Young adults’ social environment as a predictor of Ecstasy use initiation: findings of a population-based prospective study

<table>
<thead>
<tr>
<th>Journal:</th>
<th>Addiction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manuscript ID:</td>
<td>ADD-12-0758</td>
</tr>
<tr>
<td>Manuscript Type:</td>
<td>Research Report</td>
</tr>
<tr>
<td>Date Submitted by the Author:</td>
<td>03-Sep-2012</td>
</tr>
<tr>
<td>Complete List of Authors:</td>
<td>Smirnov, Andrew; University of Queensland, QADREC, School of Population Health; Queensland Health, Drug Harm Reduction Branch Najman, Jake; Queensland Alcohol and Drug Research and Education Centre, School of Population Health Hayatbakhsh, Mohammad; The University of Queensland, School of Population Health Wells, Helene; Crime and Misconduct Commission, Research and Prevention Legosz, Margot; Crime and Misconduct Commission, Research and Prevention Kemp, Robert; Queensland Health, Drug Harm Reduction Branch</td>
</tr>
<tr>
<td>SUBSTANCE:</td>
<td>stimulants</td>
</tr>
<tr>
<td>METHOD:</td>
<td>surveys</td>
</tr>
<tr>
<td>FIELD OF STUDY:</td>
<td>epidemiology</td>
</tr>
<tr>
<td>Keywords:</td>
<td>Drug offers, Drug use initiation, Ecstasy (MDMA), Epidemiology, Social contacts, Social environment</td>
</tr>
</tbody>
</table>
Young adults’ social environment as a predictor of Ecstasy use initiation: findings of a population-based prospective study

Andrew Smirnov¹,², Jake M. Najman¹,³, Reza Hayatbakhsh¹, Helene Wells⁴, Margot Legosz⁴, and Robert Kemp²

¹ Queensland Alcohol and Drug Research and Education Centre, School of Population Health, The University of Queensland, Herston Rd, Herston, QLD, Australia. 4006.
² Drug Harm Reduction Branch, Health Protection Directorate, Queensland Health, Division of the Chief Health Officer, Butterfield St, Herston, QLD, Australia. 4006.
³ School of Social Science, The University of Queensland, St Lucia, QLD, Australia. 4072.
⁴ Crime and Misconduct Commission, North Tower Green Square, St Pauls Terrace, Fortitude Valley, QLD, Australia. 4006.

Corresponding author: Andrew Smirnov, QADREC, School of Population Health, The University of Queensland, Herston Rd, Herston, QLD, Australia. 4006. Telephone: +61 7 3365 5287. Fax: +61 7 3365 5509. Email: a.smirnov@uq.edu.au

Running head: Young adults’ initiation of Ecstasy use

Word count: 3,488

Declarations of interest: This research was supported under the Australian Research Council's Linkage Projects funding scheme (project LP0776879). The views expressed are those of the authors and not necessarily those of the funding body. The authors have no competing interests to declare.
ABSTRACT

Aims Australia has one of the highest rates of Ecstasy use in the world but little is known about factors contributing to the uptake of use. We prospectively examine the contribution of social environmental factors to Ecstasy initiation. Design Population-based retrospective/prospective cohort study Setting Data from screening an Australian young adult population to obtain samples of users and non-users of Ecstasy. Participants A sample of 204 Ecstasy-naïve participants aged 19 to 23 years was obtained, and a 6 month follow-up identified those who initiated Ecstasy use. Measurements We assessed a range of predictors of Ecstasy initiation, including elements of participants’ social environment, such as Ecstasy-using social contacts and involvement in recreational settings. Findings More than 40% of Ecstasy-naïve young adults reported ever receiving Ecstasy offers. Ecstasy initiation after 6 months was independently predicted by having, at recruitment, many Ecstasy-using social contacts (OR 6.30, 95% CI: 1.60, 24.76), attending electronic/dance music events (OR 5.06, 95% CI: 1.48, 17.27), receiving an Ecstasy offer (OR 4.55, 95% CI: 1.12, 18.45), early cannabis use (OR 8.35, 95% CI: 1.65, 42.23) and psychological distress (OR 7.16, 95% CI: 1.75, 29.18). Adjusted population attributable fractions were highest for Ecstasy-using social contacts (21.4%) and event attendance (18.3%). Conclusions Ecstasy initiation appears to involve multiple pathways, including a major pathway comprising social environmental factors and less common pathways associated with psychological distress and early cannabis use, respectively. A combination of universal and targeted education programs may be appropriate for reducing rates of Ecstasy initiation and associated harms.

Keywords: Drug offers, Drug use initiation, Ecstasy (MDMA), Epidemiology, Social contacts, Social environment
INTRODUCTION

Over the last two decades there have been significant increases in the prevalence of Ecstasy (3,4-methylenedioxymethamphetamine or MDMA) use within young adult populations [1-3]. The available global data indicate that the 12-month prevalence of Ecstasy use is higher in Australia than any other country [1, 3]. However, there is limited understanding of why Ecstasy use is so common among young adults. Despite a burgeoning research literature on the health effects of Ecstasy use, there are few studies which evaluate factors that predict initiation to Ecstasy use [4-6]. There is evidence that social contextual factors such as peer drug use can play an important role in young people’s initiation of some drug use, including the use of cannabis, heroin and cocaine [7]. There is no comparable evidence concerning Ecstasy use initiation, but Ecstasy use is a pervasive element of the social life and culture of young adults in many developed countries [8-10].

Social environment

Although there is evidence that Ecstasy-using social contacts might be more pervasive among Ecstasy users than non-users, it is unclear whether such contacts are instrumental in the initiation of Ecstasy use, rather than being a consequence of use [11, 12]. Vervaeke and colleagues retrospectively examined self-reported circumstances of initiation among a convenience sample of Ecstasy users, and found that social influence was exerted by established friends [4]. These friendship groups did not appear to be socially marginal, and the type of influence reported typically involved an interactive process rather than direct pressure.

Given the high prevalence and degree of social acceptance of Ecstasy use in some young adult populations, it is plausible that initiation could occur through peer and cultural influences independently of typical individual risk factors such as delinquency and
Young adults’ initiation of Ecstasy use 4

psychological problems [7, 13-15]. This is especially relevant for early adulthood, during which there is often engagement with expansive peer networks and social settings in which drug use occurs [16-19]. However, with the exception of one study which used a purposive sample [20], previous models of Ecstasy initiation have not assessed factors such as social contact with Ecstasy-using peers and engagement with recreational settings. The purposive study did not find that these factors predicted initiation, but used a particularly low threshold to represent social contact (having one or more Ecstasy-using peers), especially given that most participants were selected on the basis of having Ecstasy-using peers or intending to try Ecstasy. Furthermore, the study did not discriminate between different recreational settings [20]. The use of Ecstasy has long been associated with electronic/dance music, but has also been documented within other settings including bars and live music venues [19, 21, 22].

Ecstasy offers and Ecstasy use

Whatever the setting, opportunities to use Ecstasy are a prerequisite for initiation, and might provide insight regarding transmission of Ecstasy use behaviour and the prevalence of use [23, 24]. Previous research suggests that a lack of opportunity to use Ecstasy is a key factor in persistent abstinence among Ecstasy-naive young adults [25]. However, there is no research concerning the extent to which Ecstasy-naive young adults are offered Ecstasy or whether such exposure contributes to subsequent decisions to try Ecstasy. Previous research concerning the prevalence of usage opportunities has not included Ecstasy. Data on lifetime patterns of exposure are limited, especially for Ecstasy-naive young people [15, 26, 27].

Individual risk factors

Certain individual factors may influence a young person’s drug use initiation as well as their social environment. Thus, any examination of the relationship between social factors and Ecstasy initiation requires consideration of individual characteristics. Drug use initiation is
For Review Only

Young adults' initiation of Ecstasy use

commonly associated with risk factors such as psychological distress, aggression, delinquency, prior drug use and low educational attainment [17, 28-31]. There is evidence suggesting that such factors may lead to Ecstasy initiation for some young adults [30, 32, 33]. However, other research raises questions regarding the extent to which Ecstasy initiation can be attributed to individual risk factors. For example, some young people might try Ecstasy earlier than other illicit drugs because they believe that Ecstasy use is relatively harmless, thereby discounting the importance of prior drug use [34]. Furthermore, risk factors such as delinquency and low education are of limited relevance with regard to young adults who first use Ecstasy during their tertiary education [35, 36].

The Natural History Study addresses the lack of knowledge concerning initiation to Ecstasy use in early adulthood, and in particular the role of social environmental factors in initiation. We examine levels of exposure to various risk factors, including Ecstasy-using social contacts and offers of Ecstasy, among a group of Ecstasy-naive young adults. We then prospectively investigate environmental predictors of Ecstasy initiation after 6 months, adjusting for key variables such as early drug use, delinquency, psychological distress and aggressive behaviour. Given the high prevalence and relative social acceptability of Ecstasy use among young adults we expect that social environmental factors will contribute to Ecstasy initiation to a greater extent than individual risk factors or prior drug use.

METHODS

Participants

The Natural History Study is a population-based retrospective/prospective longitudinal study of a young adult cohort comprising amphetamine-type stimulant (ATS) users and a comparison group (CG) of non-users. We used a novel application of population screening, using electoral roll data, to create a population-based probability sample of young drug users.
and non-users. Voting is compulsory in Australia for all citizens aged 18 years and over. In June 2008 an estimated 82% of eligible 18 to 25 year olds were registered on the Australian electoral roll [37]. A questionnaire was mailed to 18 to 22 year olds randomly selected from electoral roll data for Brisbane and the Gold Coast (Queensland, Australia). The 18 to 22 year age group was chosen because ATS use tends to commence at this age [38, 39]. The response rate to the screening questionnaire was 49.9% (N=12,079).

The present study focuses exclusively on our sample of CG participants. Of the young adults we screened, 4682 (77.7%) had never used Ecstasy or methamphetamine (i.e. they were ATS-naïve). From this group of ATS-naïve respondents, 320 were randomly selected for participation in the CG and 204 (63.8%) participated (compared with 67.4% of eligible ATS users). Participants were interviewed face-to-face at baseline (at ages 19 to 23 years) and surveyed via the Internet at 6 months. The Internet survey was completed by 97.6% of CG participants (and 95.2% of ATS users). Consequently, we had complete data for 199 CG participants after 6 months of follow-up.

**Measures**

*Drug use offers*

Previous studies define drug use opportunity as any situation in which the respondent perceived they could have used drugs if they had wished to [13, 15, 17, 38]. This definition encompasses instances where no offer of drugs is forthcoming or where drug use opportunity is entirely the result of drug-seeking behaviour [15]. Few studies have used drug offers as an alternative measure [14, 25, 40]. Questions examining exposure to drug offers might assess the transmission of drug use behaviour (from users to their peers) more accurately than measures of ambient opportunity. We used retrospective questions to assess lifetime drug offers (e.g. “*has anyone EVER offered you Ecstasy, regardless of whether you accepted or declined this offer?*”). We also asked participants how many offers they ever received. We
created a variable to indicate 3 different outcome levels in regard to Ecstasy offers (0 offers, 1-3 offers, >3 offers). Receiving 1-3 offers could be described as infrequent or chance exposure, while receiving more than 3 offers is suggestive of frequent or systemic exposure.

**Social contacts**

Participants were asked how many Ecstasy users they knew by name or face. Knowing more than 10 Ecstasy users represented the upper quartile of responses, and was designated as having a large set of Ecstasy-using social contacts.

**Recreational settings**

We asked participants about social recreational venues they visited during the previous 12 months. To distinguish between different cultural settings, we consider attendance at music festivals or electronic/dance music events compared with attendance at live music venues. These questions were asked at the 6 month follow-up, but address a time period comparable to other measures, given the 12-month timeframe. For each variable we adopted a cut-off for venue attendance of more than once in the last 12 months (reference category < once) to designate those with recurrent involvement in these settings.

**Psychological distress**

Psychological distress was evaluated using the Hospital Anxiety Depression Scale [HADS; 41]. The total scale provides a valid and reliable screen for psychological distress, with a Cronbach’s alpha of 0.88 to 0.89 [42, 43]. The HADS is appropriate for identifying psychological distress in illicit drug users because it does not refer to somatic symptoms [44, 45]. A cut-off of 16 indicated high levels of distress [46, 47].

**Delinquency and aggressive behaviour**

We used retrospective self-reports of school expulsion/exclusion, non-completion of senior secondary school and leaving home early (age < 18 years) as proxies of adolescent
delinquency [48, 49]. Aggression was measured using the aggressive behaviour subscale of the Achenbach Young Adult Self-Report Scale (YASR) [50]. The YASR is an age-appropriate measure with demonstrated validity in assessing externalising and internalising syndromes in young adults [51-54]. The YASR has a Cronbach’s alpha of 0.84 averaged across each of the syndromes, and a Cronbach’s alpha of 0.81 has been found for the aggressive behaviour syndrome [51, 53].

**Data analysis**

We used a cumulative set of prediction models to examine the extent to which Ecstasy initiation is predicted by social environment after controlling for other factors (Ecstasy offers, early drug use and individual factors). A set of relevant variables was assessed using univariable logistic regression. With consideration of the moderate sample size (N=199) a conservative threshold of \( p < 0.10 \) was used to select relevant variables for the first iteration of each multivariable logistic regression model. Backward elimination was used to develop the most parsimonious models. Population attributable fractions (PAFs) were calculated using the average attributable fraction approach, whereby factors are ‘removed’ from the model (i.e. individuals treated as unexposed) in every possible sequence, and results are averaged over all obtained attributable fractions. This method has been shown to provide plausible adjusted estimates of PAFs [55, 56]. Data were analyzed using Stata Special Edition 11.0.

**RESULTS**

**Univariable associations**

Table 1 presents the univariable associations for all considered predictors of Ecstasy initiation. Recent attendance at live music venues, leaving home before the age of 18 years and being male were non-significant. However, leaving home before the age of 18 met the
threshold for inclusion in the multivariable models. All other variables from the social
environment and individual domains were significantly associated with Ecstasy initiation. All
early drug use variables (alcohol, tobacco and cannabis) were significant.

TABLE 1 ABOUT HERE

Model 1
Social environment predictors are considered in multivariable model 1 (Table 2). Both having
a large number of Ecstasy-using social contacts (defined as knowing > 10 Ecstasy users) and
attendance at electronic/dance music events independently predicted Ecstasy initiation, with
Ecstasy-using social contacts being the stronger predictor.

TABLE 2 ABOUT HERE

Model 2
In model 2, we add the Ecstasy offer variable to the relevant predictors from model 1 (Table
2). Knowing > 10 Ecstasy users and being offered Ecstasy 1-3 times (vs. never being offered)
both independently predicted Ecstasy initiation. Being offered Ecstasy > 3 times was not a
significant predictor. Attending electronic/dance music events was not a significant predictor
but met the threshold for retention in model.

Model 3
In model 3, we add the early drug use variables to the relevant variables from model 2 (Table
2). Interestingly, inclusion of the early drug use variables increased the magnitude of the
association for having a large number of Ecstasy-using social contacts. Again, attending
electronic/dance music events was not a significant predictor but met the threshold for retention in model. Being offered Ecstasy 1-3 times was a significant predictor, similarly to model 2. From the early drug use variables, only cannabis was significant, but alcohol met the threshold for retention in the model.

**Model 4**

Model 4 is the final model in this cumulative set of prediction models (Table 2). We add individual factors to the relevant variables from model 3. Having a large number of Ecstasy-using social contacts and attendance at electronic/dance events both independently predicted Ecstasy initiation. The magnitude of the effect increased with adjustment for psychological distress. More specifically, the relationship between Ecstasy initiation and these social environmental factors was stronger in the absence of psychological distress. Early cannabis use also independently predicted Ecstasy initiation. Psychological distress was the only individual risk factor that independently predicted initiation, and this variable also attenuated the effect of aggressive behaviour; these two variables were significantly correlated but unaffected by multicollinearity. The separate and distinct effects of social environmental factors, early cannabis use and psychological distress are indicative of different pathways to initiation.

**Population attributable fraction**

The population attributable fraction (PAF) was calculated for each significant factor, to assess the likely proportion of Ecstasy initiation independently caused by each factor (Table 2). The greatest PAF pertained to having a large number of Ecstasy-using social contacts, followed by attending electronic/dance music events.
DISCUSSION

This is the first study to prospectively examine the independent role of social environmental factors upon Ecstasy initiation, with a focus on factors directly relevant to Ecstasy use, namely Ecstasy-using social contacts and attendance at different types of music events. Our finding of multiple pathways to Ecstasy initiation contributes new knowledge to this research question. Social environmental factors predicted Ecstasy initiation independently of risk factors that are typically associated with exposure to drug-related social influence, such as delinquency, aggressive behaviour and psychological distress. Psychological distress comprised another distinct pathway to Ecstasy initiation and, consistent with previous research, early cannabis use was also a contributing factor [33, 57]. However, the risk of initiation attributable to social environmental factors appears to be far greater than that which is attributable to psychological distress or cannabis use.

Social environment and drug offers

Having a large number (>10) Ecstasy-using social contacts and being involved in electronic/dance music events were robust predictors of Ecstasy initiation. Attendance at live music venues was not associated with initiation, which suggests that, despite the population-level diffusion of Ecstasy use, there is an ongoing affinity between Ecstasy use and specific cultural forms at least in the Australian context.

Given that engagement with Ecstasy-using social contacts and electronic/dance music events preceded the first use of Ecstasy, these forms of social involvement cannot have arisen as a consequence of Ecstasy use. Instead, such involvement is likely to have contributed to Ecstasy initiation, which is suggestive of some process of social influence.
These findings depart from previous studies concerning influences on drug use initiation which characterize young people’s affiliation with drug users as an aspect of delinquency, social deviance and underlying psychological problems [58]. Neither delinquency nor aggressive behaviour predicted Ecstasy initiation in this population. Furthermore, the relationship between social environment and initiation applied in particular to psychologically healthy young adults, with the contribution of environmental factors being stronger in the absence of psychological distress (i.e. following adjustment for this variable). In fact, additional analyses showed that none of the young adults with psychological distress attended electronic/dance music events. Thus, engagement with relevant social recreational settings and networks might be greater for individuals who have a comparatively high degree of social functioning and psychological wellbeing.

The characteristics of Ecstasy users in our sample are consistent with research indicating that Ecstasy use is increasingly normative among recent cohorts of young adults [9, 59, 60]. Although we did not measure drug use attitudes or beliefs, the high prevalence of offers we found among Ecstasy-naïve young adults is suggestive of a level of community acceptance of Ecstasy use. Furthermore, normative Ecstasy use may encourage initiation. In the USA, for example, cannabis-related social norms of specific birth cohorts are strongly predictive of adolescent cannabis use [59, 61].

Our study is novel for the inclusion of Ecstasy offers in the model of Ecstasy initiation. Being offered Ecstasy 1-3 times predicted initiation independently of other factors, including early cannabis use. More systemic levels of exposure to Ecstasy offers were non-significant following adjustment for other factors.

By examining Ecstasy offers we were able to assess whether the contribution of social environmental factors could be explained in terms of facilitating access to the drug. In other
words, are high levels of Ecstasy use simply perpetuated by ready availability? We found that the provision of Ecstasy offers explained a portion but not all of the relationship between the social environment and initiation. Other aspects of social engagement, such as observing or talking about Ecstasy use, might encourage initiation [4, 22, 62]. Social contact may also be a proxy for shared values, beliefs or interests that impact on Ecstasy use decisions [8]. The connection between young adults’ culture and Ecstasy use highlights the importance of considering social norms in developing appropriate policy responses.

**Psychological distress**

Psychological distress, evaluated by symptoms of anxiety and depression, independently predicted Ecstasy initiation. This finding is consistent with earlier prospective research [32, 63]. Moreover, our study is the first to consider psychological distress independently of social environmental factors. We also adjusted for early drug use. Our findings are suggestive of a direct pathway from distressing symptoms to Ecstasy initiation, rather than an indirect pathway involving processes such as social deviance and sensitization to other drugs. In this respect it is also notable that aggressive behaviour (another potential manifestation of psychological distress) was not a significant factor, contrary to previous research on drug use opportunity and initiation [28, 64].

**Population-level implications**

Our calculation of population attributable risk sheds light on the broader implications. Having Ecstasy-using social contacts and attending electronic/dance music events together account for nearly 40% of the estimated cases of Ecstasy initiation. This reflects the significant exposure of young adults to these factors. For those Ecstasy-naïve young adults who attend electronic/dance music events, harm reduction programs based at these events can support decisions not to use. However, credible universal prevention programs are required to reach
all young adults at-risk of being offered. Prevention programs should recognise that young adults are likely to perceive Ecstasy use as relatively safe on the balance of information available to them [25].

While pertaining to a smaller subpopulation of young adults, the independent and direct contribution of psychological distress is notable and adds to previous findings. Education programs and health services for young people should take account of anxiety and depression as possible motives for trying Ecstasy. Early interventions for preventing or delaying cannabis use may also provide a small reduction in young adults’ rates of Ecstasy initiation.

**Strengths and limitations**

To our knowledge this is the first study to assess the influence that young adults’ social contact and recreational settings have upon Ecstasy initiation. The Natural History Study is a population based study. Consequently, it is well placed to provide estimates of drug use initiation and levels of exposure to different risk factors at a population level. It also used a clearly defined measure of Ecstasy use opportunity.

There are some limitations of the study. Firstly, it is possible that personality traits such as sensation-seeking, which were not considered in the present study, could create a propensity not only to use Ecstasy but also to engage in social recreational settings where Ecstasy is used. Future prospective research should consider such factors.

Although the screening response rate was reasonable compared to those routinely attained from mail-out surveys and other surveys of drug use [65-68], bias may have resulted from non-response. Nonetheless, the drug use estimates we obtained are similar to other Australian population estimates [38]. In addition, our interview data concerning Ecstasy offers and early drug use are retrospective and subject to recall bias, although this problem may have been
offset to some extent by our recruitment of participants close to the age at which Ecstasy offers were first received (median of three years between first offer and baseline interview) [64, 69]. The moderate sample size of this study also means that there was low power to detect small differences that may have been present.

CONCLUSION

Our findings indicate that there are multiple pathways to Ecstasy initiation among young Australian adults. The most common pathway is one involving extensive social engagement with Ecstasy users alongside involvement in recreational settings where Ecstasy is used. The robustness of this pathway is explicable in terms of the prevalence of Ecstasy use among young adults and the social acceptance of Ecstasy compared to other drug use. A substantial proportion of the Ecstasy-naïve young adult population has some social involvement with Ecstasy users. Early cannabis use and distressing symptoms of anxiety and depression are implicated in less common pathways. With regard to psychological distress, our findings are suggestive of a direct path between such symptoms and Ecstasy initiation, thus elucidating the findings of previous research on this topic [32, 63]. Given the different characteristics of these pathways to Ecstasy initiation, a combination of strategies is required, focused on reducing rates of initiation and also reducing the harms for young adults who try Ecstasy.

ACKNOWLEDGEMENTS

The authors would like to thank the study participants, interviewers and project staff, including Kobie Mulligan, Megan Garrett and Suzanna Henderson. This paper is dedicated to the memory of Julian Young.
References


Table 1
Study group characteristics and univariable associations with use of Ecstasy by 6 month follow-up, reporting odds ratios (OR) with 95% confidence intervals (N=199).

<table>
<thead>
<tr>
<th></th>
<th>Number exposed</th>
<th>Number not exposed</th>
<th>Per cent used Ecstasy – exposed group</th>
<th>Per cent used Ecstasy – non-exposed group</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social environment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Know &gt; 10 Ecstasy users</td>
<td>34</td>
<td>165</td>
<td>35.3</td>
<td>8.5</td>
<td>5.88 (2.41, 14.35)***</td>
</tr>
<tr>
<td>Attended dance event (last 12 months)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>33</td>
<td>166</td>
<td>27.3</td>
<td>10.2</td>
<td>3.29 (1.32, 8.21)*</td>
</tr>
<tr>
<td>Attended live music venue (last 12 months)</td>
<td>114</td>
<td>85</td>
<td>13.2</td>
<td>13.1</td>
<td>1.02 (0.44, 2.35)</td>
</tr>
<tr>
<td><strong>Ecstasy offers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offered 1-3 times&lt;sup&gt;b&lt;/sup&gt;</td>
<td>45</td>
<td>109</td>
<td>22.2</td>
<td>3.7</td>
<td>7.50 (2.21, 25.43)**</td>
</tr>
<tr>
<td>Offered &gt; 3 times&lt;sup&gt;b&lt;/sup&gt;</td>
<td>45</td>
<td>109</td>
<td>26.7</td>
<td>3.7</td>
<td>9.55 (2.88, 31.61)***</td>
</tr>
<tr>
<td><strong>Early drug use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used alcohol aged &lt; 15 years</td>
<td>51</td>
<td>148</td>
<td>29.4</td>
<td>7.4</td>
<td>5.19 (2.20, 12.27)***</td>
</tr>
<tr>
<td>Used tobacco aged &lt; 15 years</td>
<td>24</td>
<td>175</td>
<td>37.5</td>
<td>9.7</td>
<td>5.58 (2.12, 14.65)***</td>
</tr>
<tr>
<td>Used cannabis aged &lt; 15 years</td>
<td>11</td>
<td>188</td>
<td>54.6</td>
<td>10.6</td>
<td>10.08 (2.82, 36.04)***</td>
</tr>
<tr>
<td><strong>Individual factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School suspension (ever)</td>
<td>22</td>
<td>177</td>
<td>27.3</td>
<td>11.3</td>
<td>2.94 (1.03, 8.39)*</td>
</tr>
<tr>
<td>Did not complete senior secondary school</td>
<td>44</td>
<td>155</td>
<td>25.0</td>
<td>9.7</td>
<td>3.11 (1.31, 7.39)*</td>
</tr>
<tr>
<td>Left home before age 18 years</td>
<td>21</td>
<td>178</td>
<td>23.8</td>
<td>11.8</td>
<td>2.34 (0.78, 7.04)</td>
</tr>
<tr>
<td>Psychological distress&lt;sup&gt;c&lt;/sup&gt;</td>
<td>21</td>
<td>178</td>
<td>28.6</td>
<td>11.2</td>
<td>3.16 (1.10, 9.07)*</td>
</tr>
<tr>
<td>Aggressive behaviour</td>
<td>19</td>
<td>180</td>
<td>31.6</td>
<td>11.1</td>
<td>3.69 (1.26, 10.80)*</td>
</tr>
<tr>
<td>Sex (male)</td>
<td>80</td>
<td>119</td>
<td>15.0</td>
<td>11.8</td>
<td>1.32 (0.58, 3.03)</td>
</tr>
</tbody>
</table>

<sup>a</sup>Includes attendance at electronic/dance music events more than once in last 12 months; <sup>b</sup>Ordinal variable: reference group is never offered Ecstasy; <sup>c</sup>Measured using the Hospital Anxiety Depression Scale.

* p < 0.05; ** p < 0.01; *** p < 0.001
Table 2
Prediction model for initiation of Ecstasy use in early adulthood (N=199).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Social environment)</th>
<th>Model 2 (Including drug offer exposure)</th>
<th>Model 3 (Including early drug use)</th>
<th>Model 4 (Including individual factors)</th>
<th>Population attributable fraction (Model 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know &gt; 10 Ecstasy users</td>
<td>6.34 (2.51, 6.01)**</td>
<td>3.85 (1.20, 12.32)*</td>
<td>4.93 (1.39, 17.50)*</td>
<td>6.30 (1.60, 24.76)**</td>
<td>21.36</td>
</tr>
<tr>
<td>Attended dance eventb</td>
<td>3.68 (1.37, 9.87)*</td>
<td>2.58 (0.93, 7.17)*</td>
<td>2.55 (0.86, 7.54)*</td>
<td>5.06 (1.48, 17.27)*</td>
<td>18.26</td>
</tr>
<tr>
<td>Offered Ecstasy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3 timesc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 3 timesd</td>
<td>5.28 (1.48, 18.87)*</td>
<td>5.43 (1.41, 20.81)*</td>
<td>4.55 (1.12, 18.45)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used alcohol aged &lt;15 years</td>
<td>2.44 (0.86, 6.92)*</td>
<td></td>
<td>2.12*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used tobacco aged &lt;15 years</td>
<td>2.07*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used cannabis aged &lt;15 years</td>
<td></td>
<td></td>
<td>8.35 (1.65, 42.23)*</td>
<td>12.63</td>
<td></td>
</tr>
<tr>
<td>School suspension (ever)</td>
<td></td>
<td></td>
<td>1.73*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not completed senior secondary school</td>
<td></td>
<td></td>
<td>2.61 (0.85, 7.96)#</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychological distressd</td>
<td></td>
<td></td>
<td>7.16 (1.75, 29.18)**</td>
<td>12.45</td>
<td></td>
</tr>
<tr>
<td>Aggressive behaviour</td>
<td></td>
<td></td>
<td></td>
<td>2.05*</td>
<td></td>
</tr>
</tbody>
</table>

*a* Multivariate odds ratio, adjusted for all other variables in model; *b* Includes attendance at electronic/dance music events more than once in last 12 months; *c* Ordinal variable: reference group is never offered Ecstasy; *d* Measured using the Hospital Anxiety Depression Scale; *e* Non-significant at $p < 0.10$ and excluded from final model; *f* Population attributable fraction calculated using average attributable fraction method.

*p* $< 0.10$; *p* $< 0.05$; ***p* $< 0.01$