

Original Research

Ice and the outback: Patterns and prevalence of methamphetamine use in rural Australia

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Abstract

Objective: This study investigated whether lifetime and recent methamphetamine use (including crystal methamphetamine) differed among city, regional and rural residents and whether particular subpopulations were more at-risk.

Design: Secondary analyses of the last three National Drug Strategy Household Surveys and corresponding Alcohol and Other Drug Treatment Services National Minimum Data Sets (AODTS NMDS).

Setting: Australian general population.

Participants: Australians who completed the 2007 (n = 22 519), 2010 (n = 25 786) and 2013 (n = 23 512) NDSHS (aged 14 +); and treatment episodes where the principal drug of concern was recorded in the 2006/2007 (n = 139 808), 2009/2010 (n = 139 608) and 2012/2013 (n = 154 489) AODTS NMDS.

Main outcome measure(s): To determine whether rural Australians were more likely to use methamphetamine than non-rural counterparts.

Results: Lifetime and recent methamphetamine and recent crystal methamphetamine use were significantly higher among rural than other Australians. Significantly more rural men and employed rural Australians used methamphetamine than their city, regional or Australian counterparts. Rural Australians aged 18–24 and 25–29 years were significantly more likely to have used methamphetamine in their lifetime than city or Australian residents. Rural Australians aged 18–24 years were significantly more likely to have recently used crystal methamphetamine.

Conclusions: Interventions tailored to address the specific and unique circumstances of rural settings are required to reduce and prevent methamphetamine use,

particularly crystal methamphetamine. Scope exists to focus prevention efforts on rural workplaces and primary care settings. Greater understanding of the higher prevalence of methamphetamine use in rural areas is required, plus implementation of comprehensive strategies and optimised treatment utilisation.

KEY WORDS: crystal methamphetamine, drug treatment, drug use, ice, methamphetamine, rural.

Introduction

There is growing concern in Australia about illicit use of methamphetamine, especially the crystalline form, 'ice'.¹ Crystal methamphetamine is more potent than base, liquid and powder forms of methamphetamine. Anecdotal reports suggest an escalation of methamphetamine use in rural locations but no detailed examination has been undertaken to-date.

Crystal methamphetamine use in rural areas is particularly concerning. Rural Australians experience compromised health compared with other Australians.^{2–4} They have shorter life expectancies^{2,5} and significantly higher mortality rates,^{4–6} unemployment,^{7,8} suicide,^{6,9} mental illness,^{2,9} injury,^{2,10} chronic illness,^{2,5} cardiovascular and diabetes-related deaths,⁶ family and domestic violence⁸ and higher alcohol^{2,11,12} and illicit drug¹³ use. Questions arise regarding the levels of crystal methamphetamine use in rural Australia.

Recent methamphetamine use has been stable at approximately 2% in Australia since 2007. However, prevalence varies by gender, age, employment status, sexual orientation and Indigenous status.¹⁴ A few older studies investigated methamphetamine use by rural/metropolitan location^{15,16}; none has investigated current rural patterns and prevalence.

This article examined methamphetamine, including crystal methamphetamine, use in rural, regional and city locations, changes over time by geographic location and demographic profile, and AOD treatment utilisation.

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What is already known on this subject:

- Particular demographic groups such as men and adults aged 25–29 years are more likely to have used methamphetamine. Although a few studies have investigated whether methamphetamine use varies across rural and metropolitan areas of Australia, none has investigated whether patterns and prevalence of methamphetamine use in rural localities have changed over time in the general Australian population. This study addressed whether rural Australians are more susceptible to methamphetamine and crystal methamphetamine use and how the profile of city, regional and rural methamphetamine users has changed over time.

Method

Secondary analyses were undertaken on the National Drug Strategy Household Survey (NDSHS) for 2007, 2010 and 2013 and the Alcohol and Other Drug Treatment Services National Minimum Data Set (AODTS NMDS). NDSHS collects data on alcohol, tobacco and illicit drug use triennially from Australians aged 12 years and older.^{14,17,18} AODTS NMDS collects data from Australia's publicly funded AOD treatment agencies on closed treatment.^{19–21}

Participants

NDSHS data from 2007 ($n = 22\,519$), 2010 ($n = 25\,786$) and 2013 ($n = 23\,512$) for participants 14+ years were included, and AODTS NMDS treatment episodes (TE) data for 2006/2007 ($n = 139\,808$ TE), 2009/2010 ($n = 139\,608$ TE), and 2012/2013 ($n = 154\,489$ TE).

Procedure

NDSHS identified patterns and prevalence of *lifetime* and *recent* methamphetamine and *recent* crystal methamphetamine use. Differences across geographic location by gender, age and employment status were examined. The form *ever* and *mainly* used was explored for 2010 and 2013.

Lifetime methamphetamine use (for non-medical purposes) was determined by two questions: 'Have you ever used Meth/amphetamine?' and 'Have you ever used Meth/amphetamine for non-medical purposes?' These questions plus 'Have you used Meth/amphetamine for non-medical purposes in the last

What this paper adds:

Compared to their city, regional and Australian counterparts,

- prevalence of lifetime methamphetamine, recent methamphetamine and recent crystal methamphetamine use is significantly higher among rural Australians.
- rural men and employed rural Australians are significantly more likely to use methamphetamine.
- rural Australians aged 18–24 years are significantly more likely to have recently used crystal methamphetamine.

Lifetime methamphetamine

- prevalence among rural Australians aged 18–24 years and 25–29 years is significantly higher than among city residents or Australians overall; and recent methamphetamine and crystal methamphetamine use increased significantly among rural people between 2007 and 2013.

These subgroups in rural locations would benefit from targeted interventions.

12 months?' established prevalence of *recent* methamphetamine use. Prevalence of *recent* crystal methamphetamine use was derived from these three questions plus 'What forms of Meth/amphetamine have you ever used?' The latter question was chosen over 'In the last 12 months, what was the main form of Meth/amphetamine that you used?' to capture any use of crystal methamphetamine by recent methamphetamine users. Participants were only asked subsequent questions if they responded 'yes' to the previous questions. Data from each question were required to establish lifetime and recent prevalence.

The AODTS NMDS was used to determine treatment demand by geographic location over time, at timeframes concurrent with NDSHS data to allow comparisons.

Treatment for methamphetamine as the principal drug of concern was recoded into a bivariate variable: 'methamphetamine' (for index codes 3100 (amphetamines not further defined), 3101 (amphetamine), 3103 (methamphetamine) and 3104 (amphetamine analogues)) and 'other' (all other index codes).

The Australian Standard Geographical Classification (ASGC) of 'remoteness' was used. ASGC identifies five 'remoteness categories' by population size, and road distance to nearest urban centre from a person's residence (in NDSHS), or treatment facility (in AODTS NMDS). The five remoteness categories: major cities,

inner regional, outer regional, remote, and very remote were collapsed into three: 'city' (major cities), 'regional' (inner regional) and 'rural' (all other areas).

The Australian Institute of Health and Welfare Ethics Committee and the Southern Adelaide Clinical Human Research Ethics Committee approved the use of AODTS NMDS.

Analysis

Frequency analyses were conducted with weighted NDSHS data using SPSS complex samples analysis. NDSHS data are weighted for selection probability, accounting for respondent's age, sex, location and household size.²² Unweighted frequency analyses were performed on AODTS NMDS. Significance testing (Z -tests) across/within years were performed on relevant reliable (i.e. $SE < 25\%$) data.

Results

Prevalence by geographic location

Prevalence of *lifetime* and *recent* methamphetamine, and crystal methamphetamine, use varied by location. In 2013, *lifetime* methamphetamine use was significantly higher in rural locations than in cities ($Z = 2.5$, $P = 0.006$), regions ($Z = 3.1$, $P = 0.001$) or Australia overall ($Z = 2.4$, $P = 0.008$) (Table 1). For *recent* methamphetamine use, significantly more rural Australians used than city ($Z = 1.9$, $P = 0.031$), regional ($Z = 3.1$, $P = 0.001$) or Australian residents overall ($Z = 1.9$, $P = 0.027$) (Table 2). Prevalence of crystal methamphetamine use was also significantly higher in rural locations than cities ($Z = 2.2$, $P = 0.015$), regions ($Z = 3.6$, $P < 0.001$) or Australia overall ($Z = 2.8$, $P = 0.003$) (Table 3).

Prevalence of methamphetamine use varied over time. Between 2007 and 2013, *lifetime* prevalence increased significantly among rural (6.4% versus 8.1%, $Z = 2.8$, $P = 0.003$), regional (5.1% versus 6.3%, $Z = 2.4$, $P = 0.008$) and Australian residents (6.3% versus 7.0%, $Z = 3.0$, $P = 0.001$) but remained stable among city residents (6.6% versus 6.9%, $Z = 1.0$, $P = 0.151$), with lifetime prevalence in 2013 highest in rural locations.

Between 2007 and 2013, *recent* methamphetamine use remained stable nationally at approximately 2% (Table 2). However, *recent* use of methamphetamine increased significantly among rural residents from 1.9% to 2.6% ($Z = 2.0$, $P = 0.022$) and decreased among city residents from 2.5% to 2.1% ($Z = 2.3$, $P = 0.011$).

For crystal methamphetamine, *recent* use in Australia increased significantly between 2007 and 2013 ($Z = 1.9$, $P = 0.030$) (Table 3). There was no change

in prevalence among city residents, but use increased significantly among rural ($Z = 4.4$, $P < 0.001$) and regional ($Z = 2.1$, $P = 0.017$) residents.

Demographic profiles varied by geographical location. While a higher proportion of men than women had used methamphetamine in their *lifetime* and *recently* (including crystal methamphetamine), rural men had the highest prevalence of use and were significantly more likely to have used methamphetamine in their *lifetime* or *recently*, or to have used crystal methamphetamine (Tables 1–3).

Australians aged 25–29 years were most likely to have used methamphetamine in their *lifetime*. Prevalence among rural 25–29 year olds was significantly higher than city ($Z = 2.3$, $P = 0.010$), or Australian ($Z = 2.1$, $P = 0.020$), counterparts (Table 1). There was no significant difference between rural versus city, regional or overall Australians aged 25–29 years in *recent* use of methamphetamine or crystal methamphetamine (Tables 2–3).

Among rural 18–24 year olds, *lifetime* prevalence of methamphetamine use was significantly higher than for those in cities or Australia overall (Table 1). *Recent* methamphetamine use by rural 18–24 year olds was not statistically different from those in city or regional locations, or Australia overall (Table 2), while rural 18- to 24-year olds' use of *crystal* methamphetamine was significantly higher than their city ($Z = 2.0$, $P = 0.021$), regional ($Z = 1.9$, $P = 0.027$) or Australian ($Z = 1.9$, $P = 0.027$) counterparts (Table 3).

Employed rural Australians were more likely to have reported *lifetime* or *recent* methamphetamine use than people in other locations (Tables 1 and 2). Prevalence of crystal methamphetamine for employed rural residents was also significantly higher than employed city, regional and Australian residents (Table 3). Unemployed rural residents had lower *lifetime* methamphetamine and *recent* methamphetamine and crystal methamphetamine prevalence compared with their counterparts in city, regions and Australia overall.

The form of methamphetamine used varied over time and by location. In 2010, the form of methamphetamine *ever* used (Table 4) and *mainly* used (Table 5) in Australia and each geographic location was powder. In 2013, crystal methamphetamine was the *main* form used in all locations. Crystal methamphetamine replaced powder as the dominant form *ever* used by Australians overall, or in cities and rural areas. Powder remained the dominant form *ever* used among regional residents.

Treatment demand

AOD treatment service utilisation also increased across all locations (2006/2007 to 2012/2013). Between

TABLE 1: Australian (aged 14 +) prevalence of lifetime methamphetamine^a use by geographic location^b, 2007, 2010 and 2013, National Drug Strategy Household Survey

	Australia %			City %			Regional %			Rural %			Sig testing Z (P) one tailed
	2007	2010	2013	2007	2010	2013	2007	2010	2013	2007	2010	2013	
Total	6.3 ^c	7.0	7.0 ^{c,d,e}	6.6 ^f	7.2	6.9 ^{f,g}	5.1 ^h	6.3	6.3 ^{d,h,i}	6.4 ⁱ	7.2	8.1 ^{e,g,i,j}	3.0 (0.001) ^c ; 1.6 (0.053) ^d ; 2.4 (0.008) ^e ; 1.0 (0.151) ^f ; 2.5 (0.006) ^g ; 2.4 (0.008) ^h ; 3.1 (0.001) ⁱ ; 2.8 (0.003) ^j
Male	7.7	8.2	8.6 ^e	7.8	8.2	8.6 ^g	6.7	7.3	7.1 ⁱ	8.7	9.3	11.0 ^{e,g,i}	3.1 (<0.001) ^c ; 3.0 (0.001) ^g ; 3.9 (<0.001) ⁱ
Female	4.9	5.9	5.3	5.4	6.2	5.3	3.7	5.2	5.6	4.0	5.1	5.4	NA
14-17	1.3 ^k	0.5 ^k	1.6 ^k	1.3 ^k	0.4 ^l	1.3 ^k	1.3 ^l	1.2 ^l	0.7 ^l	1.1 ^l	0.0	5.2 ^l	NA
18-24	11.0	9.4	8.4 ^e	11.5	9.2	8.0 ^g	8.6 ^k	9.0	8.6 ⁱ	12.2 ^k	11.2	12.2 ^{e,g,i}	1.9 (0.029) ^e ; 2.1 (0.019) ^g ; 1.3 (0.093) ⁱ
25-29	18.9	18.6	16.6 ^e	19.2	18.7	15.8 ^g	16.6	18.0	16.5 ⁱ	20.7	18.5	21.9 ^{e,g,i}	2.1 (0.020) ^e ; 2.3 (0.010) ^g ; 1.5 (0.066) ⁱ
30-39	11.4	14.7	14.7	11.7	14.6	14.3	10.6	15.4	14.7	10.9	14.0	17.1	NA
40+	2.5	3.0	3.4	2.5	3.0	3.4	2.1	2.9	3.5	3.2	3.4	3.5	NA
Employed	7.9	9.0	9.1 ^e	8.3	9.4	9.0 ^g	6.1	7.4	8.3 ⁱ	8.7	8.9	10.7 ^{e,g,i}	2.3 (0.010) ^e ; 2.4 (0.009) ^g ; 2.6 (0.005) ⁱ
Unemployed	13.1	11.0	10.9	13.2	9.8	11.3	11.6 ^k	18.2	10.1 ^k	15.8 ^k	9.1 ^k	9.3 ^k	NA
Not in the labour force	3.8	3.8	3.5	4.0	3.6	3.5	3.6	4.0	3.0	2.7	4.1	4.1 ^k	NA

^aAny form of methamphetamine; ^bFour geographic locations are used: 1. Australia overall; 2. City: comprises Australian Standard Geographical Classification (ASGC) category 'major cities'; 3. Regional: comprises ASGC category 'inner regional'; and 4. Rural: comprises ASGC categories 'outer regional', 'remote' and 'very remote'; ^cSignificance testing of 2007 versus 2013 Australia data; ^dSignificance testing of 2013 Australia versus 2013 regional data; ^eSignificance testing of 2013 Australia versus 2013 rural data; ^fSignificance testing of 2007 versus 2013 city data; ^gSignificance testing of 2013 city versus 2013 rural data; ^hSignificance testing of 2007 versus 2013 regional data; ⁱSignificance testing of 2013 regional versus 2013 rural data; ^jSignificance testing of 2007 versus 2013 rural data; ^kEstimate has a relative standard error of 25-50% and should be used with caution; ^lEstimate has a relative standard error >50% and is considered too unreliable for general use; NA, not applicable.

TABLE 2: Australian (aged 14 +) prevalence of recent methamphetamine^a use by geographic location^b, 2007, 2010 and 2013, National Drug Strategy Household Survey

	Australia %			City %			Regional %			Rural %			Sig testing Z (P) one tailed
	2007	2010	2013	2007	2010	2013	2007	2010	2013	2007	2010	2013	
Total	2.3 ^c	2.1	2.1 ^{c,d,e}	2.5 ^f	2.0	2.1 ^{f,g}	1.7 ^h	2.0	1.6 ^{d,h,i}	1.9 ^j	2.1	2.6 ^{g,i,j}	1.5 (0.072) ^g ; 2.1 (0.019) ^d ; 1.9 (0.027) ^g ; 2.3 (0.011) ^f ; 1.9 (0.031) ^g ; 0.4 (0.356) ^h ; 3.1 (0.001) ^j ; 2.0 (0.022) ^j 2.7 (0.004) ^g ; 2.6 (0.005) ^g ; 3.4 (<0.001) ^j
Male	3.0	2.5	2.7 ^e	3.2	2.4	2.7 ^g	2.6 ^h	2.6	1.9 ⁱ	2.5 ^j	2.5 ^k	3.9 ^{k,e,g,i}	NA
Female	1.6	1.7	1.5	1.9	1.7	1.6	0.9 ^k	1.5	1.3	1.3	1.7	1.3	NA
14-17	0.9 ^k	0.3 ^l	1.6 ^k	1.0 ^k	0.0 ^l	1.3 ^k	0.7 ^l	1.2 ^l	0.7 ^l	0.6 ^l	0.0	5.2 ^l	NA
18-24	5.5	5.3	4.5 ^e	5.7	5.0	4.3 ^g	4.6 ^k	5.9	4.3 ^{k,i}	5.0 ^k	6.2 ^k	6.7 ^{k,e,g,i}	1.5 (0.072) ^g ; 1.6 (0.058) ^g ; 1.2 (0.121) ^j
25-29	8.4	6.1	6.3 ^e	9.0	5.7	6.5 ^g	5.5 ^k	6.9	4.9 ^{k,i}	9.8 ^k	7.3 ^k	6.4 ^{k,e,g,i}	0.1 (0.476) ^g ; 0.1 (0.476) ^g ; 0.7 (0.239) ^j
30-39	3.9	3.4	3.1	4.3	3.1	2.9	3.3	4.1	3.4 ^k	2.3 ^k	4.2	4.3	NA
40+	0.4	0.5	0.6	0.4	0.5	0.6	0.5 ^k	0.5 ^k	0.4 ^k	0.5 ^k	0.2 ^k	0.7 ^k	NA
Employed	2.8	2.6	2.3 ^e	3.1	2.7	2.3 ^g	1.9	2.4	2.1 ⁱ	2.3	2.6	3.2 ^{e,g,i}	2.4 (0.007) ^g ; 2.3 (0.010) ^g ; 2.2 (0.016) ^j
Unemployed	6.0	4.8	5.6	7.3 ^k	4.5	6.3	3.2 ^l	8.1 ^k	4.9 ^k	3.8 ^l	2.1 ^l	0.8 ^l	NA
Not in the labour force	1.5	0.9	1.2	1.6	0.8	1.3	1.4 ^k	1.1	0.4 ^l	1.1 ^k	0.8 ^k	1.7 ^l	NA

^aAny form of methamphetamine; ^bFour geographic locations are used: 1. Australia overall; 2. City: comprises Australian Standard Geographical Classification (ASGC) category 'major cities'; 3. Regional: comprises ASGC category 'inner regional'; and 4. Rural: comprises ASGC categories 'outer regional', 'remote' and 'very remote'; ^cSignificance testing of 2007 versus 2013 Australia data; ^dSignificance testing of 2013 Australia versus 2013 regional data; ^eSignificance testing of 2013 Australia versus 2013 rural data; ^fSignificance testing of 2007 versus 2013 city data; ^gSignificance testing of 2013 city versus 2013 regional data; ^hSignificance testing of 2007 versus 2013 regional data; ⁱSignificance testing of 2013 regional versus 2013 rural data; ^jSignificance testing of 2007 versus 2013 rural data; ^kEstimate has a relative standard error of 25-50% and should be used with caution; ^lEstimate has a relative standard error >50% and is considered too unreliable for general use; NA, not applicable.

TABLE 3: Australian (aged 14 +) prevalence of recent crystal methamphetamine^a use by geographic location^b, 2007, 2010 and 2013, National Drug Strategy Household Survey

	Australia %			City %			Regional %			Rural %			Sig testing Z (P) one tailed
	2007	2010	2013	2007	2010	2013	2007	2010	2013	2007	2010	2013	
	Total	1.2 ^c	1.0	1.4 ^{c,d,e}	1.5	1.0	1.5 ^g	0.6 ^h	0.9	1.0 ^{d,h,i}	0.8 ^{k,j}	0.9 ^k	
Male	1.5	1.3	1.8 ^e	1.8	1.3	1.8 ^g	0.9 ^h	1.3	1.3 ^{i,k}	1.2 ^{k,j}	1.5 ^k	3.0 ^{e,g,i,k}	3.2 (<0.001) ^e ; 3.1 (0.001) ^g ; 3.4 (<0.001) ⁱ
Female	0.9	0.6	1.1	1.2	0.7	1.2	0.4 ^k	0.5 ^k	0.7 ^k	0.5 ^k	0.3 ^k	0.9 ^k	NA
14-17	0.5 ^k	0.0	1.1 ^l	0.7	0.0 ^l	0.7 ^l	0.4 ^l	0.0	0.0	0.0	0.0	5.2 ^l	NA
18-24	2.6	1.9	3.5 ^e	2.8	1.7	3.3 ^g	1.1 ^k	2.0 ^k	2.6 ^{i,k}	3.9 ^k	2.7 ^l	6.1 ^{k,e,g,i}	1.9 (0.027) ^e ; 2.0 (0.021) ^g ; 1.9 (0.027) ⁱ
25-29	4.5	3.4	4.6 ^e	5.2	3.0	4.8 ^g	2.1 ^k	3.9 ^k	3.5 ^{i,k}	3.6 ^k	5.0 ^k	4.8 ^{e,g,i,k}	0.1 (0.444) ^e ; 0.0 (0.500) ^g ; 0.7 (0.236) ⁱ
30-39	2.3	1.6	2.1	2.7	1.6	1.9	1.6 ^k	2.0 ^k	2.8 ^k	1.0 ^k	1.1 ^k	2.7 ^k	NA
40+	0.2	0.3	0.4	0.2	0.3	0.4	0.2 ^k	0.2 ^k	0.1 ^k	0.1 ^l	0.1 ^l	0.4 ^k	NA
Employed	1.5	1.3	1.5 ^e	1.7	1.4	1.4 ^g	0.7 ^k	1.1	1.3 ⁱ	1.0 ^k	1.3 ^k	2.3 ^{e,g,i}	2.7 (0.004) ^e ; 2.9 (0.002) ^g ; 2.4 (0.009) ⁱ
Unemployed	3.9 ^k	1.8 ^k	4.7	4.7 ^k	1.9 ^k	5.5	1.9 ^l	1.9 ^l	3.2 ^l	3.0 ^l	0.9 ^l	0.7 ^l	NA
Not in the labour force	0.8	0.3	0.9	0.9	0.3	0.9	0.5 ^k	0.5 ^k	0.3 ^l	0.5 ^k	0.3 ^l	1.4 ^l	NA

^aRecent use of crystal methamphetamine includes those who have used methamphetamine in the last 12 months and have ever used the form: 'crystal, ice'. ^bFour geographic locations are used: 1. Australia overall; 2. City: comprises Australian Standard Geographical Classification (ASGC) category 'major cities'; 3. Regional: comprises ASGC category 'inner regional'; and 4. Rural: comprises ASGC categories 'outer regional', 'remote' and 'very remote'; ^cSignificance testing of 2007 versus 2013 Australia data; ^dSignificance testing of 2013 Australia versus 2013 regional data; ^eSignificance testing of 2013 Australia versus 2013 rural data; ^fSignificance testing of 2007 versus 2013 city data; ^gSignificance testing of 2013 city versus 2013 rural data; ^hSignificance testing of 2007 versus 2013 regional data; ⁱSignificance testing of 2013 regional versus 2013 rural data; ^jSignificance testing of 2007 versus 2013 rural data; ^kEstimate has a relative standard error of 25-50% and should be used with caution; ^lEstimate has a relative standard error >50% and is considered too unreliable for general use; NA, not applicable.

TABLE 4: Form ever used by Australians (aged 14 +) who have used methamphetamine in the past 12 months by geographic location^a, 2010 and 2013, National Drug Strategy Household Survey

	Australia %		City %		Regional %		Rural %		Sig testing Z (P) one tailed
	2010	2013	2010	2013	2010	2013	2010	2013	
Powder	83.1 ^b	64.9 ^{b,c,d}	79.7 ^e	64.9 ^e	89.2 ^f	67.1 ^{c,f}	93.5 ^g	63.1 ^{d,g}	6.0 (<0.001) ^b ; 0.3 (0.374) ^c ; 0.3 (0.382) ^d ; 4.0 (<0.001) ^e ; 3.2 (0.001) ^f ; 3.9 (<0.001) ^g
Liquid	15.8	14.1	12.8	14.3	25.0	12.2 ^h	17.2 ^h	14.9 ^h	NA
Crystal	50.8 ^b	71.5 ^{b,c,d}	51.6 ^e	71.5 ^e	47.9 ^f	64.5 ^{c,f}	51.5 ^g	77.9 ^{d,g}	6.1 (<0.001) ^b ; 1.1 (0.142) ^c ; 1.1 (0.127) ^d ; 4.9 (<0.001) ^e ; 1.9 (0.028) ^f ; 3.1 (0.001) ^g
Base	37.8	28.3	35.9	25.3	47.4	37.8	31.4 ^h	34.5	NA
Tablet	32.9	26.5	34.3	26.1	33.8	35.9	23.0 ^h	20.2 ^h	NA
Prescription amphetamines	15.1	14.1	16.0	16.4	15.0 ^h	8.6 ^h	9.7 ⁱ	7.6 ^h	NA
Capsules	NA	17.0	NA	17.4	NA	22.4 ^h	NA	10.4 ^h	NA
Other	1.9 ^h	2.5	1.3 ⁱ	2.2 ^h	4.7 ⁱ	1.4 ⁱ	0.0	5.0 ⁱ	NA

^aFour geographic locations are used: 1. Australia overall; 2. City: comprises Australian Standard Geographical Classification (ASGC) category 'major cities'; 3. Regional: comprises ASGC category 'inner regional'; and 4. Rural: comprises ASGC categories 'outer regional', 'remote' and 'very remote'; ^bSignificance testing of 2010 versus 2013 Australia data; ^cSignificance testing of 2013 Australia versus 2013 regional data; ^dSignificance testing of 2013 Australia versus 2013 rural data; ^eSignificance testing of 2010 versus 2013 city data; ^fSignificance testing of 2010 versus 2013 regional data; ^gSignificance testing of 2010 versus 2013 rural data; ^hEstimate has a relative standard error of 25–50% and should be used with caution; ⁱEstimate has a relative standard error >50% and is considered too unreliable for general use; NA, not applicable.

2006/2007 and 2012/2013, methamphetamine-related treatment episodes significantly increased in city ($Z = 15.6$, $P < 0.001$), regional ($Z = 9.7$, $P < 0.001$) and rural ($Z = 4.4$, $P < 0.001$) locations and Australia overall ($Z = 16.7$, $P < 0.001$) (Table 6). This increase was proportionally smaller in rural services.

Discussion

Growing concerns about increased prevalence of methamphetamine use are not strongly supported by research data and contrast with extensive media images.²³ A more complex, variable picture has emerged.²⁴ What is clear, is that there has been a disproportionately larger increase in methamphetamine, including crystal methamphetamine, use in rural locations compared with other Australian locations.

A current challenge is to identify factors contributing to significantly higher methamphetamine prevalence in rural areas and the changes that might have produced this differential pattern of use. Risky AOD use has traditionally been higher in rural locations.^{2,11–13} Factors that contribute to higher AOD use in general (lower educational attainment, low socio-economic status, higher unemployment and isolation) may apply in

relation to methamphetamine. The recent increase in methamphetamine, especially crystal methamphetamine, use may reflect deliberate targeting of rural communities by illegal distribution networks. While no empirical evidence exists to support this speculation, anecdotal evidence suggests it may be one of several contributory factors. If so, response strategies that target this issue and sources of availability are warranted.

The need for appropriate primary and secondary level interventions specifically tailored to age and gender groups and subpopulations using methamphetamine and crystal methamphetamine in rural locations are also highlighted by these findings. In particular, rural men and employed rural Australians were both significantly more likely to have used methamphetamine in their *lifetime* or *recently* or have *recently* used crystal methamphetamine. Rural Australians aged 18–24 and 25–29 years were also at significantly greater risk of *lifetime* methamphetamine use than city or Australian counterparts overall. Rural 18–24 year olds were significantly more likely to have *recently* used crystal methamphetamine than residents located elsewhere.

As *lifetime* and *recent* methamphetamine use was significantly higher among rural employed Australians, an

TABLE 5: *Form mainly used by Australians (aged 14 +) who have used methamphetamine in the past 12 months by geographic location^a, 2010 and 2013, National Drug Strategy Household Survey*

	Australia %		City %		Regional %		Rural %		Sig testing Z (P) one tailed
	2010	2013	2010	2013	2010	2013	2010	2013	
Form of methamphetamine ever (mainly) used									
Powder	50.6 ^b	28.5 ^{b,c,d}	48.2 ^e	26.8 ^e	58.8 ^f	33.1 ^{c,f}	51.1 ^g	32.9 ^{d,g,h}	6.1 (<0.001) ^b ; 0.6 (0.258) ^c ; 0.7 (0.255) ^d ; 5.0 (<0.001) ^e ; 2.8 (0.003) ^f ; 1.9 (0.028) ^g
Liquid	0.9 ⁱ	0.5 ⁱ	0.2 ⁱ	0.2 ⁱ	3.1 ⁱ	1.4 ⁱ	1.1 ⁱ	1.2 ⁱ	
Crystal	21.7 ^b	50.4 ^{b,c,d}	23.5 ^e	51.6 ^e	12.0 ^{f,h}	38.8 ^{c,f}	27.0 ^{g,h}	54.6 ^{d,g}	8.2 (<0.001) ^b ; 1.5 (0.069) ^c ; 0.6 (0.271) ^d ; 6.6 (<0.001) ^e ; 3.5 (<0.001) ^f ; 2.9 (0.002) ^g
Base	11.8	7.6 ^h	10.7	7.0 ^h	13.1 ^h	18.4 ^h	16.2 ⁱ	1.3 ⁱ	NA
Tablet	8.2	8.0 ^h	8.4	8.7 ^h	10.0 ^h	7.4 ⁱ	3.8 ⁱ	5.3 ⁱ	NA
Prescription amphetamines	6.8	3.0 ^h	8.9	3.5 ^h	2.9 ⁱ	0.0	0.8 ⁱ	3.1 ⁱ	NA
Capsules	NA	2.0 ^h	NA	2.3 ^h	NA	0.9 ⁱ	NA	1.4 ⁱ	NA
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA
Total	100	100	100	100	100	100	100	100	NA

^aFour geographic locations are used: 1. Australia overall; 2. City: comprises Australian Standard Geographical Classification (ASGC) category 'major cities'; 3. Regional: comprises ASGC category 'inner regional'; and 4. Rural: comprises ASGC categories 'outer regional', 'remote' and 'very remote'; ^bSignificance testing of 2010 versus 2013 Australia data; ^cSignificance testing of 2013 Australia versus 2013 regional data; ^dSignificance testing of 2013 Australia versus 2013 rural data; ^eSignificance testing of 2010 versus 2013 city data; ^fSignificance testing of 2010 versus 2013 regional data; ^gSignificance testing of 2010 versus 2013 rural data; ^hEstimate has a relative standard error of 25–50% and should be used with caution; ⁱEstimate has a relative standard error >50% and is considered too unreliable for general use; NA, not applicable.

TABLE 6: *Treatment for methamphetamine^a as the principal drug of concern by geographic location^b, 2006/2007, 2009/2010 and 2012/2013, Alcohol and Other Drug Treatment Services National Minimum Data Set*

	2006/2007		2009/2010		2012/2013		Sig testing Z (P-value) one tailed
	n	%	n	%	n	%	
Australia	17 118	12.2 ^c	9930	7.1	22 038	14.3 ^c	16.7 (<0.001) ^c
City	13 397	13.7 ^c	7543	8.2	16 256	16.2 ^c	15.6 (<0.001) ^c
Regional	2701	9.8 ^c	1765	5.8	3988	12.3 ^c	9.7 (<0.001) ^c
Rural	1020	7.2 ^c	622	3.6	1794	8.5 ^c	4.4 (<0.001) ^c

^aMethamphetamine: comprises the Alcohol and Other Drug Treatment Services National Minimum Data Set index codes 3100, 3101, 3103, 3104; ^bFour geographic locations are used: 1. Australia overall; 2. City: comprises Australian Standard Geographical Classification (ASGC) category 'major cities'; 3. Regional: comprises ASGC category 'inner regional'; and 4. Rural: comprises ASGC categories 'outer regional', 'remote' and 'very remote'; ^cSignificance testing of 2006/2007 versus 2012/2013 data.

opportunity exists to implement prevention and early intervention programmes through appropriate workplace settings and employer groups.²⁵ Workplaces offer ideal intervention settings, providing captive audiences

and inherent motivational factors related to job retention, safety, productivity and duty of care.²⁵

Many people using methamphetamine exhibit low grade mental health problems, such as anxiety,

depression or mood dysregulation. Many experience disrupted sleep patterns, poor diet, dehydration and other methamphetamine-associated health problems.¹ Risk of developing these conditions is increased when the crystalline form of methamphetamine is used. These conditions often manifest in generally poor health and provide opportunities for screening and intervention in primary care settings where the presenting problem may not be drug use related. GPs and other primary care providers in rural settings thus have a potentially important role to play.

Despite the increased prevalence of methamphetamine in rural locations, rural services reported a smaller proportion of episodes of care for methamphetamine compared with services in cities and regions. This may reflect limited access to treatment facilities, lack of relevant expertise or greater concern with other drugs in rural locations. Alternatively, higher proportion of episodes of care in non-rural locations may reflect greater severity of problems among users rather than prevalence levels alone.

Numerous treatment barriers exist for methamphetamine users, regardless of residential location. Engaging and retaining methamphetamine users in treatment can be difficult and, apart from cognitive behavioural therapy, evidence-based treatment options are limited. Furthermore, access to treatment services may be limited in rural localities or curtailed by poor public transport. Other barriers to help-seeking include lack of anonymity and confidentiality and community stigma.¹⁶ Demand may be higher and capacity lower in rural treatment facilities, resulting in delayed access to treatment or the need to attend a facility located elsewhere. A multitude of service access barriers are faced by rural people which are not experienced by their metropolitan counterparts. Consequently, rural locations may particularly benefit from implementation of harm reduction measures and provision of other forms of professional help services such as online or telephone counselling.

The limitations of these data include the following: NDSHS is a self-report survey and respondents may not accurately recall/report *recent* and *lifetime* drug use. The NDSHS may not fully sample particular population subgroups at risk of drug use, including methamphetamine. Underestimation of drug use is more likely than overestimation; hence, these data are likely to be conservative. It was not possible to determine whether reported increases in crystal methamphetamine use reflected a true increase; users may have greater awareness of the drug (due to media attention) and incorrectly report using it when in fact another form or drug was used. Whether rural residents used methamphetamine in their home location or while visiting a regional or city location is unknown. State comparisons

for methamphetamine use were initially undertaken but excluded due to small sample sizes. Findings need to be considered in light of state and rurality variations. Also, AODTS NMDS reports location of facilities, not client's residence.

Harms associated with, and risk of problematic use, cannot be definitively inferred from lifetime and recent use. However, these are standard proxy measures to identify possible at-risk users noting that even infrequent use can be associated with adverse events.

Conclusion

This is the first Australian study to examine differential patterns of methamphetamine, including crystal methamphetamine, use by rural location. The findings that those living in rural locations have statistically significantly higher levels of use of methamphetamine in general, and crystal methamphetamine in particular, is concerning. It is especially concerning given pre-existing health and social vulnerabilities of those living in rural Australia. However, these findings are important as they will help inform tailored strategies and interventions needed to address this growing problem.

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