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Using population screening for recruitment of young adults engaged in illicit drug use: methodological issues and sampling outcomes

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Short title: Population screening to recruit drug users

ABSTRACT

Social stigma, legal sanctions and the associated lack of sampling frames create barriers to the probabilistic sampling of those engaged in a variety of behaviour, including illicit drug use. We used a novel sampling approach to recruit respondents into a longitudinal study examining amphetamine-type stimulant use. A young adult population was screened for lifetime drug use to create a sampling frame of amphetamine-type stimulant users and non-users. We posted 12,118
screening questionnaires to a random selection of young adults listed on the electoral roll for Brisbane and the Gold Coast, Australia (N=107,275). Using a small pre-paid incentive and intensive telephone and postal reminders we attained a screening response rate of 49.9%. Eligible amphetamine-type stimulant users (used ecstasy or methamphetamine ≥ 3 times in past 12 months) and non-users (never used ecstasy or methamphetamine) were identified by screening responses. About two-thirds of each selected group took part in the longitudinal study. Comparisons with large-scale population survey data suggest the sample was broadly representative of young adult amphetamine-type stimulant users in Australia.

Keywords: probabilistic sampling; population screening; illicit drug use; ecstasy (MDMA); methamphetamine

1. Introduction

There is limited knowledge concerning the natural history of illicit drug use. This is particularly true with regard to the use of amphetamine-type stimulants (ATS) such as ‘ecstasy’ (MDMA: 3,4-methylenedioxymethamphetamine) and methamphetamine (Degenhardt, et al., 2010, Hser, et al., 2007, Teruya and Hser, 2010, Weinberg, et al., 1998). However, an understanding of the natural history of drug use is important for developing appropriate strategies to prevent and reduce drug-related harm. The limited nature of available evidence may be partly due to the difficulty of obtaining suitable samples of drug users, a problem not confined to natural history studies. The use of population screening to identify a sample with different levels of drug involvement may present a viable alternative. However, this approach has rarely been used in illicit drug research.
1.1 Current approaches

Much illicit drug use occurs at low prevalence. Consequently, general population studies concerning ATS (i.e. methamphetamine and ecstasy) and other illicit drug use are often compromised by a lack of statistical power, even when broadly related drugs are grouped together (Lieb, et al., 2002). Due to the threat of legal sanctions and social stigma, there is also a lack of available sampling frames. For this reason, researchers of low prevalence and stigmatised behaviour tend to either recruit research volunteers using methods such as advertising, word-of-mouth and location-based sampling, or recruit from special populations such as treatment clients and arrestees, for which sampling frames may be available (Carballo, et al., 2009). Consequently, the present understanding of the natural history of illicit drug use is largely based on evidence concerning problematic drug users.

There are pitfalls with regard to applying the findings derived from non-probabilistic samples to any population group. There are also limitations of research involving special populations, even though studies involving treatment participants provide meaningful evidence concerning the long-term course of dependence on stimulants such as methamphetamine and cocaine (Hser, et al., 2008). This body of research indicates that illicit stimulant-using careers are often protracted, comprising recurrent episodes of remission and relapse (Hser, et al., 2007). However, these findings may have limited applicability (Anthony, et al., 1994, Wagner and Anthony, 2002). In particular, the duration of drug dependence and patterns of remission can differ between treatment participants and those who never obtain treatment (Carballo, et al., 2007, Day and Best, 2007). Furthermore, users of drugs such as ecstasy have low rates of treatment presentation
(Australian Institute of Health and Welfare, 2009) and treatment-based samples are typically very small (Guillot, 2007). Consequently, there is a need to study ATS (and other illicit drug use) with adequate samples drawn from the general population of people who use ATS.

1.2 Population screening

Population screening provides an avenue for creating a sampling frame which is potentially less resource-intensive than general population approaches involving large samples. Screening a random selection of the population enables ‘targeted’ recruitment of individuals who have attributes relevant to the study objectives but who, as a group, are also broadly representative of the total population with these attributes. However, the question of whether population screening is a valid and viable method of developing a sample for studies of illicit drug use has not previously been addressed. Few studies have used population screening to recruit drug users. Overwhelmingly, those that have done so have employed screening as a secondary measure; that is, the use of a subsample from a broader study to address specific research questions concerning drug use (e.g. Arria, et al., 2008).

1.3 Engagement of young adults

Participation rates in epidemiological studies have declined for many years (Arfken and Balon, 2011, Galea and Tracy, 2007). For illicit drug research, this problem might be exacerbated by the fact that young adults, who have high rates of drug use, are often less likely to participate in research compared to older people (Cunradi, et al., 2005, Galea and Tracy, 2007). Young adult respondents can also be difficult to contact, partly because of their residential mobility. Notably, household surveys of drug use have struggled with reduced participation, but problems are not
confined to particular sampling methods (Groves, 2006, Morton, et al., 2006). Population studies using screening-based recruitment also encounter difficulties. As part of the Netherlands XTC Toxicity (NeXT) Study, de Win and colleagues used pre-existing assessments from the Zuid-Holland study, which randomly recruited a cohort from a municipal register, to create a subsample of ecstasy users and matched controls (de Win, et al., 2005). However, due to non-responders (n=19) and refusals (n=46), a sample size of only 21 from a possible 98 ecstasy users was attained.

1.4 Strategies for maximising participation

Despite the inherent obstacles, some population-based research has been effective in engaging with drug users and other difficult-to-reach groups. Financial remuneration is a generally accepted method of increasing participant response, and strategies such as pre-payment for participation can be particularly effective (Church, 1993, Festinger and Dugosh, 2012, Galea and Tracy, 2007). Motivation to participate may also be influenced by intangible factors. In particular, the salience of research topics has been positively associated with research participation (Bell and Salmon, 2011, Galea and Tracy, 2007, Harrison, 1995, Matsui, et al., 2005).

1.5 Purpose of this study

This paper addresses the lack of practical experience and knowledge of population screening as a sampling option for illicit drug research, especially research concerning young adults. Firstly, we describe the strategies and activities involved in using population screening to create a sample for the purpose of investigating the natural history of ATS use in early adulthood. This sample
comprises a drug-using group and a comparison group of non-users. Secondly, we examine the sampling outcomes, including screening response rates and any associated bias, estimates of drug use prevalence obtained from screening, and study participation rates. In discussing these outcomes we assess the potential contribution of population screening to the study of the natural history of illicit drug use.

2. Methods

2.1. Study background

The sampling approach described in this paper was developed for the Natural History Study of Drug Use (NHSDU). The NHSDU is an Australian retrospective/prospective longitudinal study examining the natural history of ATS use among young adults, aged 19-23 years at recruitment. The 19-23 year age group was chosen because ATS use typically commences around this time (Australian Institute of Health and Welfare, 2008, Chen, et al., 2003, von Sydow, et al., 2002) and illicit drug use in the general population tends to peak within the 20-30 year age bracket (Chen and Kandel, 1995). The study involves an ATS-using group and a comparison group (CG), recruited through the same methods. The CG comprised individuals of the same age as the ATS group who had never used methamphetamine or ecstasy at the time of screening.

2.2 Study population

The target population for this study is young adults living in Brisbane or the Gold Coast in Queensland, Australia. Brisbane is the capital city of Queensland and the Gold Coast is a coastal city within a one-hour drive of Brisbane. The population of Brisbane in 2009 was just over 2 million and the Gold Coast was around 520,000, with young adults (aged 20-24 years)
comprising about 8.1% of the population of Brisbane and 7.6% of the Gold Coast (Australian Bureau of Statistics, 2011a, Australian Bureau of Statistics, 2011b). Females comprised 49.6% of the young adult population in Brisbane and 49.1% at the Gold Coast.

2.4. Screening and recruitment (post-pilot)

A population screening approach, informed by the outcomes of a pilot study, was used to develop a sampling frame of young adult drug users and non-users. Between December 2008 and March 2009, 13,951 invitation letters and screening questionnaires were posted to young adults listed as residing in Brisbane or the Gold Coast, Queensland, Australia. Recipients were selected randomly from electoral roll data comprising all Brisbane and Gold Coast residents aged 18-22 years in 2008 and enrolled to vote (N=107,275). The electoral data file included registrants’ age, sex and occupational status. Voting is compulsory in Australia. In June 2008 the Australian electoral roll comprised 92% of eligible voters (Australian citizens aged 18 years and older) and 82% of eligible 18 to 25 year olds (Australian Electoral Commission, 2008). Formal restrictions on eligibility are minimal. Prisoners on parole or serving a term of less than 3 years are entitled to register and can vote in some elections. Postal voting and mobile voting booths are used to increase voting rates for prisoners and residents of institutions (e.g. hospitals). Despite these arrangements, enrolment rates may be lower within these groups compared to the general population (Australian Electoral Commission, et al., 2008).

We used a one-page screening questionnaire that briefly assessed lifetime consumption patterns for alcohol, tobacco, cannabis, amphetamines and ecstasy (never used, used but not in past year, used once in past year, used twice in past year, used three or more times in past year). On the
same page we collected demographic information, contact details and preliminary consent for further participation, which we obtained to determine whether respondents could be invited to participate in the main study (i.e. post-screening). The invitation letter included with the questionnaire indicated that the study purpose was to develop knowledge of young adults’ health and alcohol and drug use, but did not suggest the specific focus was ecstasy and methamphetamine use. The letter also outlined the nature of study involvement. Completion of the one-page questionnaire implied consent for screening participation. Respondents self-completed and returned the screener in a reply paid envelope or were screened by telephone.

An AUD $5 payment was included with the screening questionnaire to provide a pre-paid incentive (i.e. not contingent upon the screening response). In addition, reminder letters and postcards were posted to recipients who did not initially respond and telephone contact was made with non-responders for whom telephone numbers could be found. Listed phone numbers were located for approximately 50% of non-responders. Given that many respondents were still living with parents, protocols were developed for telephone contact to protect privacy.

2.5. Comparison with population data

We used data from the 2010 Australian National Drug Strategy Household Survey (NDSHS) as a point of comparison for our population drug use estimates. The NDSHS is a periodic population survey conducted every three years. A detailed description of the methodology is available from published reports (Australian Institute of Health and Welfare, 2011, Roy Morgan Research, 2011). Households were randomly selected as part of a multi-stage sampling design involving stratification by geographic area. Unlike the NHSDU, young adults residing in rural locations
participated, but estimates obtained from the NDSHS did not differ according to whether this group was included. People living in institutional settings, including prisons and residential treatment services, were excluded. There were 26,648 respondents to the 2010 survey (response rate of 50.6%). We used national rather than Queensland NDSHS data due to the relatively small sample sizes, within the 19-23 year age group, for each state of Australia. However, the estimated proportions recently using ecstasy or methamphetamine in the 2010 NDSHS are very similar to the equivalent estimates for the whole of Australia (Australian Institute of Health and Welfare, 2011). For the 19-23 year age group (matching our study) there were 1365 NDSHS participants with complete data for relevant drug use questions. Weights were applied to adjust for the probability of selection, taking account of variation between sampling units and non-response (Roy Morgan Research, 2011).

2.6 Data analysis

Differences between pilot study groups in rates of self-reported drug use, for each drug type, were assessed using Poisson regression with robust error variance (Zou, 2004). The pre-paid incentive group was the reference category. We compared drug use prevalence estimates from the NHSDU and the NDSHS reporting 95% confidence intervals. A two-sample z test was used to assess the equality of these estimates. Logistic regression was used to assess the relative odds of refusing to consent to further participation, as predicted by respondents’ sex, age, drug use and occupational status, with adjustment for all variables in the full model. All analyses were conducted using Stata/SE version 11.2.

3. Results and discussion
3.1. Overview

Our findings suggest that population screening could be a viable method of developing sampling frames to recruit population samples of young adult drug users. We were able to recruit a suitable sample for the NHSDU, including ATS users and a comparison group of non-users, by screening a random selection of young adults from a population register (i.e. the electoral roll). Our screening outcomes are suggestive of small recruitment biases, with participation levels possibly being higher among females, licit and illicit drug users (not specifically ATS users) and those engaged in study or part-time/casual work. These types of bias are unlikely to compromise the study’s research objectives. Nonetheless, these findings underscore the importance of collecting relevant data to facilitate the assessment of bias. In addition, the drug use prevalence estimates we obtained from population screening are consistent with those derived from a large-scale population survey, the NDSHS.

3.2. Pilot study

To test the feasibility of population screening, a pilot study of four strategies was conducted (in November/December 2008) with a random sample of 800 residents of Brisbane and the Gold Coast aged 18-22 years. These strategies comprised the study invitation letter and screening questionnaire with: 1) no follow-up and no incentive (N=200), 2) written follow-up (N=202), 3) telephone follow-up (N=198), and 4) an AUD $5 incentive (N=200) but no follow-up. Our pilot study outcomes suggest that small pre-paid incentives, previously applied to other populations (Church, 1993), are suitable for increasing young adults’ response rate in drug use studies. The value of written and telephone follow-up was also demonstrated. Response rates for each strategy are provided in Table 1. Not all listed electoral addresses were valid, and the number of
identified out-of-date addresses varied according to the contact strategy used: the highest number were identified using mail follow-up (i.e. reminders). The pilot study response rates are calculated using the remaining valid addresses as the base number. Of the four strategies piloted, the $5 incentive was the most effective, using the initial response rate as the criterion. With this method, 36.8% of screening questionnaires were returned within one month without written or telephone follow-up.

Table 1 about here

Drug use rates reported by Group A (who received no incentive and no follow-up) generally appeared to be higher than those reported by the pilot study groups who received either the incentive or follow-up contact (Table 1). In particular, with the exclusion of any incentives or follow-up, recurrent ecstasy users (i.e. used $\geq 3$ times in past year) were recruited at 10.35 times the rate at which they were recruited using the pre-paid incentive method (95% CI: 2.25-47.62). Similar but non-significant patterns of association were observed with regard to recurrent users of cannabis (Incidence Rate Ratio [IRR] 2.83, 95% CI 0.96-8.35), alcohol (IRR 1.13, 95% CI 0.98-1.31) and tobacco (IRR 1.97, 95% CI 0.96-4.03). The lower bound estimates obtained suggest that these associations would be significant in a larger sample. Further, the magnitude of the associations for alcohol and tobacco may have been greater if a higher threshold was used to indicate recurrent drug use, given the extent of daily use of these licit drugs. These findings suggest Group A respondents may have been motivated by the salience of the research. This conclusion is consistent with the findings of research concerning socially deviant or taboo
behaviour, as well as community surveys more generally (Catania, et al., 1990; Groves, et al., 2000).

Overall, based on the study entry criteria (use of methamphetamine or ecstasy 3 or more times in the past year), 10.6% of the pilot respondents were eligible. One in ten (10.2%) had used ecstasy 3 or more times in the past 12 months and 1.9% had used methamphetamine to the same extent. All respondents consented to further involvement in the study. On the basis of these results we decided to use the pre-paid incentive method in conjunction with written and telephone follow-up for screening and recruitment.

3.3. Population screening

The use of postal and telephone correspondence throughout the main screening phase enabled us to identify invalid electoral roll listings (i.e. individuals who had moved), as it did during the pilot study. Of 13,951 addresses used for screening, 13.1% (i.e. 1,833 addresses) were identified as no longer valid. This reduced our screening sample size to 12,118 individuals who were assumed to have valid addresses. Because of the lag in young adults’ electoral roll registration, the true proportion of invalid addresses may have been greater than those we were able to identify.

We attained a response rate of 49.9%, based on 6,029 screeners (N=12,118) complete for all drug use questions, which is comparable to response rates in larger population surveys. More than 8% of screening respondents reported using ecstasy 3 or more times in the past 12 months compared
to less than 3% for methamphetamine; this difference is reflected in the final sample we recruited for the main study.

3.4. Drug use prevalence

Drug use prevalence estimates we obtained from screening are consistent with other available population data (Table 2). We compared population estimates from our screening activity (conducted in 2009) to those obtained for the same age group (19-23 years) from the 2010 National Drug Strategy Household Survey (NDSHS). Data are presented for lifetime, recent (last 12 months) and recurrent (≥ 3 times in last 12 months) use of ecstasy, methamphetamine and cannabis. The magnitude and precision of estimates obtained are generally similar. Rates of recent and recurrent ecstasy use were slightly higher in the NHSDU compared to the NDSHS, especially among females. The only other significant difference pertained to rates of recurrent cannabis use among males, which were marginally higher in the NDSHS. The differences in rates of ecstasy use may be a consequence of drug trends. Ecstasy use rates were higher in the 2007 compared to the 2010 NDSHS. Hence, our estimates obtained in 2009, could reflect an earlier point in a downward trend. It appears less likely that the difference could be due to systematic biases related to sampling, given the consistency of other drug use estimates. However, it is possible that the difference is due to error variance, which could have arisen from the NDSHS given the smaller number of 19-23 year old ecstasy users in that sample.

Table 2 about here

3.5. Bias associated with population screening
To assess possible sources of sampling bias associated with our population screening, we examined factors associated with refusing consent for participation in the subsequent study phases (as indicated on the returned screening questionnaire). In total, 5451 or 90.4% (N=6029) completed the questionnaire section pertaining to consent for future involvement. Of those completing this section, 18.7% declined further involvement. Following adjustment for all factors in the model, refusal was positively associated with male gender and being 21 years of age at the time of screening (in contrast to 18/19 years; Table 3). The potential gender bias is in contrast to convenience samples of ATS users that comprise a majority of males (e.g. George, et al., 2010). Half (50.3%) of our ATS-using participants are female. Other demographic characteristics were also relevant. Compared to those in full-time employment, full-time students were less likely to refuse. To a smaller extent, young adults engaged in part-time employment and/or part-time study were also less likely to refuse. There was no difference between full-time workers and unemployed respondents with regard to likelihood of refusal. Students’ propensity to take part in the study suggests that they perceive a greater net benefit of research participation compared to other groups in this young adult population (Dunn and Gordon, 2005, Groves, et al., 2000). Several factors may impact on the relative costs and benefits for students, including greater availability for research, a higher level of education, which may increase interest in or capacity for research participation, and the appeal of the monetary incentive, which may be stronger in the context of reliance on casual employment and parental support (Galea and Tracy, 2007, O’Malley and Johnston, 2002).

Table 3 about here
Refusal patterns also differed according to drug use levels, with recurrent drug users (i.e. using ≥3 times in the past year) being less likely to refuse. These results support our pilot study findings, which suggest that salience of the drug use topic may be a motivating factor for drug users. The unadjusted associations were significant with regard to all drugs we screened for: alcohol, tobacco, cannabis, ecstasy and methamphetamine. In the full model, both alcohol and methamphetamine use were significant, with recurrent use of these drugs reducing the likelihood of refusal. However, in practical terms, young adults using any of these drugs will probably have a greater likelihood of participating. To test this proposition, we first excluded recurrent methamphetamine users from our analytic model, and found that ecstasy use significantly reduced the likelihood of refusal (OR 0.71, 95% CI: 0.50-1.00), and then found that the association for cannabis use was also significant when recurrent ecstasy users were omitted (OR 0.71, 95% CI: 0.51-0.98).

It is possible that this participation bias may elevate drug use prevalence estimates we obtained from screening. If this is the case, the resulting bias is consistent with other (more intensive) population sampling approaches, given the concordance of estimates from our data and the NDSHS. However, any inflation of estimates could be offset by other response patterns. In particular, monetary incentives have been shown to reduce response bias associated with respondents’ level of interest in the topic (Groves, et al., 2006). The drug use prevalence estimates from our screening data suggest drug use may be a less salient topic for students compared to other groups. Prevalence of ATS use was highest for unemployed young adults and those employed full-time (ecstasy: 10% employed full-time and 9.6% unemployed; methamphetamine: 3.3% and 4.8%), in contrast to those engaged in full-time study (ecstasy:
6.1%; methamphetamine 1.1%). Consequently, other factors, tangible or otherwise, must be acting to elevate the response rate among students who do not have a strong interest in the research topic.

Response bias pertaining to drug use may also affect internal estimates of association obtained from data collected during the post-recruitment study phases. However, this bias is likely to strengthen rather than attenuate estimates of association pertaining to drug use levels. This may be a special characteristic of our targeted population sampling approach, and is in contrast to general population studies in which non-response is often associated with higher levels of the ‘problem’ behaviour (Badawi, et al., 1999, Cunradi, et al., 2005, Groves and Peytcheva, 2008).

Further, our estimates of association are not affected by selective response patterns in the same way as prevalence estimates. For example, a greater representation of females is unlikely to alter the association between gender and drug use, even though it may increase the capacity to detect such an association. Estimates of association are only likely to be adversely affected if there is combined bias, relating to the outcome and the independent variable, such as an over-representation of high-level drug use among female respondents (Carter, et al., 2012, Criqui, 1979, Sogaard, et al., 2004). This does not appear to be the case in the present study, given that the response probabilities relating to gender and drug use were mutually independent.

3.6. Recruitment

Eligible screening respondents were invited to participate in the NHSDU, which at baseline comprised a face-to-face interview. Respondents were contacted by email and telephone using
details they provided in the screening questionnaire. From 6029 responses, 522 (8.7%) were eligible to participate on the basis of their ATS use. In addition, 4682 (77.7%) had never used ecstasy or methamphetamine (i.e. they were ATS-naïve). Of eligible ATS users, 352 (67.4%; N=522) participated in the baseline interview. Of ATS-naïve respondents, 320 were randomly selected for participation in the comparison group (CG), and 204 (63.8%) agreed to participate. All participants were paid for attending interviews; the ATS-using participants were paid AUD $50 for an interview of about 1 ½ to 2 hours, and CG participants were paid AUD $30 for approximately 1 hour (i.e. payment reflecting the time required). The similar participation rates of ATS-using and non-using groups suggest that bias related to drug use at recruitment (i.e. post-screening) may be minimal. Because respondents had already been screened regarding their willingness to participate, non-response at this stage may largely reflect respondents’ availability for research. All study participants were aged 19-23 years at baseline in 2009.

3.7. Limitations

Like other general population samples, the NHSDU may not have adequate coverage of socially marginal or isolated groups, such as prisoners, the homeless and those residing in institutional settings. With regard to the NDSHS, which we used for comparison, these specific groups are excluded. However, those living (short or long-term) in prisons and other institutional settings, including hospitals, comprise a very small proportion (about 0.5%) of the young adult population in Australia (Australian Bureau of Statistics, 2011c). Consequently, their exclusion is unlikely to significantly alter the population estimates obtained or the composition of the NHSDU sample. The study of marginal groups is better achieved by other sampling methods, which have been
well utilised in studies of groups such as prisoners, offenders and treatment participants (Hser, et al., 2007).

In addition, the electoral non-enrolment of approximately 18% of young adults potentially introduces sampling bias, and the nature of this bias is impossible to directly quantify. However, the available evidence indicates that young adults’ electoral non-participation in Australia is not strongly related to social disadvantage or social functioning (Hoffman and Lazaridis, 2013, Print, et al., 2004). Lower enrolment rates among young adults are partly due to a lack of awareness of aspects of electoral administration, contributing to delays in initial registration. Moreover, there are common features of early adulthood which make this group difficult to locate and contact. It is normal for Australian young adults to change residence frequently (Australian Bureau of Statistics, 2013), and personal updating of enrolment is often delayed except in the lead-up to an election. Eligible voters who move without updating their details and cannot be contacted by the Australian Electoral Commission are deleted from the roll (Australian Electoral Commission, et al., 2008). Further, a high proportion of Australian young adults exclusively use mobile (i.e. cell) phones, rather than fixed lines, which are often not listed in public phone directories, making electoral listings more difficult to verify (Dal Grande and Taylor, 2010).

Finally, the application of population screening as a sampling method depends on the availability of a suitable population register. In some countries the rate of voter registration is too low to facilitate population sampling. Other types of civil registers may be available in some settings, and resources such as telephone directories can be used if their coverage is adequate (UN Department of Economic and Social Affairs, 2008). Many of our respondents were screened over
the telephone, suggesting that telephone screening may be viable in drug use studies. However, it should also be noted that limits are often placed upon research access to population registers, including electoral rolls, due to privacy and other concerns (e.g. Loff, et al., 2013).

4. Conclusion

The recruitment outcomes for our sample of young adult drug users, and comparison group of non-users, indicate that targeted population screening strategies could be a viable alternative to more intensive sampling strategies such as household surveys and other general population studies. Our estimates of drug use parameters are comparable to estimates obtained from a national household survey, and the extent and types of screening response bias we identified have not adversely affected the study objectives. Most notably, drug use involvement did not appear to be a barrier to response, and may have actually increased rates of participation. It is important, however, to bear in mind that our results are specific to a young adult population of stimulant users. The relatively high prevalence of amphetamine-type stimulant use in this age group probably increased the opportunity for adequate participation. The same may not apply to age groups or drug types with lower prevalence of consumption. In addition, pre-paid incentives and intensive follow-up contact seemed to increase our response rate. With these considerations in mind, the strategic application of population screening as a sampling method could improve the quality of information available concerning a variety of population groups who are engaged in stigmatised behaviour or who are otherwise difficult to access. More specifically, population screening could be useful for in-depth examination of drug use topics, including illicit stimulant use, which may be outside the scope of large collaborative studies. This probabilistic approach to
sampling also enables the identification of possible sources of bias, which is not possible for much of the research examining illicit drug use.
References


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<th>N screeners mailed-out</th>
<th>200</th>
<th>202</th>
<th>198</th>
<th>200</th>
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<td>N screeners with valid addresses&lt;sup&gt;a&lt;/sup&gt;</td>
<td>184</td>
<td>158</td>
<td>170</td>
<td>190</td>
</tr>
<tr>
<td>N screeners returned (Response Rate)</td>
<td>20 (10.9%)</td>
<td>23 (14.6%)</td>
<td>31 (18.2%)</td>
<td>70 (36.8%)</td>
</tr>
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<table>
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<tr>
<th>Proportion using&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Tobacco ≥3 times</th>
<th>Alcohol ≥3 times</th>
<th>Cannabis ≥3 times</th>
<th>Ecstasy ≥3 times&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Amphetamine ≥3 times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A: No follow-up and no incentive</td>
<td>40.0%</td>
<td>95.0%</td>
<td>25.0%</td>
<td>30.0%</td>
<td>5.0%</td>
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<tr>
<td>Group B: Mail follow-up</td>
<td>31.2%</td>
<td>84.4%</td>
<td>9.4%</td>
<td>12.0%</td>
<td>3.1%</td>
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<tr>
<td>Group C: Telephone follow-up</td>
<td>30.4%</td>
<td>82.6%</td>
<td>17.4%</td>
<td>13.0%</td>
<td>4.3%</td>
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<td>Group D: $5 incentive</td>
<td>20.6%</td>
<td>83.8%</td>
<td>8.8%</td>
<td>2.9%</td>
<td>0.0%</td>
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</tbody>
</table>

<sup>a</sup> The number of electoral roll addresses identified as out-of-date subtracted from the total number of screening questionnaires mailed-out; <sup>b</sup> The proportion reporting use of each substance on 3 or more occasions in the past 12 months; <sup>c</sup> Significant difference between groups in proportion of respondents who reported recurrent ecstasy use (≥ 3 times in past 12 months; p < 0.01).
Table 2. Estimated population prevalence of drug use by sex (ages 19 to 23 years): ever used, used in last 12 months, and used 3 or more times in last 12 months (NHSDU: Males, N=2643; Females, N=3386; NDSHS: Males, N=606; Females, N=759)

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ever used (95% CI)</td>
<td>Used last 12 months (95% CI)</td>
</tr>
<tr>
<td><strong>Ecstasy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NHSDU - %</td>
<td>22.7 (21.2-24.4)</td>
<td>15.7 (14.3-17.1)</td>
</tr>
<tr>
<td>NDSHS - %</td>
<td>21.0 (17.6-24.8)</td>
<td>12.3 (9.7-15.6) ^*</td>
</tr>
<tr>
<td><strong>Methamphetamine</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NHSDU - %</td>
<td>11.9 (10.7-13.2)</td>
<td>6.3 (5.4-7.3)</td>
</tr>
<tr>
<td>NDSHS - %</td>
<td>10.1 (7.8-13.0)</td>
<td>5.9 (4.2-8.3)</td>
</tr>
<tr>
<td><strong>Cannabis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NHSDU - %</td>
<td>41.1 (39.2-43.0)</td>
<td>24.9 (23.2-26.6)</td>
</tr>
<tr>
<td>NDSHS - %</td>
<td>41.7 (37.3-46.3)</td>
<td>26.0 (22.3-30.0)</td>
</tr>
</tbody>
</table>

^a Point estimates reported with 95% confidence interval. NDSHS data are weighted to adjust for the probability of selection. ^* < 0.05; ^** < 0.01
Table 3. Prediction model of refusing further participation (N=5451)\(^a\)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>% who refused consent</th>
<th>Unadjusted OR (95% CI)</th>
<th>Adjusted OR(^b) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex (Male)</strong>(^c)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with characteristic (N)</td>
<td>without characteristic (N)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.3 (2377)</td>
<td>16.0 (3074)</td>
<td>1.51 (1.32-1.74)(^***)</td>
<td>1.48 (1.29-1.70)(^***)</td>
</tr>
<tr>
<td><strong>Age</strong> (^d)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 years</td>
<td>17.8 (1295)</td>
<td>16.7 (1491)</td>
<td>1.08 (0.89-1.32)</td>
</tr>
<tr>
<td>21 years</td>
<td>20.8 (1315)</td>
<td>16.7 (1491)</td>
<td>1.31 (1.09-1.59)(^**)</td>
</tr>
<tr>
<td>22/23 years</td>
<td>19.9 (1350)</td>
<td>16.7 (1491)</td>
<td>1.24 (1.02-1.49)(^*)</td>
</tr>
<tr>
<td><strong>Recurrent drug use</strong> (^e)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol (\geq 3) times</td>
<td>18.1 (4674)</td>
<td>22.4 (777)</td>
<td>0.77 (0.64-0.92)(^***)</td>
</tr>
<tr>
<td>Tobacco (\geq 3) times</td>
<td>17.0 (1448)</td>
<td>19.4 (4003)</td>
<td>0.85 (0.73-1.00)(^*)</td>
</tr>
<tr>
<td>Cannabis (\geq 3) times</td>
<td>13.7 (620)</td>
<td>19.4 (4831)</td>
<td>0.66 (0.52-0.84)(^**)</td>
</tr>
<tr>
<td>Ecstasy (\geq 3) times</td>
<td>11.8 (476)</td>
<td>19.4 (4975)</td>
<td>0.55 (0.42-0.74)(^***)</td>
</tr>
<tr>
<td>Methamphetamine (\geq 3) times</td>
<td>7.6 (145)</td>
<td>19.1 (5306)</td>
<td>0.35 (0.19-0.65)(^**)</td>
</tr>
<tr>
<td><strong>Occupational status</strong> (^f)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Studying full-time</td>
<td>14.6 (2080)</td>
<td>22.5 (2234)</td>
<td>0.59 (0.50-0.69)(^***)</td>
</tr>
<tr>
<td>Part-time work/ study</td>
<td>17.8 (753)</td>
<td>22.5 (2235)</td>
<td>0.75 (0.60-0.92)(^**)</td>
</tr>
<tr>
<td>Unemployed/not in paid work</td>
<td>21.6 (384)</td>
<td>22.5 (2235)</td>
<td>0.95 (0.73-1.24)</td>
</tr>
</tbody>
</table>

\(^a\) Logistic regression with refusal as outcome (base outcome is consent to further participation), reporting odds ratios (OR); \(^b\) Adjusted for all included variables; \(^c\) Reference category is female sex; \(^d\) Reference category is age 18/19 years; \(^e\) Refers to last 12 months, Reference category is use of drug < 3 times in last 12 months; \(^f\) Reference category is full-time employment.

\(^*\) p < 0.05; \(^**\) p < 0.01; \(^***\) p < 0.001
Highlights

- We develop a sampling frame of young adult stimulant users using population screening
- The population screening response rate was 49.9% (N=12,118)
- Drug use prevalence estimates from screening are comparable to other population data
- Response rates were highest among females, alcohol/drug users and students
- This sampling method provides credible population-level data concerning drug use