

# The relationship between crystalline methamphetamine use and methamphetamine dependence

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Received 2 December 2005; received in revised form 18 April 2006; accepted 18 April 2006

## Abstract

**Background:** The aim of the current study was to determine whether crystalline methamphetamine users are more dependent on methamphetamine than people who use other forms of the drug, and if so, whether this could be accounted for by their methamphetamine use history.

**Method:** A structured face-to-face interview was used to assess drug use patterns and demographics among a convenience sample of 309 regular methamphetamine users from Sydney, Australia. Dependence on methamphetamine in the past year was measured using the Severity of Dependence Scale. The use of crystalline methamphetamine in the past year was confirmed using a photographic identification sheet.

**Results:** Participants who had used crystalline methamphetamine in the past year were significantly more likely to be dependent on methamphetamine than participants who took only other forms of methamphetamine during this time (61% versus 39%). Methamphetamine dependence was also associated with injecting or smoking methamphetamine (67% and 58%, respectively versus 30% for intranasal or oral use), using methamphetamine more than weekly (68% versus 34%), having used the drug for more than 5 years (61% versus 36%), and having used 'base' methamphetamine in the past year (59% versus 39%). Crystalline methamphetamine use remained significantly associated with methamphetamine dependence after adjusting for these patterns of methamphetamine use.

**Conclusions:** Methamphetamine users who took crystalline methamphetamine in the past year were more likely to be dependent than methamphetamine users who had not taken the crystalline form of the drug during this time.

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**Keywords:** Methamphetamine; Crystalline methamphetamine; Dependence; Drug; Route of administration; Injecting; Smoking; Duration

## 1. Introduction

Methamphetamine use has become a major problem in the United States of America (Cho and Melega, 2002; Rawson et al., 2002; Roehr, 2005), South Africa (Parry et al., 2004), and within the Southeast Asia and Pacific region (Farrell et al., 2002b; Topp et al., 2002; United Nations Office on Drugs and Crime, 2005). Methamphetamine use is associated with a range of serious health problems, including neurotoxicity (Jernigan et al., 2005), cognitive impairment (Nordahl et al., 2003; Woods et al., 2005), cardiac pathology (Karch et al., 1999), HIV risk behaviours (Molitor et al., 1998), psychosis (Farrell et al., 2002a; Hall et al., 1996; McKetin et al., in press) and poor physical health (Greenwell and Brecht, 2003).

Many of the adverse effects of methamphetamine occur as a consequence of long-term frequent use, driven by dependence on the drug. Dependence on drugs is influenced by a range of individual, environmental and societal factors (Cicchetti and Rogosch, 1999; Glantz and Pickens, 1992; Goeders, 2003; Kendler et al., 2003; Patton, 1995), but is also strongly related to patterns of drug use. Drug use patterns that vary with dependence include route of administration (Barrio et al., 2001; Gossop et al., 1995; Volkow and Swanson, 2003), dose (Carroll and Lac, 1997), age of initiation into drug use (Glantz and Pickens, 1992), frequency of drug use, and duration of drug use (Barrio et al., 2001). Evidence suggests that although some of these use patterns are strongly reinforcing, and can therefore instigate dependence (Carroll and Lac, 1997; Kalivas and Volkow, 2005; Volkow et al., 2000), their occurrence also reflects the natural progression of a drug using career.

There is a substantial body of research examining the progression to drug dependence from experimental or occasional drug use. This literature shows that users typically progress from

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swallowing or snorting drugs, through to more efficient routes of administration that provide a higher dosage and a more rapid drug effect, as their tolerance to the drug develops (Darke et al., 1994; Strang et al., 1992). In general, this research has shown that dependent drug users tend to be older, male, injecting drug users who initiated use at a younger age and have a very entrenched pattern of heavy drug use (Strang et al., 1999). There are also a range of other reasons, besides tolerance, why people progress to using more efficient routes of administration, and related heavy patterns of drug use. These reasons are grounded in the user's perception about the efficacy and social acceptability of particular drug use patterns, the user's own perception of risk, their personal risk factors for becoming dependent on drugs (e.g., psychopathology or a history of trauma) and their social network (Crofts et al., 1996; Darke et al., 1994; Fuller et al., 2002; Neaigus et al., 2001).

In the case of methamphetamine, use patterns vary widely, and there has been limited investigation of what use patterns are associated with people being dependent on the drug (Gossop et al., 1992; Hall and Hando, 1994). One of the factors that appears to be related to dependence is the form of methamphetamine used. Specifically, crystalline methamphetamine is thought to be a particularly dangerous form of the drug with high dependence liability, and compulsive use patterns have been observed among both people who smoke and inject crystalline methamphetamine (Cho, 1990; Matsumoto et al., 2002; Tohhara et al., 1990). Cho (1990) attributed the addictive nature of crystalline methamphetamine to its high purity, and also to the fact that it can be smoked or 'chased', which causes an intense drug effect similar to intravenous administration. Despite this view, there has been no empirical investigation of whether crystalline methamphetamine users are more likely to report symptoms of dependence than people who use other forms of methamphetamine. Nor has there been any systematic examination of whether other factors, such as route of administration or duration of use, contribute to higher levels of dependence among this population.

Crystalline methamphetamine use is a recent trend in Australia, which has complemented an existing market for low purity powder methamphetamine, known as 'speed', and a somewhat stronger damp or oily powder sold as 'base' methamphetamine (Topp et al., 2002). Consistent with the international experience, the emergence of crystalline methamphetamine has been coupled with an increase in methamphetamine-related problems, which have been attributed largely to the crystalline form of the drug (Topp et al., 2002). Dependence and related problems among crystalline methamphetamine users, however, could be related to a range of factors, including concurrent use of 'speed' or 'base' methamphetamine, duration of use, route of administration, or the socio-demographic characteristics of people who use this more potent form of the drug.

The aim of the current study was to examine whether crystalline methamphetamine users were more likely to be dependent on methamphetamine than people who used other forms of the drug. We also sought to examine to what extent dependence among crystalline methamphetamine users could be accounted for by their being longer-term users with heavier metham-

phetamine use patterns. This was done by undertaking a cross-sectional survey of regular methamphetamine users and comparing the past year prevalence of methamphetamine dependence, and other methamphetamine use patterns, among participants who had used crystalline methamphetamine during this time with those who had not.

## 2. Method

### 2.1. Participants and procedure

Participants were 309 regular methamphetamine users from Sydney who were recruited through advertisements in free press publications, newspapers, websites, needle and syringe programs, and through word of mouth. Recruitment took place between December 2003 and July 2004. Inclusion criteria for participation were having used methamphetamine at least 12 times during the past year and being at least 16 years of age. A structured questionnaire was administered face-to-face by researchers at a mutually convenient location (e.g., cafes, parks and health centres). Interview venues were chosen to ensure that participants had adequate anonymity and privacy. The research project was approved by the University of New South Wales Human Research Ethics Committee prior to commencement. All participants were volunteers who completed informed consent prior to participation and were reimbursed AU\$30 for their time and travel expenses.

### 2.2. Measures

**2.2.1. General drug use history.** General drug use measures included: (a) frequency of methamphetamine use in the past year (less than weekly, weekly, more than weekly but less than daily, and daily or almost daily); (b) age of first methamphetamine use; (c) main route of methamphetamine administration (injection, smoking, snorting or swallowing) in the past year; (d) other drugs used in the past year. Participants were asked to consider all forms of methamphetamine when they responded to questions relating to methamphetamine use, including those forms sold under the street names 'speed', 'base', 'ice' and 'crystal meth'.

**2.2.2. Forms of methamphetamine.** Forms of methamphetamine were categorised as: (a) powder methamphetamine or 'speed'; (b) damp or oily 'base' methamphetamine; (c) crystalline methamphetamine or 'ice'; (d) other forms of the drug (e.g., liquid, pills), according to the classification system developed by Topp et al. (2002). For each of these forms of methamphetamine, information was obtained on: (a) lifetime use; (b) any use in the past year; (c) days used in the past month; (d) typical number of use occasions per day; (e) typical quantity used per occasion; (f) preferred route of administration.

Crystalline methamphetamine users were defined as participants who had taken crystalline methamphetamine in the past year. The use of crystalline methamphetamine was verified using photographs of crystalline methamphetamine and comparative photographs of other forms of methamphetamine seized by Australian law enforcement agencies (see McKetin et al., 2005). The

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