine use and 'thrill'-related crimes (Doane & Marshall, 1996). For instance, Klee and Morris (1994) suggest that while the criminal activity of heroin users is often driven by the need for money to fund their drug use, the criminal activity of amphetamine users was motivated more by the need for excitement and thrills. Unlike heroin users, amphetamine users had more positive perceptions of the relationship between amphetamine use and crime, and saw their criminal activities as building self-esteem and enhancing their social networks.

In Queensland, health workers have recently been experiencing increased instances of clients with paranoid and aggressive behaviours associated with methamphetamine use (Australian Crime Commission, 2003). A particular population of concern are IV drug users who had previously been using heroin and had begun using methamphetamine during a period of 'heroin drought', and who exhibited clear deleterious changes in their mood and behaviour. The Queensland Ambulance Service also reported increased attendance at amphetamine-related cases over this period noting that they were very resource intensive because of the potential for the patient to be agitated and aggressive (Australian Crime Commission, 2003). Methamphetamine-related aggressive behaviour is also an emerging issue of concern for law enforcement officers (Australian Bureau of Criminal Intelligence, 2002).

New Zealand-specific data are lacking. The Law Enforcement Subsystem keeps data on the number of cases resulting in conviction for drug offences, but methamphetamine offences are not separately identified. In a recent New Zealand study of drug enforcement officers' perceptions, two-thirds reported noticing changes in the level of violence⁴ being committed by methamphetamine users. Forty percent of those who reported change, reported noticing "*more serious violence*", and 26% reported noticing "*more domestic violence*" (Wilkins, Reilly et al., 2004). Family and relationship breakdown is typically associated with drug dependence, and any aggression and violence resulting as a consequence of methamphetamine induced paranoia, hostility and agitation is particularly likely to be manifest in domestic violence (Topp et al., 2002).

2.5 Injuries related to manufacture

 New Zealand's first clandestine methamphetamine laboratory was discovered in 1996 (Institute of Environmental Science and Research, 2003). Police found nine laboratories in 2000, 41 in 2001 and 147 in 2002 (Institute of Environmental Science and Research, 2003). In the first 10 months of 2003 police closed down 146 clandestine laboratories (referred to 'clan labs' colloquially) (Institute of Environmental Science and Research, 2003). Ease of manufacture and increased clandestine production has played a significant role in the proliferation and spread of methamphetamine use in the US (Cretzmeyer et al., 2003; Murray, 1998). It has been suggested that New Zealand's domestic demand has developed in response to domestic manufacture (New Zealand Police, 2002). This mirrors the US experience where the closing of laboratories in one jurisdiction has led to the emergence of methamphetamine problems (reflected in the need for treatment services) in areas to which laboratories have relocated (Rawson, Anglin et al., 2002), indicating that the manufacture precedes the demand.

Manufacture of potent forms of methamphetamine involves relatively simple chemical processes, and the precursor chemical from which it is manufactured is frequently a fairly common chemical found in over the counter medicines (Irvine & Chin, 1991). In New Zealand this is pseudoephedrine (Ministerial Action Group on

⁴ Cannot say this relates to offences. The question was "have you noticed any changes in the level of violence, if any, being committed by methamphetamine users?" – nowhere in the section of this report is the term violent offences used.

Drugs, 2003), whilst in other countries ephedrine is used as a precursor (United Nations Office on Drugs and Crime, 2003; United States Drug Enforcement Administration, 1996). However clandestine manufacture poses many chemical hazards. While the processes are relatively simple, manufacture of methamphetamine involves the use of highly flammable, very toxic and corrosive chemicals (Institute of Environmental Science and Research, 2003; Irvine & Chin, 1991) which can cause harm through inhalation, ingestion and direct contact. Groups of people placed at risk are the methamphetamine manufacturers (colloquially known as 'cooks'), other adults and children who may be resident where a lab is located, neighbours, later occupants of the site, police and forensic scientists (Burgess, 1997) and there are wider environmental risks involved in the storage and disposal of highly toxic chemicals (Burgess, 1997; Burgess, Barnhart, & Checkoway, 1996; Irvine & Chin, 1991).



Many 'cooks' may also be heavy methamphetamine users and have been reported to regularly take risks when handling dangerous chemicals and in the chemical processes of manufacture (Horne, 1997; New Zealand Police, 2002). In the US, one in five laboratories is discovered because of an explosion, and there is a risk of severe burns to anyone near a laboratory (Institute of Environmental Science and Research, 2003). Case reports of patients involved in methamphetamine manufacture detail second degree burns, and anhydrous ammonia ocular injury (Lee, Farley, Brodrick, & Blomquist, 2003). Methamphetamine manufacturing has also resulted in death by phosphine gas poisoning (Willers-Russo, 1999).

Special consideration must be given to environmental decontamination of methamphetamine laboratory sites and to the protection of exposed populations during this process (Irvine & Chin, 1991). There are high hazard risks associated with the closing down and deconstruction of a laboratory, and subsequent scene investigation. Law enforcement agents need specialist knowledge and equipment and ongoing training to safely dismantle idiosyncratic and unsafe laboratories (Rawson et al., 2002). In New Zealand the Institute of Environmental Science and Research team comprises forensic scientists with specialist training as clandestine laboratory investigation chemists. Their expertise needs to be continually updated because of the complexity of possible drug synthetic pathways and the potential for idiosyncratic development in the way drugs are manufactured. This specialist

capacity is vulnerable due to a world shortage of trained clandestine laboratory scientists and chemists (Institute of Environmental Science and Research, 2003).

There is potential for secondary contamination of emergency department (ED) personnel in cases where individuals contaminated by the processes of methamphetamine manufacture have turned up unannounced at medical centres (Horton, Berkowitz, & Kaye, 2003b); (Burgess, 1997). The risk of injury through secondary contamination depends of the toxicity and concentration of the substance on the patients hair, skin and clothing, and the duration of contact that the ED personnel has with the patient (Horton et al., 2003b). Decontamination is recommended for patients who report skin irritation (Burgess, 1997) and those whose hair, skin or clothing is grossly contaminated with solid or liquid vapour, including condensed vapour (Horton et al., 2003b). The clothing of patients who smell strongly of the chemical exposure should be removed and bagged (Burgess, 1997).

Disposal of chemical waste products from methamphetamine production creates human and environmental risk (Australian Bureau of Criminal Intelligence, 1999). Such disposal is likely to be indiscriminate, such as directly into the ground, down drains and toilets – especially with the arrival of police - and concealed chemical stocks may be dangerously stored in unsafe containers (New Zealand Police, 2002). The chemicals used and the gases produced can leach into and contaminate the fabric of the building itself, posing health risks to the manufacturers and others in the locale. An abandoned laboratory in a domestic residence poses risks to any unwitting future occupants⁵ (Irvine & Chin, 1997; Burgess, 1997).

The mobility and makeshift nature of clandestine laboratories exacerbates the dangers and increases the risks of harm to others. An extreme example is the recent local case of a laboratory discovered in the back of a car – potentially constituting a very mobile bomb (New Zealand Herald, 2004e). Methamphetamine laboratories have also reportedly been found in a motel room and a farm water tank (New Zealand Herald, 2004d; New Zealand Police, 2003). Some law enforcement

⁵ While there have been no documented cases of injury caused to residents of an ex-laboratory site, in June 2004, a West Auckland couple won compensation from their landlord after they found that the house they had rented had been used as a P Lab. The Tenancy Tribunal awarded the couple \$990, ruling the owners had failed to clean up the property. The owners claimed they had been unaware that the property had been used as a P Lab, and that the police had not passed that information on, nor had they issued a cleaning order.

efforts in the US have seen manufacture simply move to areas where there are less intensive community eradication efforts and this has preceded an appearance of people seeking treatment for methamphetamine problems in those new areas (Rawson, Anglin et al., 2002; Rawson, Gonzales et al., 2002).

2.6 Injuries to children

Because methamphetamine is easily and frequently manufactured in private residences, there may be children living in clandestine laboratory sites. In the US, the National Drug Intelligence Centre reports that 2028 children were present at seized methamphetamine laboratory sites in the US and that 35% of those tested positive for toxic levels of chemicals (National Drug Intelligence Center, 2002; NIDC, 2002). Other authors report increasing numbers of contaminated children presenting to children's emergency medical centres in the US who have been exposed to the effects of methamphetamine just by being members of the household (Mecham & Melini, 2002).

The National Drug Intelligence Centre report on children at risk (2002), lists the direct injuries that children present at methamphetamine laboratories are exposed to, including inhalation, burns and more indirect injuries from neglect, malnutrition, and abuse. Mecham and Melini (2002) discuss toxicologic and social consequences of children being present at methamphetamine laboratories, including caregiver neglect, access to weapons, targets of sexual abuse. Children exposed to methamphetamine also demonstrate respiratory distress, agitation and hyperactivity (Mecham & Melini, 2002). The more dependent a child is on its caregiver, the more consistently the passive exposure affects the child. Infants and toddlers in the home for long periods are the most vulnerable group.

More descriptive reports of cases of children involved in methamphetamine-related emergency events note that that the predominant injuries sustained by children were respiratory irritation and trauma. Other reported health effects included gastrointestinal problems, chemical burns, brain damage, headaches, and skin and eye irritation (Horton, Berkowitz, & Kaye, 2003a).

Kolecki's (1998) review of 18 paediatric patients inadvertently poisoned with methamphetamine shows that they commonly presented with tachycardia, agitation, inconsolable crying and irritability, and vomiting.

However, while providing indicative data about a potentially growing population health concern, current investigations are largely descriptive and involve small research populations, and have not been carried out in New Zealand. 

3.0 Interventions

The currently available literature on interventions aimed at preventing injury and reducing harm arising from methamphetamine use is sparse, and mostly attends to issues related to the treatment of individuals who are methamphetamine dependent. Methamphetamine use has been associated with risk-taking behaviours, such as unsafe sex and unsafe injecting. Other links that have been made, such as those between unsafe driving and methamphetamine use, are largely inferential and based on what is known about the psychophysiological affects of methamphetamine.

Perhaps because of this, literature on interventions tends to focus on those risk behaviours for which there is firm evidence of an association with methamphetamine use. Interventions that concentrate on reducing injecting or improving injecting techniques in general, for example, are likely to reduce the risk of injected-related injuries such as needle-stick injuries. Further indications for injury prevention interventions might be extrapolated from the literature on those risk behaviours; however that is beyond the current scope of this review.

Moreover there is also a case to be made for a closer attention to the specificities of methamphetamine itself as, to a certain extent, the more general approach may overlook important aspects of the drug, such as its effects and its particular methods and patterns of use. This would require not only further targeted epidemiological study, but also more ethnographic research that might further an understanding of the social practise of methamphetamine use, the meanings attached to it and the social contexts in which it occurs.

3.1 Reducing the risk of injecting-related harm and the transmission of blood born viruses.

Australian and US research has identified a need for health promotion activities and community education around methamphetamine use and aimed at particular user groups such as men who have sex with men (MSM), injecting drug users and youth (Halkitis et al., 2003; Longo, Henry-Edwards, Humeniuk, Christie, & Ali, 2004; Sattah et al., 2002; Zule & Desmond, 1999).

Methamphetamine use among MSM has been intimately linked with sexual adventurousness and risk taking and thus gives rise to concerns about a potential rise in HIV and other blood born virus infection (Halkitis et al., 2003; Slavin, 2004). While much of the research focuses on implications for counselling and interventions at the level of the individual (eg, Halkitis et al., (2003) and Semple et al. (2003), other efforts to reduce methamphetamine-related harm amongst the MSM and gay communities have tended to be non-specific – such as through the general promotion of safe sex and clean needles (Slavin, 2004). Slavin argues for the development of harm reduction responses which take account of the specificity of methamphetamine in its social as well as psychological effects. Education should take account of the contexts in which methamphetamine is used (Clatts, Wells, & Goldsarnt, 2001; Colfax & others, 2001; Slavin, 2004).

Similarly, the literature on injecting-related harm and methamphetamine use focuses on pre-existing broad harm reduction issues and safe injecting messages aimed at reducing the transmission of HIV and HCV (see for example: Zule & Desmond, 1999). Australian research claiming implications for youth interventions, considers methamphetamine in the general context of party drug use and is still documenting patterns and trends of use thereby identifying a growing need for intervention (Breen, 2004; Degenhardt & Topp, 2003; National Drug & Alcohol Research Centre, 2004). Thai research on youth use suggests that in developing preventative programs particular attention needs to be paid to peer influence and to challenging life situations and pressures (German et al., 2004; Sattah et al., 2002).

3.2 Reducing the risk of driving-related injuries associated with methamphetamine

Australian surveys of illicit drug users and driving indicate a strong perception that there is little likelihood of being caught by police for driving under the influence of drugs – and that this was a major reason for continuing to drug-drive (Aitken et al., 2000; Davey et al., 2001). Consequently, minimising the impacts of methamphetamine use on driving and related risks of harm is probably best viewed as part of a broader objective to remove drug-impaired drivers from the road and to increase perceptions of the likelihood of being apprehended if driving under the influence of drugs (Australasian Centre for Policing Research, 2003).

3.3 Reducing risks in the workplace

Some US researchers also suggest workplace deterrents such as drug testing (Rawson, Anglin et al., 2002). However, the broader socio-cultural context in New Zealand about workplace drug testing suggests that such programmes are unlikely to be supported here (Bennett & Coggan, (2004).

Frontline health services, and emergency medical departments in particular, are workplaces specifically recognised in the literature as needing protocols to identify and deal with methamphetamine affected patients safely. As well as being well versed in medical problems associated with methamphetamine use, health service workers including emergency department, mental health and alcohol and other drug staff may need additional training and support to manage the behaviours often associated with methamphetamine intoxication and withdrawal, in particular to safeguard themselves and others (Rawson, Anglin et al., 2002; Wickes, 1993). Healthpages.co.nz, a New Zealand online health directory suggests that a number of hospitals, including Middlemore and Waikato, have increased security and implemented staff training and policies specifically on how to effectively deal with patients under the influence of the drug. This has been as a result of some users becoming irrational and violent, and because of 'P'-related theft problems (Healthpages.co.nz, 2004).

The literature available from police and environmental decontamination workers indicates that these professions have, and are regularly scrutinising, expert protocols designed to protect their own staff (Australasian Centre for Policing Research, 2003; Institute of Environmental Science and Research, 2003).

3.4 Reducing risks associated with methamphetamine manufacture

Methamphetamine manufacture not only poses risks to the 'cook' and other occupants of a house used as a methamphetamine laboratory, but potentially also to future occupants of the property. The New Zealand Tenancy Tribunal has ruled that renting out contaminated premises is in breach of a landlord's obligation to provide premises in a reasonable state of cleanliness. The Tenancy Services division of the Ministry of Housing has posted an information sheet on landlords' obligations with regard to rental properties used in the manufacture of

methamphetamine. This information sheet also includes a list of signs that a landlord can use to identify if a property has been used as a 'P lab' (see Ministry of using Tenancy Services, 2004).

Both ephedrine and pseudoephedrine are key precursor chemicals used in the illicit production of methamphetamine. Ephedrine is currently a prescription medicine in New Zealand while pseudoephedrine is a common ingredient in many over the counter remedies for coughs and cold symptoms (Expert Advisory Committee on Drugs, 2003). The Ministry of Health has recently advised against an outright ban on pseudoephedrine-based products (Anderton, 2004). The Associate Minister of Health states that although an outright ban might have an initial impact on methamphetamine production, it would also be likely lead to increasing illicit importation and use of other ingredients in methamphetamine manufacture by hard drug importation rings (Anderton, 2004).

However, some pharmacies have discontinued selling the pseudoephedrine-based products as they feel this reduces their risk of becoming a target for armed robberies, and most others have tightened procedures to record purchases in order to identify 'shoppers' who are paid to buy pseudoephedrine products from a variety of pharmacies (Healthpages.co.nz, 2004). Recently, pseudoephedrine has been classified as a Class C, part III Controlled Drug under the 1975 Misuse of Drugs Act, with the aim of maintaining tighter control over manufacture of products distribution and distribution onto the illicit market edsafe, 2004).

4.0 Issues Arising

4.1 Comments on the current research

Research literature has been produced at only a few sites – predominantly the US and Australia. A small number of authors recur, often appearing to ‘recycle’ the same data. In contrast to the New Zealand experience, US studies also assume that methamphetamine users will be predominantly injecting users, and many of the users in the samples are also cocaine users, and are drawn from treatment services.

Surveys and studies of people using treatment services should be expected to be representative of only a certain sector of users. While the reluctance of methamphetamine users to enter treatment has been reported (Rawson, Gonzales et al., 2002), a reluctance to recognise the problematic nature of use might be expected to be greater among controlled, rather than binge users, i.e., typically those who use methamphetamine to assist in social functioning or success – working, studying, weight loss or as weekend-only party use. Also a criminal element will be over-represented if treatment is a court-imposed condition.

Current Australian studies are largely concerned with information from intravenous and poly drug users and homosexual men, and purposive samples tend to be drawn almost exclusively from these groups. While a high rate of intravenous use has been reported in Australia, in New Zealand methamphetamine is most likely to be smoked (Wilkins, Reilly et al., 2004). Hawaiian research might offer some useful insights as, unlike the mainland US, methamphetamine is most commonly smoked in Hawaii (see National Institute on Drug Abuse, (1998) and Wolkoff, (1997).

Overall, there is a lack of detailed information about New Zealand methamphetamine users and methamphetamine use. Accurate information about illicit drug use is understandably difficult to obtain. Community networks are sensitive to changes and are essential to gathering drug misuse data, to monitor existing data systems, and to identify specific needs such as treatment, prevention or public policy redirection (Hall & Broderick, 1991). However, purposive samples drawn from specific networks and treatment services will over sample particular user groups, potentially veiling other issues and profiles. Studies which have explored

police and treatment services workers may be vulnerable to perceptions shaped by sensationalist media and other reports. Information from the supply side is better suited to provide information about changes rather than absolute rates. Thus, ideally, information from a variety of sources – information from health service and treatment providers, information from users, and supply or manufacture information from border control or laboratory seizures - would be triangulated.

Two New Zealand studies currently offer data on methamphetamine. One reporting on the information extractable from the National Drug Survey (Wilkins et al., 2002) lacks any very specific detail about methamphetamine use and harmful effects. The other reports on the perceptions of drug treatment service workers and police, as well as the experiences of community accessed sample of methamphetamine users, and arrestees (Wilkins, Reilly et al., 2004).  This second study reports having noticed a greater cross section of society; younger and more middle class groups using methamphetamine. One interesting question then relates to whether injury and harm associated with methamphetamine use is differentiated by socio-economic status in New Zealand.

The term 'P' seems to be a rather generic one in the New Zealand literature and more needs to be known about variations in form, such as those identified in the Sydney study (see Topp et al. (2002). Variants in form could also be expected to be related to different methods and patterns of use, and therefore carry different risks of harm. A distinction between imported and locally manufactured methamphetamine may also have implications for management of supply.

4.2 Services and agencies affected

The US literature indicates that not only are frontline agencies such as the police, emergency services and treatment services affected by methamphetamine use, but that there are also implications for the criminal justice system and for workplace and educational settings (Rawson, Anglin et al., 2002). Australian research has identified a need for improved treatment protocols for methamphetamine misuse and dependence, as mental health, drug treatment, social health and law enforcement agencies will face an increase in methamphetamine related problems (Longo et al., 2004).

Excessive methamphetamine use can result in medical emergencies, thus it is important that frontline medical emergency staff recognise possible complications of overdose and that protocols are in place to deal with them, as hypothermia and convulsions can be fatal (National Institute on Drug Abuse, 1998). Health service workers may also need special training to safely manage the behaviours that may arise from methamphetamine intoxication and withdrawal (Rawson, Anglin et al., 2002; Wickes, 1993).

While only a small proportion of methamphetamine users experience overt psychosis as a result of their use, this condition is of a significant concern to the police (as expressed in the Australasian Centre for Policing Research, 2003) and the public – (as evidenced in the news media), particularly with regard to dangerous driving and aggressive behaviours.

Problems and risks associated with the clean up of manufacturing sites in residential areas signal to issues relating to council or other public agency record keeping and compensation or insurance to discourage resettlement of contaminated sites.

In New Zealand, the Ministerial Action on Drugs Methamphetamine Action Plan has recommended ensuring adequate resourcing of treatment and clinical services; training, developing treatment protocols and the support and supervision of police, emergency workers and other workers whose work brings them into direct contact with users; more liaison with Australian agencies on current treatment projects focusing on behavioural change treatment approaches, workforce development for drug educators in order to reduce demand both in communities with methamphetamine problems and to encourage self-prohibition amongst producer-supplier-user communities (e.g., gangs) and to improve public health information on methamphetamine, more research into ways of dealing with clandestine laboratories and their effects, a register of methamphetamine related injuries, illnesses and deaths, and outcome research on treatment options (Ministerial Action Group on Drugs, 2003).

4.3 New Zealand-specific issues

Despite but anecdotal evidence regarding the types of injuries and other harms caused by methamphetamine in New Zealand. Much of the rest is inferred on the

basis of methamphetamine's effects and some speculative media reporting. However, high profile dramatic or sensational problems such as injury and death following police pursuits are not necessarily the most prevalent harms.

International literature directs a lot of attention at criminal, youth dance party, MSM HIV, and IV drug users. There are some indications of more mainstream use in New Zealand. Consequently, harms might then be expected to pertain to more daily activities such as driving and workplace risks.

The use of both alcohol and cannabis is high in New Zealand and so the potential for these drugs to be used concomitantly with methamphetamine is high. Given the prominent role alcohol plays in New Zealand society and the potentially negative effect of combining alcohol with methamphetamine on mental disorder (Chen et al., 2003) this combination of substances may pose a bigger problem than that of other poly drug or intravenous drug use in this country.

The specific risks and patterns of use associated with smoking methamphetamine also need to be considered seriously.

Wilkins and colleagues (2004) report the perception among drug enforcement and drug treatment workers that there has been an increase in intravenous use of methamphetamine in New Zealand. A study of Sydney users associates injecting use with the higher quality of crystals imported from Asia (Topp et al., 2002), where injecting is a more dominant mode of using (Cho, 1991). If this insight proves to be germane to the New Zealand situation, then injecting use could be expected to increase as the quality of the local product improves, or as more high quality crystal is imported.

4.4 Opportunities for preventing methamphetamine related harm in New Zealand

There are limited data available in New Zealand on methamphetamine-related hospital admissions (Ministerial Action Group on Drugs 2003). These may be of three types: 1) injuries associated with the use of the drug and its action on the body; 2) injuries associated with methamphetamine use on a third party; 3) injuries related to the manufacture of methamphetamine. One of the limitations of the

available data is a lack of differentiation between methamphetamine-related admissions and those arising from the abuse and misuse of other stimulants (Expert Advisory Committee on Drugs, 2002). However there is anecdotal evidence from some treatment services which report an increase in the number of people with problems associated with the abuse of methamphetamine (Expert Advisory Committee on Drugs, 2002).

A number of health and public safety risks are created with the growth in 'backyard' manufacturing of methamphetamine. The chemicals used are highly toxic, inflammable and explosive. While there has been no statistical evidence, in New Zealand, to show a direct correlation between burns patients admitted to hospital as a result of injuries occurring in exploding methamphetamine laboratories, anecdotal evidence does suggest an increase in burn related injuries (Ministerial Action Group on Drugs, 2003; Burgess 1997).

Evidence from recent Auckland interviews with methamphetamine users (Wilkins, Reilly et al., 2004) suggests that injecting use of methamphetamine is not uncommon, and moreover that it may be increasing. Combined with perceptions from these interviews indicating that people are using methamphetamine at a younger age, this has important implications for safer injecting messages.

There is potential for an increase in overall community awareness of methamphetamine-related harm. It would seem prudent to support existing central government and other agency efforts, e.g., various DHB information packages, Te Puni Kokiri development of resources for Maori communities, local Police district efforts.

The literature raises issues about methamphetamine and driving and suggests an association with vehicular trauma. Combined with the history of truck drivers use of stimulants in general there is some basis for workplace interventions here. While workplace drug testing is not readily accepted by the New Zealand workforce, there may be a case to be made for long distance driver testing by transport authorities. Interventions at the level of the worker are, of course, not the only option and it might be more fruitful to work with unions and workplace safety agencies to effect conditions of work and change the contexts that encourage or reward the results of stimulant use.

4.4.1 The potential role of ACC through injury prevention capacity:

Based on the literature reviewed in this report, the following actions are recommended for consideration by ACC:

- Development of injury prevention resources for methamphetamine users that are cognisant of current and future methods of use. If high quality crystal imports increase and/or the quality of local manufacturing improves, Australian experience suggests there will be a shift towards more injecting users. Recent local research suggests that IV use is already more common than previously thought. It also indicates a diverse and young user base. This signals to a need to promote safe injecting practices and to work with existing health promotion agencies to increase IDU awareness of risks associated with injecting methamphetamine, particularly with regard to HIV and HCV. Injury prevention/public health messages that are generic to preventing uptake of injecting drug use could be developed and disseminated. However, Australian researchers are starting to argue that prevention programmes and messages need to take account of the specificities of methamphetamine – its effects and the social context of its use. This would require more local ethnographic research.
- Development of intersectoral partnership initiatives to address the broader health issues associated with methamphetamine misuse. Mental health issues such as depression and suicidal ideation appear likely to be exacerbated during withdrawal.
- Development of intersectoral partnership initiatives and resources to minimise methamphetamine related drug-driving. ACC could support development of appropriate injury prevention and health promotion resources, and in identified high risk areas, support community action through local injury prevention consultants. Other partners could include Land Transport Safety Authority, Police, and transport employer groups.
- Support for, and development of, intersectoral partnership initiatives to reduce methamphetamine related injuries to third parties. Particular populations of concern include ED staff, enforcement staff, families of methamphetamine users, and children present at sites where methamphetamine is manufactured. ACC may also want to advocate for support for a similar model to current US

situation, where if children are found at methamphetamine manufacturing site, then parents are automatically charged with child neglect (frequently resulting in a prison sentence and child removal). Alternatively, given evidence suggesting the evolution of methamphetamine production to a 'cottage industry' occurring within increasingly diverse sectors of the community, then ACC could support initiatives to provide more emphasis on increased public awareness of the dangers to children.

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