

# Injecting drug use opportunities and reasons for choosing not to inject: A population-based study of Australian young adults who use stimulants

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## Abstract

**Introduction.** Understanding reasons for choosing not to inject drugs, among those who have never injected before, may be helpful for reducing transitions to injecting drug use. This study examines opportunities to inject and reasons for never injecting in young adults who used stimulants. **Methods.** Data are from a population-based study of young adults who used ecstasy and methamphetamine ( $n = 313$ ), recruited in Queensland, Australia in 2008/2009. At the follow-up, participants who had never injected ( $n = 293$ ) completed a 13-item instrument on reasons for never injecting. We conducted a principal components analysis to identify types of reasons (scored 0–100) and multivariate regression to predict endorsement of these reasons. **Results.** Approximately one-in-five of all participants ever had an opportunity to inject and there was no gender difference in the propensity to accept an opportunity. Four types of reasons, labelled risk perception, subjective effects, social environment and aversion, were identified. Male gender was associated with lower endorsement of risk perception ( $\beta = -7.94$ ; 95% confidence interval [CI]  $-13.37, -2.51$ ) and social environment ( $\beta = -7.35$ ; 95% CI  $-13.15, -1.54$ ). Having friends who injected was associated with lower endorsement of the social environment ( $\beta = -8.88$ ; 95% CI  $-14.83, -2.94$ ), and higher endorsement of aversion ( $\beta = 7.67$ ; 95% CI  $1.44, 13.89$ ). **Discussion and Conclusions.** Our findings suggest that injecting drug use opportunities are common among young adults engaged in recreational drug use, with males and females equally likely to accept an opportunity. A strong aversion to injecting and a hedonic preference for non-injecting drug use may reduce the likelihood of accepting these opportunities. [Casey LE, Pourmarzi D, Wessel EL, Kemp R, Smirnov A. Injecting drug use opportunities and reasons for choosing not to inject: A population-based study of Australian young adults who use stimulants. *Drug Alcohol Rev* 2022;41:873–882]

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## Introduction

Injecting drug use (IDU) is associated with a range of harms that are specific to injection as a route of drug administration. One major form of physical harm is the transmission of blood-borne viruses, such as hepatitis C virus (HCV) and HIV [1,2]. Globally, it is estimated that 52.3% of people who inject drugs (PWID) are HCV-antibody positive and in Australasia, 57.1% of PWID have been exposed to HCV [3–5]. A small proportion (0.3%) of Australians were identified as having recently injected (i.e. within the last 12 months) [6], however, the health complications and indirect costs associated with

infections from drug injection have a significant impact on health-care systems [7]. Skin and soft tissue infections, including serious and systemic infections such as endocarditis and septicæmia, are also commonly associated with IDU and greatly contribute to health-care costs [8,9]. In addition, IDU is associated with higher rates of drug dependence compared to other routes of administration [10,11], entailing a greater risk of harm to individuals. Preventing people from transitioning to IDU from other routes of administration may be an important part of strategies that aim to reduce these harms [2,12], alongside established harm reduction services, such as needle and syringe programs [13].

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The education level of an individual may influence a person's drug use trajectory. Not completing high school, an indicator of socio-economic disadvantage, has been associated with an increased risk of transitioning to IDU [12,14]. In Australia and elsewhere, IDU is more prevalent among men than women [3,6]. These differences in prevalence are likely to be associated with gender differences in drug use exposure opportunities and drug use transitions [15], which in turn may reflect gender differences in socialisation [16]. In addition, for women who inject drugs, the pathways to these behaviours may differ in some respects from those for men [16]. Thus, it is pertinent to consider possible gender differences when examining IDU exposure opportunities and reasons for not injecting. Furthermore, adolescents and young adults are key populations to target to reduce the number of individuals who transition to IDU. Early adulthood is a peak period for drug uptake [17] and young age at first drug use is linked with IDU [12,14,18]. The opportunity to inject drugs is an important factor in the initiation of IDU. While there is extensive evidence concerning the role of peers and acquaintances in first injecting experiences [19,20], there is little population-level evidence regarding exposure opportunities for IDU among young adults.

Preferred methods of drug administration can also be shaped by a variety of personal perceptions and beliefs concerning desired drug effect (including intensity), convenience, cost-effectiveness and social benefits [21–24]. However, when conducting a desktop literature review, it is evident that research examining reasons for choosing not to inject drugs among people who have never injected drugs is scarce. The existing evidence base is predominantly focused on samples of people who formerly injected drugs [12,22,25,26]. Des Jarlais *et al.*'s [22] study of 104 people living in New York, USA who formerly injected drugs found that concerns about health (excluding HIV), social stigmatisation and self-image were the most common reasons for not injecting drugs. Ivsins and Marsh [25] conducted 50 interviews in Canada with people who used drugs to explore why they favoured certain routes of drug administration. The key reasons identified for non-IDU were personal preferences for smoking, fear of needles and overdosing concerns [25]. A study of 20 people who used heroin via non-injection routes in Birmingham, UK found contraction of blood-borne viruses, fear of needles and health consequences to be dominant reasons for never injecting [12]. In a US study, Kelley and Chitwood [26] also identified fears around HIV and needles as the most important reasons provided by their sub-sample of 300 people who snorted heroin.

To address these gaps in the literature, we examined exposure opportunity for IDU and reasons for never

injecting, in a population-based sample of Australian young adults who used amphetamine-type stimulants (ATS; i.e. ecstasy [MDMA] and methamphetamine).

## Methods

### *Participants*

Data for the current study are drawn from the baseline face-to-face interview (conducted in 2009) and the 30-month follow-up online survey (2011/2012) of the Natural History Study of Drug Use (NHSDU). The NHSDU was a population-based study of 352 young adults (aged 19–23 years) from Brisbane and the Gold Coast, Australia, who used ATS (i.e. use of ecstasy or methamphetamine three or more times within the last 12 months at recruitment into the study). The NHSDU is described in detail elsewhere [27].

The retention rate for the 30-month follow-up survey was 90.3% ( $n = 318$ ). Three cases were excluded from the analysis due to missing data, as well as two participants who responded with 'Prefer not to say' on the survey question that asked whether they had ever injected drugs. This resulted in a final sample of 313 young adults who used ATS. All participants provided informed consent and the NHSDU received ethical approval from the University of Queensland's Behavioural and Social Sciences Ethical Review Committee (approval number: 2007-001-367).

### *Measures*

*Opportunity to inject.* The opportunity to inject was measured by a single question. Participants were asked: 'Has anyone ever provided you with the opportunity to inject drugs, regardless of whether or not you decided to inject? This doesn't include drugs prescribed to you for injection (e.g. Insulin)'.

*Ever injected drugs and recency of injection.* Having ever injected drugs was measured by a single question: 'Have you ever injected any drugs? This doesn't include drugs prescribed to you for injection (e.g. Insulin)'. Participants who had injected drugs were also asked how recently they had injected (i.e. within 12 months).

*Reasons for not injecting drugs.* A set of questions examining reasons for having never injected drugs were developed by the NHSDU researchers, drawing on previous research on factors associated with transitions to IDU [12,22]. Participants who had never injected drugs were presented with 13 potential reasons for having never injected drugs (shown in

Table 3) and were asked to indicate how much each reason applied to them using a 4-point Likert scale ('doesn't apply to me at all'=1, 'applies to me only to a small extent'=2, 'applies to me a reasonable extent'=3 and 'applies to me very much'=4).

*Propensity to inject drugs.* A measure of propensity to inject drugs, given the opportunity, was calculated by dividing the number of participants who had ever injected by the number of participants who had had an opportunity to inject.

*Substance use.* Alcohol, tobacco, cannabis, ecstasy and methamphetamine use at baseline and 30 months was measured by the number of days of use within the last month (last 31 days).

*Risk perceptions.* At 30 months, participants were asked about how risky they perceived the use of ecstasy and methamphetamine to be [e.g. 'In your opinion, how risky to a person's health (mental and physical) is ecstasy?']. Participants responded using a 4-point Likert scale ('without risk' = 1, 'a little risky'=2, 'moderate risk' = 3 and 'very risky' = 4). For methamphetamine, two questions were asked (i.e. perceived risk of snorting/swallowing methamphetamine and the perceived risk of injecting methamphetamine) to distinguish between these different routes of administration.

### Analysis

We conducted a descriptive analysis of reasons for choosing not to inject drugs, by reporting the proportions of participants who endorsed different reasons. Fisher's exact test was used to assess statistical significance between the two groups. A principal components analysis was used to analyse the factors and develop a typology of reasons for never injecting among young adults who used ATS, using the reasons for never injecting drugs [28]. The 'polychoric' Stata command was used as it allows for the assessment of categorical variables. The analysis of the factors in a correlation matrix (Table S1) allowed for the number of final categories of reasons to be identified. Correlations between variables and rotated common factors in a structure matrix allowed the reasons for never injecting drugs to be assigned to each factor. Each variable's largest correlation coefficient determined its allocation to one of the four factors.

The variables pertaining to each factor were added together and converted to a standardised score (0–100) for each factor, enabling direct comparisons

across factors. Multivariate analysis of variance and multivariate linear regression were used to test overall model significance. The categories were jointly regressed on a set of independent variables comprising participant socio-demographic characteristics, substance use and risk perceptions, and estimates with 95% confidence intervals were calculated. A method of adjustment for type I errors (e.g. Bonferroni correction) was considered to account for the large number of variables fitted in the regression model, however, this was not implemented in the final analysis due to the increase of type II errors and the potential for poorer statistical inferences [29,30]. A contrast test was performed to determine whether the associations between the variables and outcomes of the model were statistically significant. All data were analysed using Stata/SE (version 15.1).

## Results

### *Opportunities for and engagement in injecting drug use*

While more than one-in-five (21.7%) participants had had the opportunity to inject drugs in their lifetime, more than one in 20 (6.4%) had ever injected drugs and only 3.5% had injected within the last 12 months (Table 1). There was no significant difference in the proportions of males and females who had been provided an opportunity to inject (25.8% [ $n = 151$ ] cf. 17.9% [ $n = 162$ ]) or who injected given the opportunity (30.6% [ $n = 39$ ] cf. 27.4% [ $n = 29$ ]).

### *Participant characteristics*

Demographic characteristics of the sample are presented in Table 2. The majority of the sample had completed year 12 or higher (89.8%), and almost half of the sample were working on a full-time basis (45.1%). The injection of methamphetamine and heroin were predominately viewed to be very risky (86.6% and 91.4%).

### *Reasons for never injecting drugs*

Table 3 presents responses to the survey questions examining reasons for not injecting drugs among participants who had never injected drugs ( $n = 293$ ). The most strongly endorsed reasons (i.e. applied 'very much') included 'It's not my idea of fun' (67.9%), 'It's not safe' (66.6%), 'You can get HCV and HIV from injecting' (59.4%) and 'I don't want to get addicted' (51.5%).

**Table 1.** Prevalence of injecting drug use and opportunities to inject in young adults who use stimulants (n = 313)

	Total % (n = 313)	Male % (n = 151)	Female % (n = 162)	P-value <sup>a</sup>
<i>Opportunity to inject (ever)<sup>b</sup></i>				
Yes	21.7	25.8	17.9	0.059
No	78.3	74.2	82.1	
<i>Lifetime (ever) injecting drug use<sup>c</sup></i>				
Yes	6.4	7.9	4.9	0.196
No	93.6	92.1	95.1	
<i>Recent (12 month) injecting drug use<sup>d</sup></i>				
Yes	3.5	4.6	2.5	0.232
No	96.5	95.4	97.5	
<i>Propensity to inject<sup>e</sup></i>				
Yes	29.5	30.6	27.4	0.496
No	70.5	69.4	72.6	

<sup>a</sup>Fisher's exact test was used. <sup>b</sup>Participants were asked if they had ever been offered the opportunity to inject drugs (i.e. lifetime). <sup>c</sup>Participants were asked if they had ever injected drugs (i.e. lifetime). <sup>d</sup>Participants were asked if they had injected drugs within the last 12 months (i.e. recent). <sup>e</sup>Propensity to inject, given the opportunity, shows the proportion of those who had injected among those who were given the opportunity to inject; the base number for this measure was the sum of participants who have been presented the opportunity to inject (total: n = 68; male: n = 39; female: n = 29).

### Principal components analysis

As shown in Table 4, four principal factors were identified, representing four overarching categories of reasons for choosing not to inject drugs. These were labelled risk perception (five reasons), subjective effects (three reasons), social environment (three reasons) and aversion (two reasons).

Risk perception mainly comprised reasons relating to beliefs about injection-related harms and health concerns: 'It's not safe', 'It's not my idea of fun', 'You can get HCV and HIV from injecting', 'I don't want to get addicted' and 'People who inject drugs are reckless'. The subjective effects factor highlights specific preferences for non-injecting routes of administration over injecting, and perceptions toward PWID: 'You get a better effect from swallowing/snorting drugs', 'You have more control over drug effects when swallowing/snorting' and 'People who inject drugs are boring'. Social environment captured the social aspect of injecting and focused on the lack of opportunity to inject drugs: 'Never had the opportunity to inject', 'Never really thought about injecting' and 'None of my friends inject'. Aversion comprised reasons regarding emotional-based fear in partaking in drug injection: 'I don't like needles' and 'Someone close to me has been negatively affected by injecting drug use'.

### Multivariate regression model

A multivariate regression model was developed to predict the total score (0–100) for each factor (Table 5). A contrast test was also performed, in which gender, having the opportunity to inject, having friends who inject drugs and risk perceptions of methamphetamine injection were identified as significant contributors to the overall model (Table S2).

Being male was associated with significantly lower scores for risk perception ( $\beta = -7.94$ ; 95% confidence interval [CI]  $-13.37, -2.51$ ;  $P = 0.004$ ). Perceiving methamphetamine injection ( $\beta = -15.36$ ; 95% CI  $-24.45, -6.28$ ;  $P = 0.001$ ) as moderately risky was also associated with lower scores on this factor. A similar finding was identified in the heroin model ( $\beta = -15.34$ ; 95% CI  $-26.25, -4.43$ ;  $P = 0.006$ ).

Believing that ecstasy use entails little to no risk was associated with a lower score for subjective effects ( $\beta = -8.82$ ; 95% CI  $-16.65, -0.99$ ;  $P = 0.027$ ). Similarly, believing that the injection of methamphetamine is moderately risky was associated with a lower score ( $\beta = -9.84$ ; 95% CI  $-17.80, -1.87$ ;  $P = 0.016$ ). Conversely, believing that methamphetamine use is either moderately risky ( $\beta = 6.49$ ; 95% CI  $0.56, 12.41$ ;  $P = 0.032$ ) or entails little to no risk ( $\beta = 11.83$ ; 95% CI  $3.10, 20.55$ ;  $P = 0.008$ ) was associated with a higher score for subjective effects.

Being provided the opportunity to inject ( $\beta = -13.34$ ; 95% CI  $-21.58, -5.11$ ;  $P = 0.002$ ), having friends who inject ( $\beta = -8.88$ ; 95% CI  $-14.83, -2.94$ ;  $P = 0.004$ ) and being male ( $\beta = -7.35$ ; 95% CI  $-13.15, -1.54$ ;  $P = 0.013$ ) were significantly associated with a lower score for social environment. Using ecstasy on  $\geq 3$  days in the last month at the 30 month follow-up showed a similar association ( $\beta = -17.14$ ; 95% CI:  $-34.30, 0.01$ ;  $P = 0.050$ ).

Having been suspended from school ( $\beta = 7.23$ ; 95% CI  $0.66, 13.80$ ;  $P = 0.031$ ) and having friends who injected drugs ( $\beta = 7.67$ ; 95% CI  $1.44, 13.89$ ;  $P = 0.016$ ) were associated with a higher score for aversion. Furthermore, viewing methamphetamine injecting as moderately risky was associated with a lower score for this factor ( $\beta = -10.91$ ; 95% CI  $-21.08, -0.74$ ;  $P = 0.036$ ).

### Discussion

In our population-based sample of Australian young adults who used ATS, around one-in-five had experienced an opportunity to inject drugs, but most had never accepted an opportunity. Only one-in-ten reported having injected in their lifetime, and around half of this group had injected within the last

**Table 2.** Demographic characteristics and drug use factors of participants (n = 313)

Factor	Proportion, % (n)
Age <sup>a</sup> , mean	20.85 (1.18)
Employment	
Yes, full-time	45.1% (141)
Yes, part-time	41.5% (130)
No, unemployed	13.4% (42)
Income (per fortnight) <sup>a,b</sup> , mean	\$1065.38 (850.58)
Highest level of education completed	
Year 10 (or equivalent) or lower	10.2% (32)
Year 12 (or equivalent)	60.4% (189)
Tertiary education <sup>c</sup>	29.4% (92)
Ever suspended from school	
No	65.5% (205)
Yes	34.5% (108)
Type of residence	
Family house	61.7% (193)
Rented house or unit	31.3% (98)
Own house or accommodation	7.0% (22)
Relationship status <sup>d</sup>	
Single	42.0% (131)
In a relationship, but not living together	39.4% (123)
In a relationship, de facto	18.6% (58)
Substance use (days of use in last month) <sup>e</sup>	
Alcohol <sup>f</sup>	
0 days	3.5% (11)
1–2 days	11.9% (37)
≥3 days	84.6% (264)
Tobacco	
0 days	34.8% (109)
1–2 days	12.2% (38)
≥3 days	53.0% (166)
Cannabis	
0 days	49.2% (154)
1–2 days	18.2% (57)
≥3 days	32.6% (102)
Ecstasy	
0 days	52.1% (163)
1–2 days	34.5% (108)
≥3 days	13.4% (42)
Methamphetamine	
0 days	87.2% (273)
1–2 days	9.3% (29)
≥3 days	3.5% (11)
Perceived risk <sup>g</sup>	
Ecstasy	
Very risky	31.0% (97)
Moderate risk	45.7% (143)
Little to no risk	23.3% (73)
Methamphetamine (swallowing/snorting)	
Very risky	43.8% (137)
Moderate risk	41.5% (130)
Little to no risk	14.7% (46)
Methamphetamine (injecting)	
Very risky	86.6% (271)
Moderate risk	12.1% (38)
Little to no risk	1.3% (4)
Heroin	
Very risky	91.4% (286)
Moderate risk	7.0% (22)
Little to no risk	1.6% (5)

<sup>a</sup>The mean is followed by the standard deviation in brackets. <sup>b</sup>Four people did not respond to the question and were removed from this part of the analysis. <sup>c</sup>Tertiary education refers to Technical and Further Education (TAFE), trade qualifications, and university (undergraduate). <sup>d</sup>One person cited 'Prefer not to say' and was removed from this part of the analysis. <sup>e</sup>Substance use was measured at baseline. <sup>f</sup>One person did not respond to the question and was removed from this part of the analysis. <sup>g</sup>Risk perceptions were measured at 30-month follow-up.

**Table 3.** Proportions of responses for each reason for choosing not to inject drugs (n = 293)

Reasons	Does not apply to me at all (%)	Applies to me only to a small extent (%)	Applies to me to a reasonable extent (%)	Applies to me very much (%)
Never had the opportunity to inject	45.7	17.1	11.6	25.6
I do not like needles	37.6	16.7	9.9	35.8
Never really thought about injecting	35.5	15.3	20.5	28.7
People who inject drugs are reckless	24.9	13.0	15.0	47.1
Better effect from swallowing/snorting	68.3	14.3	8.5	8.9
It is not safe	14.0	6.8	12.6	66.6
Someone close to me has been negatively affected	62.1	10.9	7.9	19.1
People who inject drugs are boring	75.1	9.5	6.5	8.9
More control over drug effects when swallowing/snorting	61.8	16.4	11.2	10.6
It is not my idea of fun	14.3	6.8	10.9	67.9
I do not want to get addicted	26.3	8.9	13.3	51.5
None of my friends inject	31.7	14.7	15.4	38.2
You can get hepatitis C and HIV from injecting	17.7	7.5	15.4	59.4

12 months. Our findings suggest that the main reasons for not injecting drugs, among those who had never injected, are health-related concerns, an emotive aversion to injecting, the absence of IDU in their social environment and specific preferences for non-injecting routes of administration.

Approximately one-in-five people from our sample had ever been given an opportunity to inject drugs; however, less than 7% had ever injected. This suggests that while opportunities to inject are not uncommon

**Table 4.** Results of principal components analysis for reasons for choosing not to inject

Factor	Correlation coefficients
<i>Risk perception</i>	
It's not safe	0.84
It's not my idea of fun	0.84
You can get hepatitis C and HIV from injecting	0.76
I do not want to get addicted	0.72
People who inject drugs are reckless	0.70
<i>Subjective effects</i>	
Better effect from swallowing/snorting	0.79
More control over drug effects when swallowing/snorting	0.68
People who inject drugs are boring	0.64
<i>Social environment</i>	
Never had the opportunity to inject	0.69
Never really thought about injecting	0.63
None of my friends inject	0.57
<i>Aversion</i>	
I do not like needles	0.59
Someone close to me has been negatively affected	0.52

for young adults who use recreational drugs, many young adults refuse these opportunities. This could also be reflective of the perspectives of participants who use ecstasy, but not methamphetamine, since they are less likely to inject than participants who only use methamphetamine. Despite this notion, however, it has been suggested that the exclusive use of ecstasy may still lead to the opportunity to inject, as the social settings and drug markets regarding a young adult's drug use are dynamic in nature [31]. The propensity to accept an opportunity to inject may be related to substance use patterns and associated risk perceptions. In addition, there was no difference between men and women in their propensity to inject given the opportunity. Although there was not a significant gender difference in the lifetime prevalence of IDU in our study, other epidemiological data suggest that IDU is more common among men than women in Australasia and other regions [3,6]. Our findings suggest that these differences do not reflect any gender differences regarding the propensity to inject given the opportunity. These findings are consistent with seminal research examining the relationship between gender, exposure opportunity and the propensity to use drugs [15].

In our regression model, we examined the patterns of association between the four factors and relevant individual and contextual variables, which provided some insight on the likely characteristics of people who endorse different types of reasons. Our risk perception factor is closely aligned with previous evidence as it relates to the perceived harms of injecting [12,22,25,26], which correspond to some of the harms reported by people formerly and currently engaged in IDU. There was also a pattern of association between drug-specific risk perceptions and the different sets of

Table 5. Multivariate regression model predicting composite scores (0–100) on each factor<sup>a</sup>

Variables	Risk perception		Subjective effects		Social environment		Aversion	
	Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)	
Sex (male) <sup>b</sup>	-7.93 (-13.37, -2.51)**	1.23 (-3.53, 5.99)	-7.35 (-13.15, -1.54)*	-2.94 (-9.02, 3.14)				
Senior certificate (no) <sup>c</sup>	1.20 (-4.11, 6.52)	0.44 (-4.21, 5.10)	-3.08 (-8.76, 2.60)	3.89 (-2.06, 9.84)				
School suspension (yes) <sup>d</sup>	-0.08 (-5.95, 5.79)	2.69 (-2.45, 7.83)	-1.19 (-7.46, 5.08)	7.23 (0.66, 13.80)*				
Opportunity to inject (yes) <sup>e</sup>	1.38 (-6.33, 9.08)	2.69 (-4.06, 9.45)	-13.34 (-21.58, -5.11)**	-0.39 (-9.01, 8.24)				
Friends inject (yes) <sup>f</sup>	-4.35 (-9.91, 1.21)	-2.29 (-7.16, 2.59)	-8.88 (-14.83, -2.94)**	7.67 (1.44, 13.89)*				
<i>Ecstasy: days of use in last month (baseline)<sup>g</sup></i>								
1–2 days	-2.04 (-7.91, 3.83)	0.61 (-4.53, 5.76)	-3.38 (-9.65, 2.89)	0.46 (-6.11, 7.03)				
≥3 days	5.10 (-3.17, 13.36)	-0.62 (-7.87, 6.62)	-2.39 (-11.23, 6.44)	1.01 (-8.24, 10.26)				
<i>Methamphetamine: days of use in last month (baseline)<sup>g</sup></i>								
1–2 days	1.78 (-7.68, 11.24)	5.35 (-2.95, 13.65)	4.44 (-5.68, 14.56)	5.90 (-4.69, 16.50)				
≥3 days	-0.01 (-17.19, 17.17)	6.78 (-8.28, 21.84)	5.16 (-13.20, 23.53)	-6.90 (-26.13, 12.34)				
<i>Ecstasy: days of use in last month (30 months)<sup>g</sup></i>								
1–2 days	2.35 (-4.98, 9.70)	4.47 (-1.96, 10.89)	1.78 (-6.05, 9.62)	0.10 (-8.10, 8.31)				
≥3 days	3.44 (-12.61, 19.49)	0.43 (-13.64, 14.50)	-17.14 (-34.30, 0.01)*	-11.86 (-29.83, 6.11)				
<i>Methamphetamine: days of use in last month (30 months)<sup>g</sup></i>								
1–2 days	-4.30 (-15.88, 7.28)	2.27 (-7.89, 12.43)	0.25 (-12.14, 12.63)	3.31 (-9.66, 16.28)				
≥3 days	-8.31 (-22.02, 5.40)	2.90 (-9.12, 14.92)	1.04 (-13.62, 15.70)	5.34 (-10.01, 20.69)				
<i>Perceived risk ecstasy use<sup>h</sup></i>								
Moderate risk	2.15 (-4.96, 9.26)	-2.23 (-8.46, 4.00)	1.17 (-6.43, 8.77)	-7.37 (-15.33, 0.59)				
Little to no risk	1.81 (-7.13, 10.74)	-8.82 (-16.65, -0.99)*	0.46 (-9.09, 10.00)	-4.19 (-14.19, 5.81)				
<i>Perceived risk methamphetamine use<sup>b,i</sup></i>								
Moderate risk	1.49 (-5.27, 8.24)	6.49 (0.56, 12.41)*	-1.25 (-8.47, 5.97)	3.35 (-4.22, 10.91)				
Little to no risk	4.01 (-5.94, 13.96)	11.83 (3.10, 20.55)**	4.42 (-6.22, 15.06)	-3.86 (-15.00, 7.28)				
<i>Perceived risk methamphetamine injection<sup>h</sup></i>								
Moderate risk	-15.36 (-24.45, -6.28)***	(80, -1.87)**	-6.76	-10.91				
Little to no risk	-26.88 (-78.67, 24.91)	11.74 (-33.67, 57.15)	-27.88 (-83.26, 27.49)	19.06 (-38.93, 77.05)				
<i>Perceived risk heroin use<sup>j</sup></i>								
Moderate risk	-15.34 (-26.25, -4.43)**	-4.76 (-14.32, 4.81)	-2.82 (-14.49, 8.85)	-2.42 (-14.64, 9.79)				
Little to no risk	4.71 (-39.05, 48.48)	-5.25 (-43.62, 33.12)	28.78 (-18.01, 75.57)	-6.92 (-55.92, 42.08)				

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ . <sup>a</sup>Composite scores were calculated by standardising the sum of data set variables for each factor. <sup>b</sup>Reference category is 'female'. <sup>c</sup>Senior certificate refers to completion of year 12 (i.e. secondary education) or equivalent; reference category is 'yes'. <sup>d</sup>Participants were asked whether they had ever been suspended or expelled from school; reference category is 'no'. <sup>e</sup>Refers to ever having the opportunity to inject; reference category is 'no'. <sup>f</sup>Reference category is 'no'. <sup>g</sup>Days of use in last month refers to the number of different days a substance was used in the last 31 days; reference category is 'zero times'. <sup>h</sup>Reference category is 'very risky'; the 'a little risky' and 'without risk' responses were merged into the 'little to no risk' category; 'other methods' for methamphetamine refer to swallowing/snorting (i.e. non-injection methods). <sup>i</sup>Refers to non-injecting drug use. <sup>j</sup>Includes injecting drug use.

reasons endorsed. Perceiving methamphetamine injection and heroin use as very risky was associated with a higher score on the risk perception factor.

Women tended to score higher than men on both the risk perception and social environment factors, suggesting that women could be more likely to perceive injection as risky, and that their social environment may be less conducive to injecting opportunities or behaviours. These gender differences may be inter-related, given the possible role of social learning in the development of risk perceptions [16]. In other words, a social environment that excludes opportunities for injection may also foster negative attitudes toward injection. Alternatively, the higher endorsement of these factors may indicate that social environments are an important contributor to the likelihood of injecting for women, who may inhibit a wide range of environments.

The social environment factor related to peer norms about injecting and lack of opportunity to inject (e.g. 'None of my friends inject' and 'Never had the opportunity to inject'). The identification of this factor suggests that peer norms contribute not only to transitions into injecting [19,20,32], but also decisions not to inject. We would expect the social environment factor to be endorsed by young adults who did not have an opportunity to inject and did not have friends who injected. The lower endorsement of the social environment factor by young adults who used ecstasy frequently (at 30 months) suggests that those engaged in more frequent patterns of ecstasy use may be more likely to have had the opportunity to inject, discussed injection or socialised with PWID [33]. This exposure may reflect variations in the settings and socio-cultural environments of ecstasy use [25]. Understanding these variations may be helpful for targeting drug education for those at risk of injection.

Believing that methamphetamine use was relatively safe was associated with stronger endorsement of the subjective effects factor, yet believing that ecstasy use was relatively safe was associated with weaker endorsement of this factor. These group differences in the prominence given to hedonic aspects of non-IDU may reflect the fact that IDU is a likely option for methamphetamine use but not for ecstasy use [34]. Using drugs such as crystal methamphetamine and heroin may increase the likelihood of transitioning to injecting, due to perceived positive subjective effects of injecting and associated group norms [14]. However, the young adults in our sample who were comfortable using methamphetamine were also conscious of hedonic advantages of non-injecting routes of administration. There may be particular value in harm reduction education for people who use methamphetamine that centres on the hedonic advantages that they perceive.

The aversion factor represents a relatively novel finding and comprises a strongly emotive set of reasons for not injecting drugs (e.g. 'I don't like needles' and 'Someone close to me has been negatively affected'). This factor may reflect attitudes formed from personal observation of negative consequences of injection by peers or family members, or from social norms regarding IDU [12]. Having friends who inject was associated with higher scores for the Aversion factor, which may be due to witnessing these friends inject and observing negative impacts. Being suspended from school, an indicator of anti-social behaviour [35], was also associated with higher scores on this factor, perhaps because of the likely affiliation with peers who became engaged in IDU. Focusing our efforts on specific transformative events, which recount key moments in the drug use patterns of individuals, may allow us to see what shapes their drug use trajectories [25].

To our knowledge, this is the first study to closely examine reasons for never injecting in a sample of young adults engaged in non-injecting drug use. In addition, our population-based sampling may enhance the study generalisability for urban areas within Australia. Some limitations should be noted. First, the time that has surpassed since data collection is a limitation, as the baseline data used in this study is over a decade old. In addition, the 13 reasons included in the survey questions did not allow for other reasons outside of the included list to be explored. Overdose concerns, for example, are a reason for not injecting that has been examined in previous research, but was not included in our study [12,26]. The 'It's not safe' reason may encompass harms like overdosing, but injecting being unsafe may also refer to skin and soft tissue infections and transmission of blood-borne viruses. Furthermore, there is potential for participant non-response to have biased our results; however, our high retention rate after 30 months (90.3%) has likely minimised any bias. Finally, there is uncertainty about the magnitude of some associations in the regression model due to small numbers in some groups. The small proportion of PWID in our study may reduce the validity of our gender comparisons.

The identification of reasons for never injecting, which are strongly endorsed by young adults who are likely to have the opportunity to inject, may have a useful role in reducing transitions to IDU. Unlike many previous studies [12,22,25,26], our sample comprised non-injecting participants, whose perceptions were not developed through direct experiences of injecting drugs, but rather through other processes, perhaps including observation of peers who inject and social narratives regarding injection [32]. Thus, our findings may be useful for designing programs to prevent young



adults engaged in non-IDU from ever injecting. Furthermore, because these attitudes and beliefs about drug administration were held by young adults engaged in relatively common recreational patterns of drug use [27], the findings may facilitate the targeting of health messages to a large section of the young adult population who are exposed to opportunities to inject drugs. It may be worth investigating whether harm reduction programs that are based in recreational settings where stimulant use occurs, and which integrate relevant education, could be effective in reducing transitions to IDU and associated harm [12].

Further research could be conducted with different population groups to expand the evidence base, including young adults living in rural, regional and/or remote areas, given that stimulant use is sometimes prevalent in these settings [36]. Young adults living in these settings are likely to face different social and environmental factors from those living in urban areas [37].

## Conclusion

This study contributes to the available evidence on reasons for choosing not to inject drugs, by describing reasons endorsed by young adults who are engaged in the non-injecting recreational use of stimulants, and who are potentially exposed to opportunities to inject. The reasons we found differ from previous research in important respects, including the emotional aversion to injection reported by some young adults, specific preferences for the effects of non-injecting routes of administration, and the possible role of social learning in forming negative perceptions about injecting drug use. Harm reduction and secondary prevention programs for people who use drugs that highlight both injection-related harms and the subjective benefits of not injecting, may help to reduce transitions to IDU and its associated harms. Further research is required to develop and test strategies for reducing transitions to injection among people who may have the opportunity to inject drugs.

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## Conflict of Interest

The authors have no conflicts of interest.

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### Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

**Table S1.** Polychoric correlation matrix of reasons for choosing not to inject drugs.

**Table S2.** Results from contrast test for variables in the multivariate regression model.