R. McKetin, J. Chalmers, L. Burns,
L. Vogl, K. Grech, T. Slade & R. Grove

Research to explain and respond to the ecstasy situation in Australia: A birth cohort analysis of national ecstasy use trends

NDARC Technical Report No. 313

RESEARCH TO EXPLAIN AND RESPOND TO THE ECSTASY USE SITUATION IN AUSTRALIA: A BIRTH COHORT ANALYSIS OF NATIONAL ECSTASY USE TRENDS

Rebecca McKetin, Jenny Chalmers, Lucy Burns, Laura Vogl, Katrina Grech, Tim Slade and Rachel Grove

Technical Report No. 313

ISBN: 978-0-7334-2912-5

Table of Contents

LIST OF TABLES

LIST OF FIGURES

Acknowledgements

This research was funded by the Australian Government Department of Health and Ageing. The Australian Institute of Health and Welfare (AIHW) are acknowledged as the custodians of the National Drug Strategy Household Survey data and thanks go to the staff at the AIHW for their support in providing and analysing the data.

EXECUTIVE SUMMARY

Background and aims

Ecstasy use in Australia has risen steadily over the past decade to become the second most common illicit drug used after cannabis. Although the overall prevalence of ecstasy use has recently stabilised, this aggregate trend masks ongoing increases among women, adolescents and older adults. This trend stands in contrast to that for other illicit drugs, which have shown a steady decline in recent years.

The aim of this study was to identify which sub-groups of the Australian population have been affected by increasing levels of ecstasy use, and to subsequently indentify what strategies might be helpful in circumventing the perpetuation of these trends. Specifically, we sought to:

- more precisely identify which gender and age sub-groups of the Australian population have been affected by increasing levels of ecstasy use;
- better understand what factors have been driving these ecstasy trends, in terms of age, period and birth cohort trends; and
- consider what strategies might be helpful in circumventing ongoing increases in ecstasy use.

In order to achieve these aims, we used data from the 2001, 2004 and 2007 National Drug Strategy Household Surveys to examine intra-cohort trends in ecstasy use by age and gender. This same data was used to construct a pseudo-cohort, from which we could determine whether ecstasy trends were due to birth cohort effects (i.e., intergenerational differences in ecstasy use), age effects (e.g., more 30 to 40 year olds taking up ecstasy use) or a period effect (e.g., ecstasy use being more popular in 2007 than in 2001). We contrasted these ecstasy trends with those for other illicit drugs (cannabis and methamphetamine) in order to understand why ecstasy use is following a different trajectory at a population level to that seen for other illicit drugs. Finally, in the discussion section of the report we consider what strategies could be used to circumvent further increases in ecstasy use.

Method

Data were taken from the 2001, 2004 and 2007 National Drug Strategy Household Surveys (NDSHS). Lifetime and past year prevalence for ecstasy use were calculated for three-year age bands which were further stratified by sex. For the pseudo-cohort analysis, eight three-year birth cohorts were constructed, the oldest of which was born in 1964–66 and the youngest of which was born in 1985–87. These analyses were repeated for cannabis and methamphetamine use. Prevalence estimates and 95% confidence intervals were derived in SAS using weighted survey data. Missing data were assumed to be missing at random and were excluded from the analysis.

Trends in drug use within each birth cohort were examined across the 2001 to 2007 period. Incidence was inferred from an increase in the lifetime prevalence between successive surveys within a given birth cohort. Desistance (discontinuation of use) was calculated as the percentage of ecstasy users who reported lifetime use but who did not report ecstasy use in the past year. Birth cohort effects were examined by comparing the prevalence of ecstasy use between birth cohorts at a given age.

Results

Over the 2001 to 2007 period, there was an increase in ecstasy use in the 26–37 year age bracket for both men and women, and for girls in the 14–16 year old age bracket.

The pseudo-cohort analysis showed that the increase in ecstasy use in the 26–37 year age bracket was due to the ageing of ecstasy users born between 1964 and 1981. These birth cohorts had much higher levels of ecstasy use than earlier birth cohorts. As they aged, they moved into the 26–37 year age bracket, displacing the older generations who had low levels of ecstasy use. This increased the prevalence of ecstasy use in the 26–37 year age band.

Ecstasy use among men decreased in more recent birth cohorts (i.e., from 1982 to 1990) but this reduction was less apparent for women, and there was a sharp increase in use of ecstasy among women in the 1991–93 birth cohort. This increase was responsible for the rise in prevalence among 14–16 year old girls in the 2007 survey.

There were important gender differences in use. Women were more likely to desist from using ecstasy in their early twenties than men, leading to lower levels of ecstasy use among women than men throughout the remainder of their adulthood. This gender difference in ecstasy use was enhanced by a birth cohort effect, whereby women born prior to 1979 were less likely to use ecstasy than their male counterparts.

Other trends of note included a sharp increase in the up-take of ecstasy use (i.e., incidence) through the teenage years and early twenties (around 2–3% per year), which is typical of illicit drug use. Ecstasy use declined as people moved through the remainder of their adulthood, with little evidence of people initiating ecstasy use after the age of thirty. Similarly, there was little evidence of former ecstasy users re-initiating use of the drug beyond thirty years of age.

Ecstasy trends differed from those seen for other illicit drugs (methamphetamine and cannabis). Both methamphetamine and cannabis showed reasonably stable use across successive birth cohorts from 1964 up until 1981 and then a subsequent decline in more recent birth cohorts (i.e., 1982–87). There were also trends showing a recent increase in desistance among people who had used these drugs (i.e., an increase in the number of people giving up cannabis or methamphetamine).

Implications and recommended interventions

Australia is current experiencing the impact of an ageing population of ecstasy users. This trend is due to an increasing trend toward ecstasy use in birth cohorts from 1964 through to 1981. These people would have initiated ecstasy use during the 1980s and 1990s, and many have continued to use the drug throughout their adulthood. This has had a long-term impact on the overall level of ecstasy use in Australia, and, projecting forward based on current trends, it will continue to inflate the prevalence of ecstasy use in older age brackets over the coming decade.

The use of ecstasy among men has begun to decline in more recent birth cohorts, but this same decline has not been seen for women. In fact, there has been a resurgence of ecstasy use among women in the youngest birth cohorts that we examined, which has resulted in a significant increase in the prevalence of ecstasy use among women in the 14–16 year age range.

There are two strategies that can be used to ameliorate these trends. First, interventions that reduce the up-take of ecstasy use among teenagers and young adults will not only arrest the recent trend toward increasing ecstasy use among 14–16 year old girls (and the high incidence rate in this age range more generally), but it will also circumvent future increases in ecstasy use in older age brackets which will occur over time as these young birth cohorts age. School-based drug prevention programs would be a suitable way to address ecstasy use in the teenage years, and a social influence model could be used to tailor the intervention toward teenage girls. This type of prevention model has been developed and successfully trialled in Australia (Vogl et al., 2009).

The second strategy is to reduce the continuation of ecstasy use into adulthood among people who do try the drug; that is, to encourage desistance among existing ecstasy users. This will reduce the number of ecstasy users who continue to use the drug through their adulthood, and hence the number of 'ageing' ecstasy users in the population. Interventions to increase desistance would need to consider modifying risk factors for ongoing drug use, such as attitudes toward ecstasy use, availability of ecstasy, and social risk factors for drug use (e.g., unemployment, social functioning). These strategies need to particularly consider the risk factors for ongoing ecstasy use among young men.

Finally, little consideration has been given to the harms associated with long-term ecstasy use and how such harms may evolve in an ageing population of drug users. The risk of acute harm from using ecstasy may be greater in older users, while chronic ecstasy use may also augment the risk of age-related health problems (e.g., cardiovascular pathology). Further attention needs to be directed at identifying the characteristics of this population of ageing ecstasy users and understanding the health implications of long-term ecstasy use.

Conclusion

In conclusion, Australia is facing a situation where there is an opportunity to intervene and circumvent a further increase in ecstasy use in Australia. Appropriate prevention strategies exist to reduce the up-take of ecstasy use among school-age teenagers, and these need to be implemented. It is less clear what would be the best strategy to encourage desistance from ecstasy use among adults, but there are a range of risk factors that could be modified, and these need to be explored in more detail.

1 INTRODUCTION

1.1 Background

Illicit drug use in Australia has fallen over the past decade according to the triennial National Drug Strategy Household Survey (NDSHS). Three consecutive surveys of falling cannabis use, a heroin shortage, and more recent declines in methamphetamine use are all cause for celebration from a drug policy perspective. However, such declines have not been seen for ecstasy (Figure 1).

Ecstasy only appeared on the drug scene in any measurable level in the early 1990s, and its use has since increased to become the second most common illicit drug used after cannabis. 1.5 million Australians have tried ecstasy and over half of these are under the age of 30 years. Among young adults (20–29 years) approximately one in four have tried ecstasy and one in ten currently use the drug (AIHW 2008).

Recent trends suggest a stabilisation of ecstasy use in Australia (Table 1); however, such aggregate trends in drug use, as presented in the NDSHS, can mask significant variation within a population. This appears to be the case with ecstasy use, with ongoing increases observed among women, adolescents and adults aged 30–40 years.

Specifically, although ecstasy use has stabilised among men (4.4% past year use in both the 2004 and 2007 survey) and among young adults (20–29 years, 12% in 2004 vs. 11.2% in 2007), it has continued to rise among 30–39 year olds (2.4% in 2001, 4.0% in 2004 and 4.7% in 2007) and among women (2.3, 2.4 and 2.7% across the 2001–2007 surveys respectively). Use in the youngest age group (14–19 year olds) has shown a slight increase in 2007 compared to 2004 (4.3% to 5%) (AIHW, 2002, 2005, 2008).

Understanding such intra-cohort trends is important for identifying population sub-groups where interventions are needed. It is also necessary to understand what epidemiological factors are driving changes in drug use within these population sub-groups. All too often, it is assumed that an increase in drug use in a particular age bracket reflects more people in that age bracket taking up drug use. While this might seem an obvious interpretation of the data, trends in drug use can also result from generational differences in drug use and changes in the composition of the population over time (e.g., the ageing of a particular generation of people). For this reason, the following section overviews the various scenarios that can lead to a rise in the prevalence of drug use between one national household survey and the next.

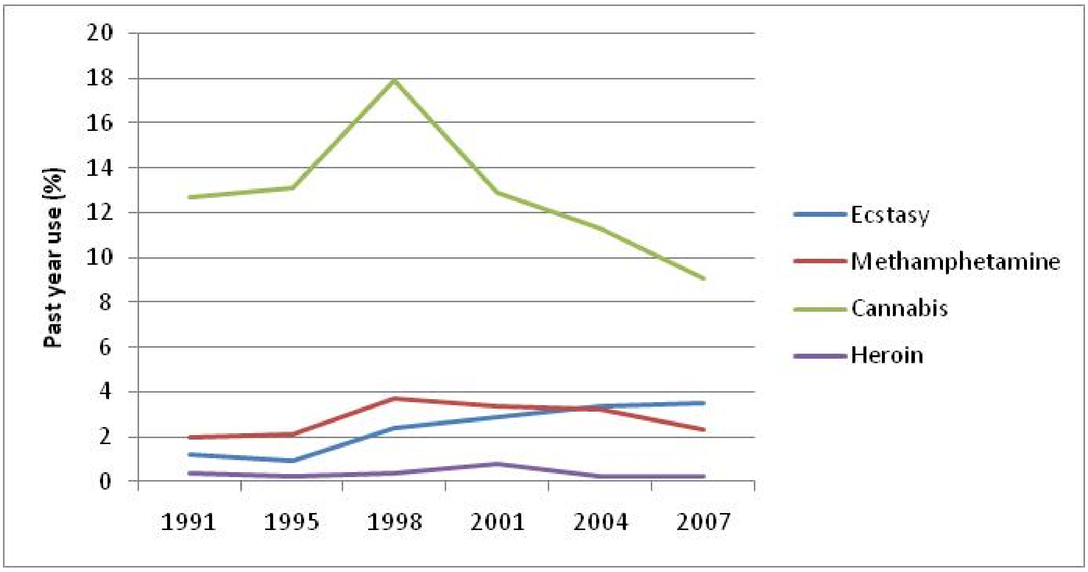


Figure 1. Trends in the past year use of illicit drugs in Australia, 1991–2007

Table 1. Lifetime and current prevalence of ecstasy use in Australia by gender, 2001–2007

	Females	95% CI	Males	95% CI	Total	95% CI
Lifetime						
2001	5.1	4.6–5.6	7.1	6.5–7.7	6.1	5.7–6.4
2004	6.0	5.5–6.5	9.1	8.4–9.8	7.5	7.1–7.9
2007	7.6	7.1–8.1	10.2	9.6–11.0	8.9	8.4–9.4
Current						
2001	2.3	2.0–2.6	3.6	3.2–4.0	2.9	2.6–3.2
2004	2.4	2.1–2.7	4.4	3.9–4.9	3.4	3.1–3.7
2007	2.7	2.3–3.1	4.4	3.8–5.0	3.5	3.2–3.9

1.2 Factors affecting trends in drug use

Aggregate changes in drug use can reflect several different underlying epidemiological processes. These processes have important implications for what is causing an apparent increase in drug use, and consequently how best to respond to that increase. They can essentially be summarised as age effects, period effects, birth cohort effects and effects due to changes in the population composition over time (including the ageing of birth cohorts, attrition and migration).

1.2.1 Birth cohort, age and period effects

Birth cohort effects: A birth cohort refers to a group of people born at the same time. A birth cohort effect results from a common experience, or reaction, among a particular generation of people. Differences between birth cohorts can also be thought of in terms of generational differences. A birth cohort effect would be that younger generations of Australians are more likely to use ecstasy because they have a more lenient attitude toward illicit drug use than older generations. Birth cohort effects manifest as differences in drug use between generations (birth cohorts) when they are at the same age.

Age effects: Age effects refer to changes over a person's life course that are due to ageing. Age-related trends in drug use are impacted on by the rate at which people initiate drug use (i.e., incidence) and the extent to which they subsequently desist from using the drug. In the case of drug use, including ecstasy use, incidence rises rapidly through the teens and early twenties, and the use of the drug subsequently declines as people mature into their adulthood (Compton et al., 2005). Age effects can be seen by examining changes in drug use over time within a given birth cohort of people.

Period effects: A period effect refers to an event or change that occurs at a particular time, or over a specific period of time. A good example of a period effect for drug use is the Australian heroin shortage, whereby reduced availability of heroin in 2001 led to a widespread reduction in heroin use at this time. Period effects in drug use manifest as a change in drug use at a particular point in time (e.g., a given year) across all birth cohorts and all age groups.

Birth cohort, age and period effects interact. For example, younger generations may have a more lenient attitude toward drug use than older generations (cohort effect); such a cohort effect may not impact on drug use in the context of limited drug availability, but it may contribute to a rise in drug use during periods of high drug availability (period effect), and it would be most likely to do so for people in their late teens and twenties, because this is the peak age for drug use (age effect).

The three entities of age, birth cohort and period are also necessarily inter-related. Birth cohort is a function of age (birth year = survey year – age), people age over successive surveys (age = survey year – birth year), and the time of the survey is a function of a person's age and the year they were born (survey year = birth year + age). Disentangling whether drug trends are due to birth cohort, age effects or period effects is therefore very difficult.

1.2.2 Trends due to changes in the population composition

Changes in the prevalence of drug use can also arise from overall changes in the demographics of a population. When the number of drug users entering the population (by birth or, in the case of drug use, by entering the 'at risk' age for drug use) is greater than the number leaving the population (i.e., through ageing, death or emigration) the prevalence of drug use will increase (assuming other factors remain constant). In other words, any change in the population composition that occurs between surveys has the potential to change the prevalence of drug use. Factors that need to be considered in the context of drug use include population changes due to migration, mortality and age. Under-reporting of drug use is a further factor that can confound trends in use and is therefore discussed here.

Age

Age is the most significant factor to consider in the context of drug surveys because drug use is high during adolescence and early adulthood and decreases strongly with age (Compton et al., 2005). Consequently, any ageing of a population will typically reduce the prevalence of drug use, while increases in the proportion of young people in a population will conversely inflate the prevalence of drug use. For this reason, it is necessary to examine drug trends within specific age bands, or strata, to determine drug use trends un-confounded by changes in the age structure of the population.

The ageing of birth cohorts can also have a marked impact on drug trends when there are inter-generational differences in drug use. As birth cohorts age and die off, they are replaced by younger, more recent birth cohorts. Any differences in drug use between successive generations will change the prevalence of drug use. This displacement can have a particularly marked effect on the prevalence of drug use within a specific age bracket, the composition of which can be completely replaced between successive surveys.

The potential impact of an ageing birth cohort can be seen by considering the age bands in the NDSHS. Take the example of ecstasy use in the 30–40 year age bracket in the 2001 NDSHS. This age bracket corresponded to people born from 1961 to 1971, who would have entered their adulthood during the 1980s. By the 2010 survey, much of this birth cohort would have moved into the 40–50 year age bracket, and the 30–40 year age bracket would have been replaced with the next generation of Australians, who were born between 1970 and 1980. In other words, any difference in ecstasy use in the 30–40 year age bracket between 2001 and 2010 would not only reflect changes in the popularity of ecstasy between these two time periods but also the difference in ecstasy use between two generations of Australians.

Migration

Population migration (i.e., immigration and emigration) can also change the prevalence of drug use if there is a net difference in drug use between immigrants and emigrants. Unfortunately there are no comprehensive data available through which we can determine the impact of immigration on drug use trends in Australia. However, the impact of immigration on drug use is likely to be minimal because annual migration comprises less than 3% of the total Australian population (Australian Bureau of Statistics, 2010).

Death

Finally, the death of drug users will necessarily reduce the prevalence of drug use in a population. Deaths due to ecstasy do occur (Kaye et al., 2009), but they are uncommon relative to the number of people who use ecstasy, and consequently mortality is unlikely to bias trends in the prevalence of ecstasy use.

Under-reporting

Downward trends in drug use can also arise from under-reporting of drug use. This is an important consideration because the disclosure of illicit drug use in general population surveys is strongly affected by community views on the social acceptability of drug use. This problem is most likely to occur for drug use patterns that are highly stigmatised. A tell-tale sign of under-reporting is a drop in the lifetime use of drug use within a birth cohort (because a respondent cannot change from having tried a drug to subsequently not having tried it, meaning that lifetime prevalence within a birth cohort should remain stable or increase over time). Such drops in lifetime use can also arise from other forms of attrition (e.g., mortality among drug users, incarceration of drug users).

1.3 Pseudo-cohort analysis

Distinguishing between age effects, birth cohort effects and period effects can only be done by looking at successive birth cohorts over time to see whether they differ in their exposure to drugs and how their subsequent use of drugs changes over time. Ideally these comparisons are made within longitudinal cohort studies, where individuals are tracked over time. However, this is costly and often difficult. Instead, a 'pseudo-cohort' analysis can be done.

The pseudo-cohort is an alternative to a longitudinal study. It compares drug use in one birth cohort over successive cross-sectional surveys of the population. For example, birth cohort trends among people who were born in 1970 can be seen by comparing the characteristics of 30 year olds in 2000 with 31 year olds in 2001, 32 year olds in 2002, and so forth. A pseudo-cohort analysis shows how drug trends change over time within a particular birth cohort (i.e., as a birth cohort ages). It also shows how drug use differs between each birth cohort when they are at the same age.

A limitation of the pseudo-cohort approach is that it assumes that each cross-sectional survey provides an un-biased picture of drug use in the population. Any violation of this assumption may cause specious trends in drug use. On the other hand, pseudo-cohorts have the advantage that they do not suffer from participant drop-out (attrition) which can bias the findings from longitudinal studies. Pseudo-cohorts are also less costly than longitudinal studies (provided that the survey data needed to undertake the analysis are already available).

An important difference between a pseudo-cohort analysis and a longitudinal cohort study is in how the data are interpreted. In a longitudinal study, individual people are followed over time. In contrast, the data from a pseudo-cohort represent a population average, and therefore trends reflect the net change in the population, rather than the behaviour of individual people within that population (which cannot be inferred from a pseudo-cohort).

Pseudo-cohort analysis has been applied to population-based surveys to examine trends in various areas of public health, including cancer, reproductive behaviour, mental health, tobacco smoking and alcohol consumption (Grucza et al., 2008; Grucza et al., 2008b; Helakorpi et al. 2004; Lynskey et al., 2000). To date, the pseudo-cohort approach has not been widely used to understand trends in illicit drug use, and only a handful of studies have attempted to disentangle birth cohort effects from age and period effects (Hall et al., 1999; Degenhardt et al., 2000; Roxburgh et al., 2010).

1.4 Aim

The main aim of this study was to identify which sub-groups of the Australian population have been affected by increasing levels of ecstasy use, and to subsequently indentify what strategies might be helpful in circumventing the perpetuation of these trends. Specifically, we sought to:

- more precisely identify which age and gender sub-groups of the Australian population have been affected by increasing levels of ecstasy use;
- better understand what factors have been driving these ecstasy trends, in terms of age, period and birth cohort trends; and
- consider what strategies might be helpful in circumventing ongoing increases in ecstasy use.

In order to achieve these aims, we used data from the 2001, 2004 and 2007 NDSHS to more precisely define intra-cohort trends in ecstasy use by age and gender. This same data was used to construct a pseudo-cohort, from which we could determine whether ecstasy trends were due to birth cohort effects (i.e., intergenerational differences in ecstasy use), age effects (e.g., more 30–40 year olds taking up ecstasy use) or a period effect (e.g., ecstasy use being more popular in 2007 than in 2001). We contrasted these ecstasy trends with those for other illicit drugs (cannabis and methamphetamine) in order to understand why ecstasy use is following a different trajectory at a population level to that seen for other illicit drugs. Finally, the discussion section of this report considers what strategies could be used to circumvent further increases in ecstasy use in Australia.

2 METHOD

Data on lifetime and past year use of ecstasy were taken from the 2001, 2004 and 2007 National Drug Strategy Household Surveys (NDSHS). The NDSHS is a population-based survey of drug use in the Australian general population which has been conducted triennially since 1985. These surveys employ a multi-stage probability sampling procedure and the data are weighted to provide a 'close-to-random' sample of the Australian population aged 14 years and over. The sample sizes for the 2001, 2004 and 2007 surveys were 26,744, 29,445, and 23,356 respectively (from a population denominator of 15,726,966, 16,407,600 and 17,226,200 respectively). The response rate was 50% in 2001, 48% in 2004 and 51% in 2007. The current analysis has been restricted to these more recent surveys because of the smaller sample sizes in the early surveys.

The questions used to assess lifetime and past year ecstasy use respectively were "Have you ever used ecstasy?" and "Have you used ecstasy in the last 12 months?". In this report current, use of ecstasy refers to use in the past year. Ecstasy was defined as drugs sold under the street names "XTC, E, Ex, Ecci, E and C, Adam, Eve, MDMA, MDDA, MDEA, PMA". The 2001 survey assessed the use of ecstasy and designer drugs together ('Ecstasy/Designer Drugs') which included gamma-hydroxy-butyrate (GHB) in addition to ecstasy. The prevalence of GHB use according to the subsequent survey was 0.5 and 0.1% lifetime and current use respectively (AIHW, 2005).

Prevalence estimates and 95% confidence intervals were derived using weighted data using the 'PROC surveyfreq' command in SAS. The analysis included the combined survey sample for each year (i.e., including all methods of data collection). Missing data were assumed to be missing at random and were excluded from the analysis (this is the procedure used to derive published prevalence estimates from the NDSHS) (AIHW, 2005).

Lifetime and past year prevalence were calculated for three-year age bands, which were further stratified by sex. This analysis was limited to the 14 to 43 year age band, with negligible ecstasy use beyond 43 years of age. For the pseudo-cohort analysis eight three-year birth cohorts were constructed, the oldest of which was born in 1964–66 and the youngest of which was born in 1985–87. The earliest and latest birth cohorts are not presented in the main body of this report because they did not have data covering the 2001 to 2007 period, but their data are detailed in the Appendix and referred to where relevant.

Birth cohort effects were determined by comparing the prevalence of ecstasy use between birth cohorts when they were at the same age. Trends in current and lifetime ecstasy use within each birth cohort were examined across the 2001 to 2007 period. Incidence was inferred from an increase in the lifetime prevalence of use between successive surveys within a given birth cohort. The level of desistance within each birth cohort was calculated as the proportion of people who reported lifetime use but who did not report use of the drug within the past year. This proportion was multiplied by 100 to give the percentage of lifetime users who were no longer current users for each survey. Conversely, re-initiation of use was inferred by decrease in desistance over time within a birth cohort.

Desistance (%) = [(Lifetime prevalence – past year prevalence)/lifetime prevalence] x 100

3 RESULTS

3.1.1 Ecstasy use by age and gender

Gender and age differences in ecstasy use in Australia are presented in Figure 2. These data are based on the 2007 NDSHS. Current ecstasy use refers to the use of ecstasy in the past year.

The most striking feature of ecstasy use is its predominance among young adults. Current use of the drug is strongly concentrated in the 20–31 year age bracket; the use of ecstasy beyond the mid-thirties is negligible by comparison. In this context, the overall population prevalence estimates of 3.5% past year use and 9% lifetime use convey limited information about the level of ecstasy use within the Australia population: use in early adulthood is two to three times higher than this national average, and lifetime exposure is even more varied, ranging from less than 3% to 28%.

The aggregate prevalence of ecstasy use is higher among men than women for both current and lifetime use (see Table 1 in the introduction for details). However, this gender disparity is only true for Australians beyond their early twenties (Figure 2). Below this age the prevalence of ecstasy use is similar for men and women. This gender trend is reversed in the very youngest age group (i.e., 14–16 years) where use is higher among girls than boys ($p < 0.05$, see Table A1 in the Appendix).

There are stronger gender differences for current ecstasy use than for lifetime use (Figure 2). For women, the peak age of current ecstasy use is 20–22 years, after which ecstasy use drops off rapidly. In contrast, current ecstasy use among men continues to increase through their twenties. This trend suggests that men might be more likely than women to continue using ecstasy into their adulthood. Gender differences in desistance, and their impact on ecstasy trends, will be discussed in more detail later in this report.

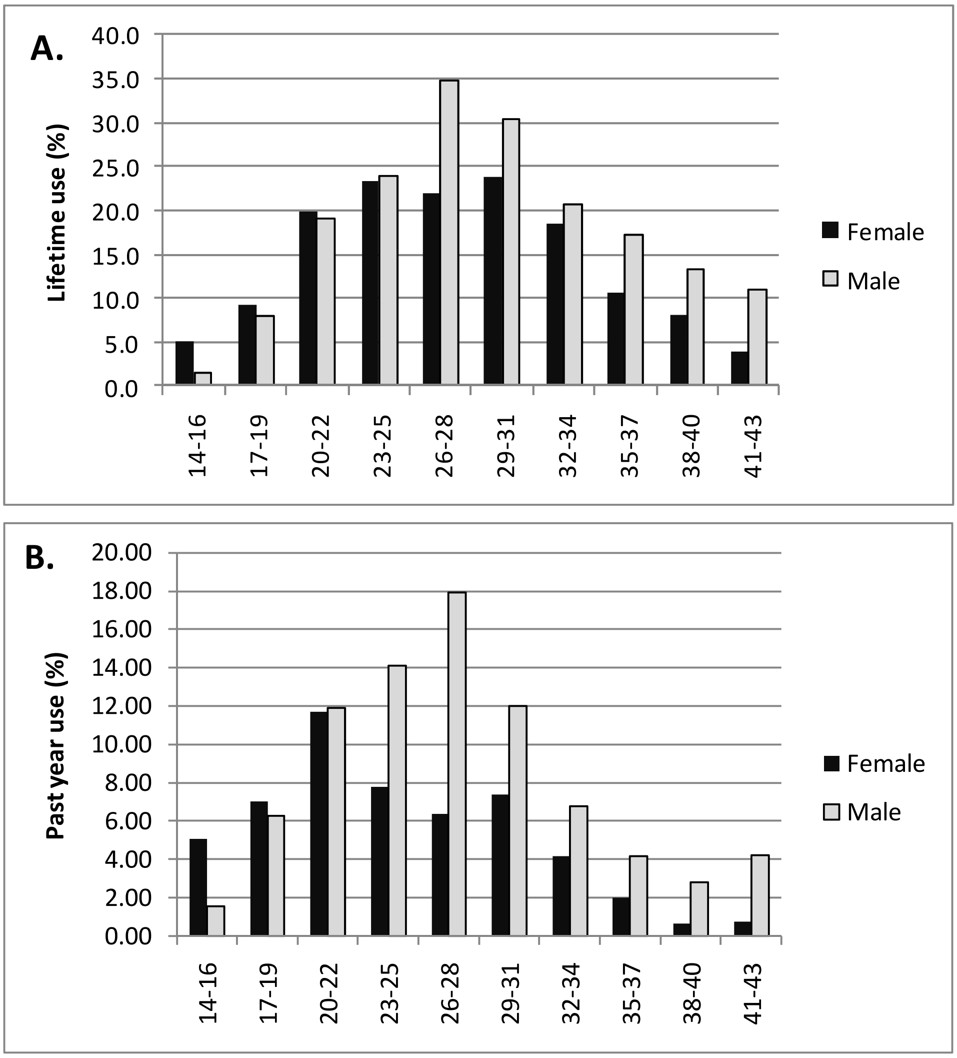


Figure 2. Lifetime (A) and past year (B) ecstasy use by age and gender, 2007

3.1.2 Trends in ecstasy use by age and gender

Trends in ecstasy use within each age band are presented in Figure 3. These trends are disaggregated by gender (for current ecstasy use only) in Figure 4. (Prevalence estimates and confidence limits are detailed in Tables A1 and A2 of the appendix.)

Examination of ecstasy use across the 2001 to 2007 NDSHS surveys reveals three important trends:

- an increase in ecstasy use in the 26–37 year age bracket for both men and women;
- no substantial change in ecstasy use in the 17–25 year age bracket; and
- an increase in ecstasy use among 14–16 year old girls.

These trends are detailed below.

Increased ecstasy use in the 26–37 year age bracket: Between 2001 and 2007 there was a significant increase in ecstasy use among Australians in the 26–37 age bracket. This trend was apparent for both lifetime and current use of ecstasy and it was apparent for both men and women (Figure 3). The aggregate prevalence of ecstasy use in this age band is presented in Table 2. There were significant increases in both lifetime and current ecstasy use over this time period ($p < 0.05$): lifetime use of ecstasy increased 10.9 percentage points, from 10.6% to 21.5%, while current ecstasy use rose 3.2 percentage points, almost doubling the prevalence seen in 2001 (Table 2).

Table 2. Ecstasy use in the 26–37 year age bracket, 2001–2007

	Ecstasy use in the 26–37 year age bracket			
	Lifetime		Past year	
	%	95% CI	%	95% CI
2001	10.6	(9.6–11.6)	3.9	(3.3–4.5)
2004	16.4	(15.2–17.6)	5.9	(5.1–6.7)
2007	21.5	(19.9–23.1)	7.1	(6.1–8.1)

Stable ecstasy use among younger adults (17–25 years): There was no significant increase in ecstasy use among younger adults (17–25 years) between 2001 and 2007 (Figure 3). If anything, there was a slight decline in use among males in this age bracket (Figure 4B): past year ecstasy use declined 2.6 percentage points over this time, but this drop was not statistically significant ($p > 0.05$).

An increase in current ecstasy use among 14 to 16 year old girls: Finally, there was an increase in current ecstasy use in the 14 to 16 year old age bracket between 2004 and 2007 (Figure 4A). This was due to an increase in ecstasy use among girls: past year use rose from 2.3% in 2004 to 5.0% in 2007 ($p < 0.05$) with comparatively low ecstasy use among boys in this age group (< 2%, Figure 4B).

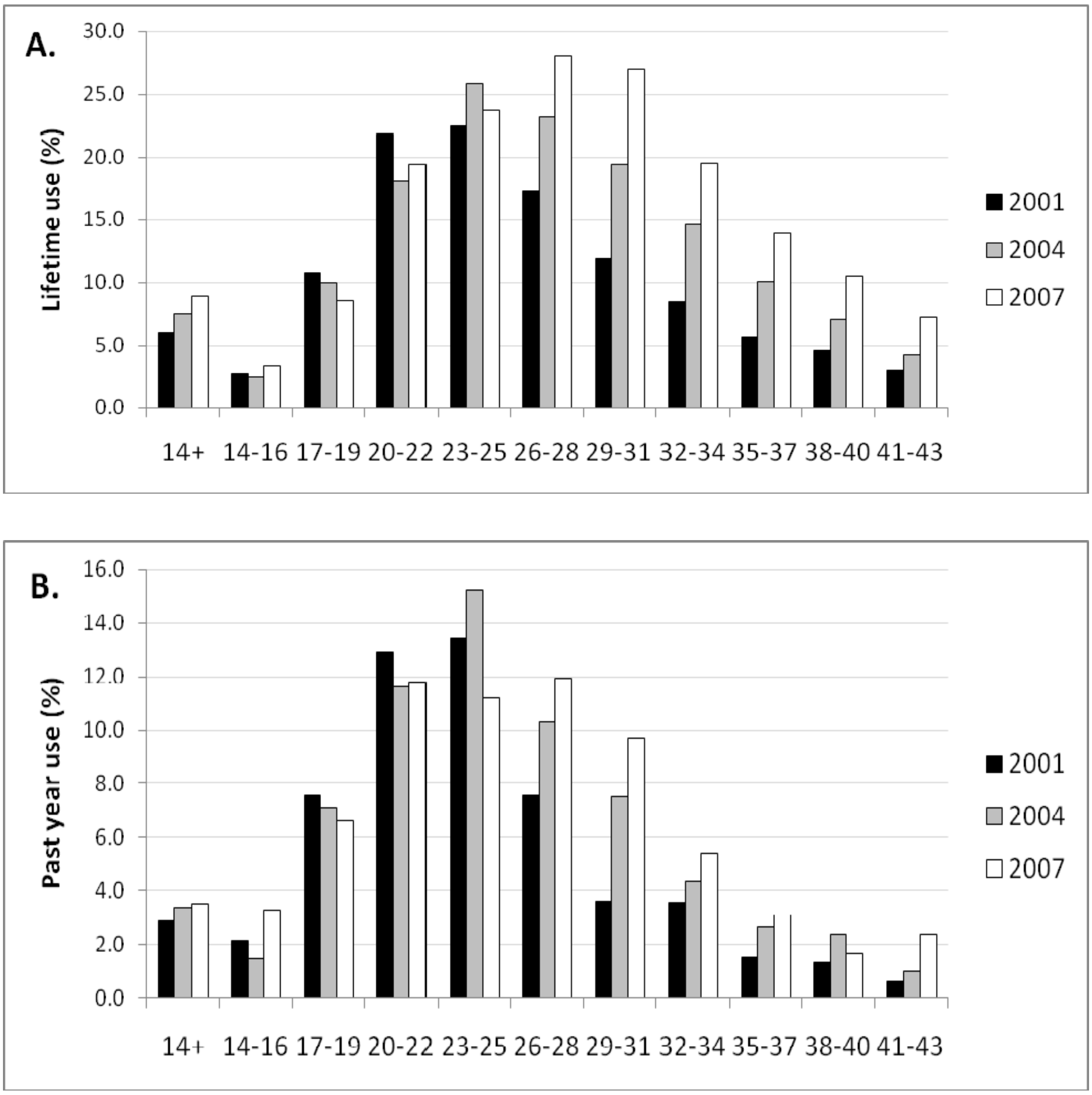


Figure 3. Trends in the lifetime (A) and past year (B) use of ecstasy by age, 2001–2007

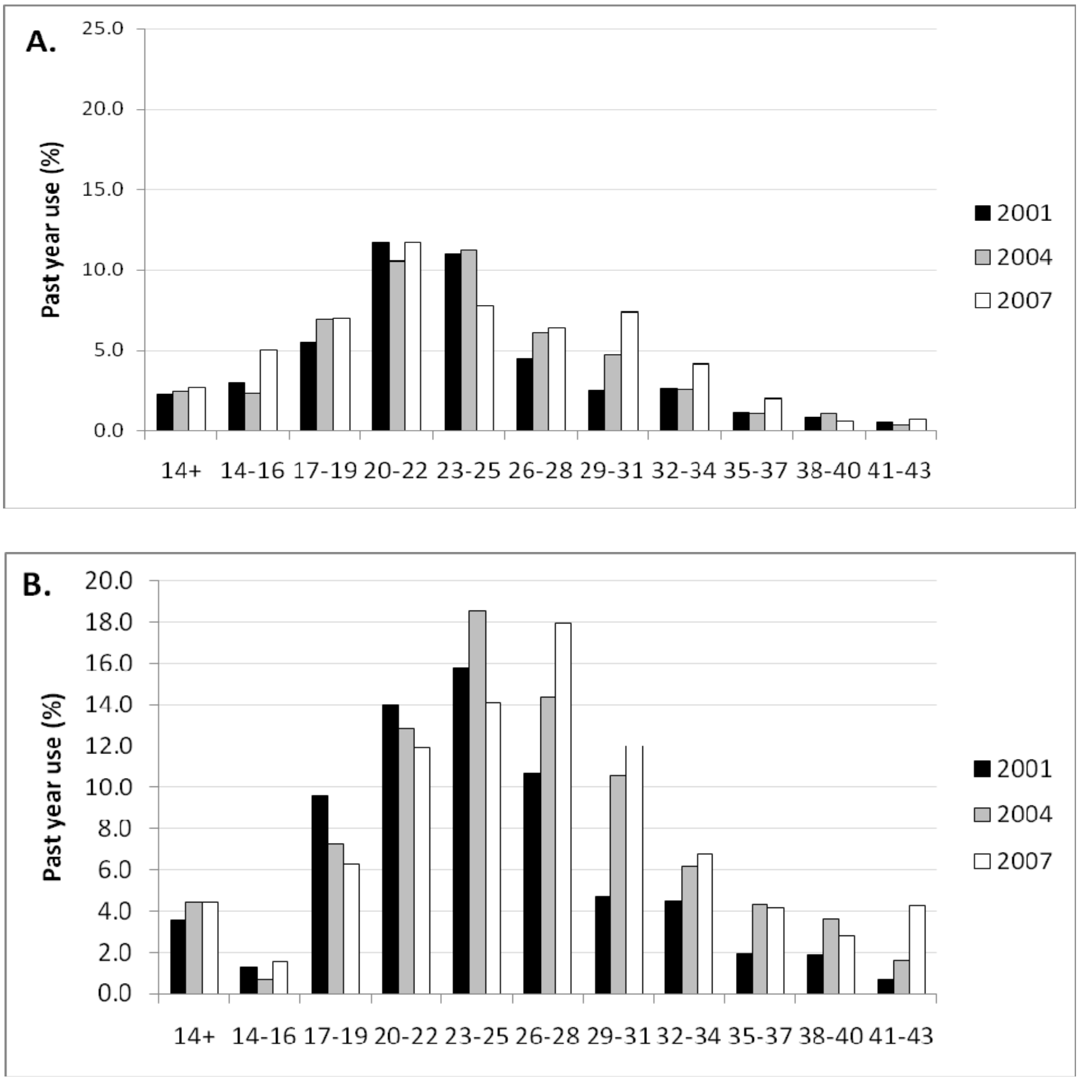


Figure 4. Past year ecstasy use by age for women (A) and men (B), 2001–2007

3.2 Pseudo-cohort analysis

In the previous section we documented an increase in ecstasy use in the 26–37 year age bracket for both men and women, and increasing use among 14–16 year old girls. In the following sections, we will use a pseudo-cohort approach to determine whether these upward trends in ecstasy use reflect more people using ecstasy in these age brackets (e.g., initiation of ecstasy use among people in their late twenties to thirties, due to either age-related increases in ecstasy use or period effects), or whether they can be better accounted for by generational differences in ecstasy use (e.g., an ageing birth cohort effect). We can only partially examine trends among 14–16 year girls, because, being the youngest age bracket in the survey, we do not have data on their ecstasy use prior to 2007.

3.2.1 Ecstasy use within birth cohorts

To determine whether Australians in the 26 to 37 year age bracket increased their use of ecstasy during the 2001 to 2007 period, we examined how ecstasy use changed over this time within individual birth cohorts. People who were aged 26–37 years old during the 2001–2007 period were born between 1964 and 1981.

Trends in the current use of ecstasy within these birth cohorts are shown in Table 3[1]. Each row in this table presents the past year prevalence of ecstasy use for a given birth cohort over the 2001, 2004 and 2007 NDSHS surveys (reading from left to right). Note that the youngest of these birth cohorts (1979–81) was entering the 26–37 year age bracket in 2001, and the eldest birth cohort (1964–66) leaving it, and therefore changes in their ecstasy use over the 2001–2007 period would not affect prevalence within the 26–37 year age band.

From Table 3 it is clear that Australians who were in the 26 to 37 year age bracket during the 2001 to 2007 period had stable to declining use of ecstasy over this time. This reduction in ecstasy use was apparent for both men and women. The only exceptions to this trend were for men in the youngest birth cohort (1979–81) before they entered the 26–37 year age range, and in the eldest cohort (1964–66), after they left this age range.

In conclusion, the increase in ecstasy use in the 26–37 year age bracket does not reflect an increase in the use of ecstasy among Australians in this age band. In fact, Australians reduced their use of ecstasy as they moved through their late twenties and thirties. This suggests that the increase in ecstasy use in the 26–37 year age band is probably due to an ageing cohort effect. This possibility will be explored in the next section.

---

[1] For the sake of clarity, only those birth cohorts that were aged 26–37 years during the 2001 to 2007 period are presented, namely Australians born from 1964 to 1981. Data for all birth cohorts can be found in Table A3 of the Appendix.

Table 3. Past year ecstasy use within the 1964 to 1981 birth cohorts by gender, 2001–2007

Birth cohort	Past year ecstasy use (%)			Change in past year ecstasy use (percentage points)		
	2001	2004	2007	2001 to 2004	2004 to 2007	2001 to 2007
Total						
1979–81	12.9	15.2	11.9	2.3	-3.3*	-0.9
1976–78	13.4	10.3	9.7	-3.2*	-0.6	-3.7*
1973–75	7.6	7.5	5.4	-0.1	-2.1*	-2.2*
1970–72	3.6	4.3	3.1	0.7	-1.2*	-0.5
1967–69	3.5	2.6	1.7	-0.9	-1.0	-1.9*
1964–66	1.5	2.4	2.4	0.9	0.0	0.9
Females						
1979–81	11.7	11.2	6.4	-0.4	-4.8*	-5.3*
1976–78	11.0	6.1	7.4	-4.9*	1.3	-3.6*
1973–75	4.5	4.8	4.1	0.3	-0.6	-0.3
1970–72	2.5	2.6	2.0	0.0	-0.6	-0.5
1967–69	2.7	1.1	0.6	-1.6*	-0.5	–2.1*
1964–66	1.1	1.1	0.7	-0.1	-0.4	-0.4
Males						
1979–81	14.0	18.5	17.9	4.5*	-0.6	3.9
1976–78	15.8	14.4	12.0	-1.4	-2.3	-3.8
1973–75	10.7	10.6	6.8	-0.1	-3.8*	-3.9*
1970–72	4.6	6.1	4.2	1.5	-2.0	-0.5
1967–69	4.5	4.3	2.8	-0.2	-1.5	-1.7
1964–66	1.9	3.6	4.2	1.7*	0.6	2.3*

*$p < 0.05$

3.2.2 Birth cohort effects

Birth cohort trends in lifetime and current ecstasy use are depicted in Figure 5, and are presented separately for men and women in Figures 6 and 7. These figures show the trend line for ecstasy use within each birth cohort across the 2001 to 2007 period (read from left to right). The trend lines in Figure 5(B) represent the same data that is presented above in Table 3. However, in Figures 5 to 7, the trend in ecstasy use within each birth cohort is plotted against the age of the birth cohort. For example, the cohort of people born in 1979–81 is represented by the green line. In 2001, members of this cohort were 20–22 years of age, in 2004 they were 23–25 years of age, and in 2007 they were 26–28 years of age. This presentation of the data allows birth cohort effects to be examined. Birth cohort effects appear as a vertical separation between the trend lines for each cohort (i.e., the difference in ecstasy use between two birth cohorts when they are at the same age). Birth cohort effects for current ecstasy use are also detailed in Table A4 of the Appendix. Note that successive birth cohorts run from right to left on these figures, with the oldest birth cohort (1964–66) on the far right and the youngest, most recent, birth cohort (1985–87) on the left.

Figure 5 (A) shows a clear incremental increase in the lifetime use of ecstasy with each successive birth cohort between 1964 and 1981. For example, 12.0% of Australians born in 1970–72 had tried ecstasy by the time they were 29–31 years of age; this figure increased to 19.5% for the subsequent 1973–75 birth cohort and again for those born in 1976–78, of whom 27.1% had tried the drug by this age ($p < 0.05$). Increasing lifetime exposure to ecstasy was accompanied by a significant increase in current ecstasy use, which was most marked in birth cohorts from 1970 through to 1981 (Figure 5 (B)).

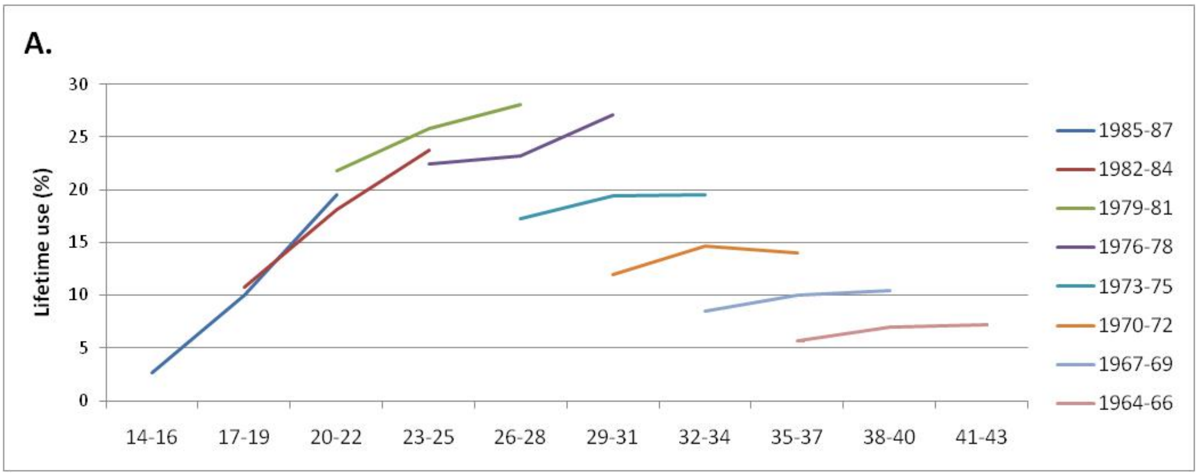
While this birth cohort effect occurred for men and women, it continued for several years longer among men (i.e., up until the 1979–81 birth cohort for men vs. the 1976–78 birth cohort for women) and its impact on past year ecstasy use was greater for men than for women (Figure 7).

In contrast, there was a gradual reduction in ecstasy use among men born after 1981, which culminated in a significant 3.3 percentage point reduction between the 1982–84 and the 1988–90 birth cohorts (see Table 4A in the appendix for details). This decrease brought ecstasy use among men back in line with their female counterparts in the youngest birth cohorts (Figure 7).

Women born after 1981 initially followed the same trend toward reduced ecstasy use as their male counterparts (i.e., in the 1982–84 birth cohort), but this trend did not continue through to more recent birth cohorts. In fact, there was a significant increase in ecstasy use among women in the very youngest birth cohort (1991–93), who were 14–16 years of age in 2007. Ecstasy use in this birth cohort was around double that seen among the 14–16 year olds who they succeeded (i.e., 5.0% vs. 2.3% and 3.0% for the 1985–87 and 1988–90 birth cohorts respectively). This trend is not shown in Figure 7 because there was only one year of data for the 1991–93 birth cohort, but their data are detailed against previous birth cohorts of the same age in the Appendix (Table A4).

In summary, there were three key birth cohort trends that emerged from the data:

1. an increase in ecstasy use across successive birth cohorts from 1964 to 1981 (this trend had a greater impact on ecstasy use among men than women);
2. a reduction in ecstasy use among men in subsequent birth cohorts, from 1982 to 1990, which was only apparent for women in the 1982–84 birth cohort; and
3. a significant increase in ecstasy use among 14–16 year old girls in the 1991–1993 birth cohort compared to their predecessors.



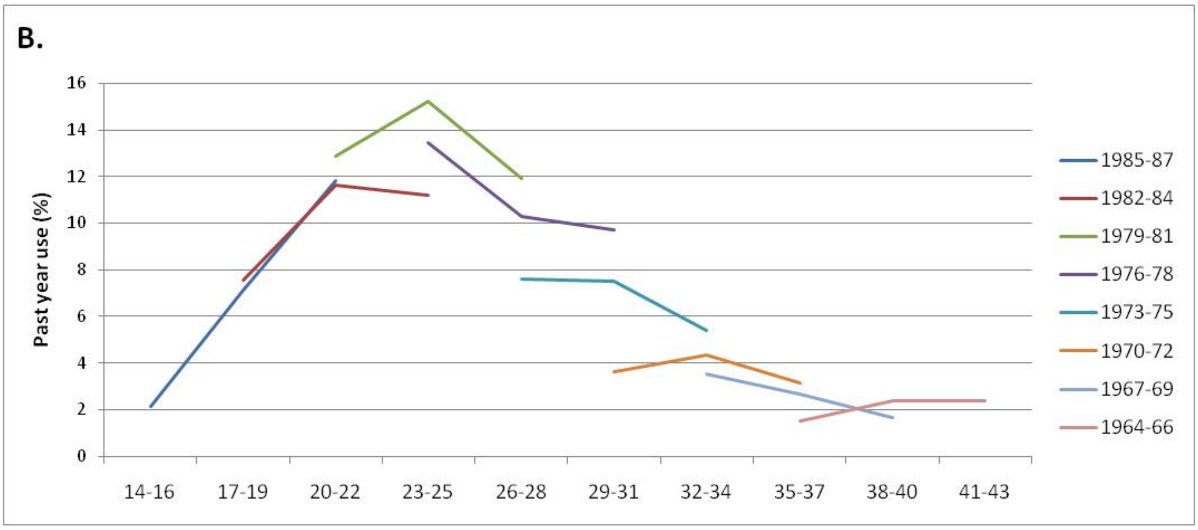
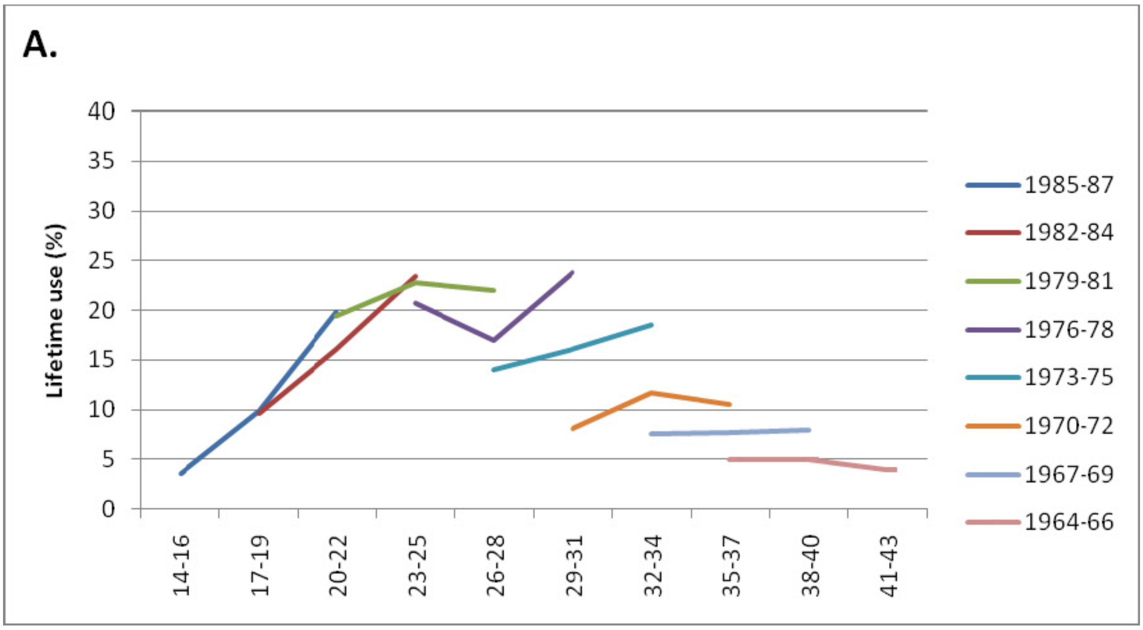


Figure 5. Birth cohort trends in lifetime use (A) and past year use (B) of ecstasy by age, 2001–2007

<u>Interpreting birth cohort graphs</u>

Each trend line represents ecstasy use across the 2001 to 2007 period (from left to right) within a specific birth cohort. Successive birth cohorts run from right to left on these figures, with the oldest birth cohort (1964–66) on the far right and the youngest (1985–87) on the left.

Trends in ecstasy use within each birth cohort can be seen from the trend lines for past year use. An increase in the lifetime prevalence of ecstasy use within a birth cohort reflects the up-take of ecstasy use within that cohort, or incidence. Differences in the prevalence of ecstasy use between birth cohorts, or birth cohort effects, can be seen by comparing the prevalence of ecstasy use between birth cohorts when they are at the same age (i.e., birth cohort effects appear as a vertical separation between the trend lines).



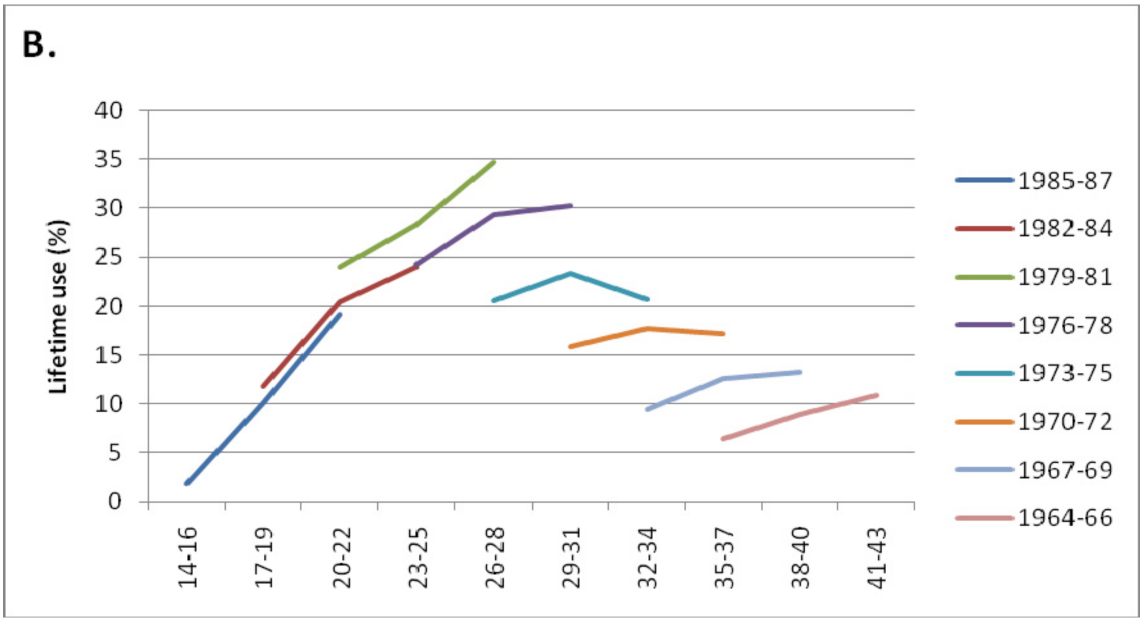


Figure 6. Birth cohort trends in lifetime ecstasy use by age for women (A) and men (B), 2001–2007

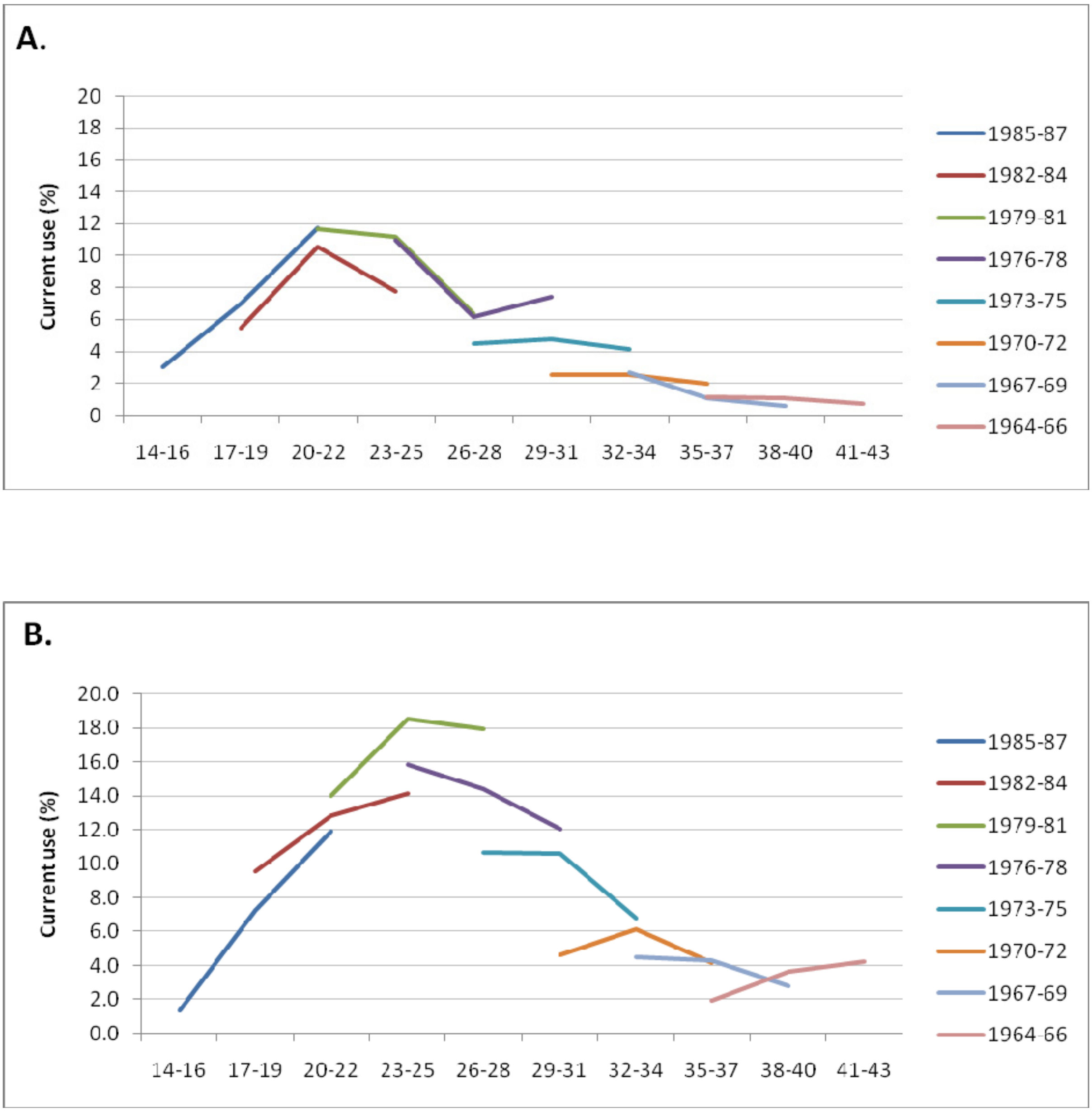


Figure 7. **Birth cohort trends in past year ecstasy use by age for women (A) and men (B), 2001–2007.**

3.2.3 An ageing birth cohort effect

The increase in ecstasy use in more recent birth cohorts can account for a rise in ecstasy use in the 26–37 year age bracket between the 2001 and 2007 NDSHS surveys. Specifically, in 2001, the 26–37 year age band was comprised of people born between 1964 and 1975. By 2007 this same age band was comprised of people born six years later (i.e., 1970–81). The birth cohorts that moved into the 26 to 37 year age bracket between 2001 and 2007 — that is, the 1976–81 birth cohort — had a much higher prevalence of ecstasy use than the 1964–69 birth cohort who were leaving this age bracket (i.e., 10–15% vs. 1–3% current use).

Specifically, the difference in the past year prevalence of ecstasy use between birth cohorts entering the 26–37 year age band, and those leaving it, was between 9 and 12 percentage points. Because this shift displaced half of the 26–37 year old age band, it would roughly account for a 5 to 6 percentage point increase in the past year prevalence of ecstasy use over the 2001 to 2007 period. This would more than account for the observed 3 percentage point increase in past year ecstasy use seen between 2001 and 2007 in the 26–37 year age bracket (as described in Table 2, earlier in this report).

In conclusion, an ageing birth cohort effect can easily account for the increase in the prevalence of ecstasy use in the 26–37 year age bracket between 2001 and 2007. More recent birth cohorts were more likely to use ecstasy. As these more recent birth cohorts aged, they moved into the 26–37 year age bracket, displacing older birth cohorts who had comparatively low rates of ecstasy use. In other words, the increase in ecstasy use in the 26–37 year age bracket seen in the NDSHS is due to the ageing of more recent generations of Australians, who have higher rates of ecstasy use.

3.2.4 Trends in incidence and desistance

Trends in incidence and desistance are discussed below because these may be impacting on ecstasy trends, and also because they have important implications for prevention strategies.

Incidence trends

The incidence, or up-take, of ecstasy use in each birth cohort can be inferred from an increase in the lifetime use of the drug from one survey to the next within a given birth cohort (Figure 5).

As expected, the incidence of ecstasy use was highest in birth cohorts who were in their teens and early twenties: the up-take of ecstasy during this period was around 2–3 percentage points per year. There was little evidence of incidence among older birth cohorts (i.e., those aged 26–37 years during the 2001 to 2007 period). Similar trends can be seen for men and women (Figures 6 and 7).

There was evidence of a period effect between 2001 and 2004. This can be seen by a small but consistent increase in lifetime ecstasy use (i.e., incident cases) in all birth cohorts born prior to 1979. The same effect may not be evident in more recent (younger) birth cohorts because of their already steep increase in exposure to ecstasy across this period. This increase in people trying ecstasy between 2001 and 2004 did not translate into a significant increase in current ecstasy use: as discussed earlier in this report, current use was stable or declining within birth cohorts across this period. However, the up-take of ecstasy use between 2001 and 2004 may have offset declines in ecstasy use that would have occurred in its absence.

Desistance from ecstasy use

The proportion of ecstasy users desisting from ecstasy use for each birth cohort over the 2001 to 2007 period is shown in Figure 8, and these trends are disaggregated by gender in Figure 9. For each birth cohort, desistance appears to increase from one survey to the next (Figure 8). This trend is consistent with age-related desistance because of the remarkable consistency in desistance rates for a given age from one birth cohort to the next, irrespective of the survey year.

These data suggest that desistance from ecstasy use increases steadily over the course of adulthood, with half of people who have tried ecstasy having desisted from use by their late twenties. This figure increased to between 60–90% by age 40. However, as alluded to earlier in this report, men and women differ in their desistance, with women being more likely to desist from using ecstasy as they enter their twenties, compared to males, more of whom continue to use through their adulthood (Figure 9).

There is no clear evidence of a consistent birth cohort effect in desistance, with the rate of desistance being very similar between birth cohorts for a given age (this can be seen by the close horizontal alignment of the trend lines for each birth cohort in Figure 8), perhaps with the exception of slightly lower rates of desistance in the very oldest birth cohorts (pre 1970) and slightly higher desistance among women in the 1982–84 birth cohort (Figure 9).

Re-initiation of ecstasy use

A decrease in desistance within a particular birth cohort indicates re-initiation of ecstasy use among former users of the drug. There are three fairly tenuous drops in desistance within birth cohorts, all of which occurred between 2001 and 2004. The first of these suggests re-initiation of ecstasy use among women in the 1982–84 birth cohort. The second two are among men in the 1970–72 and 1979–81 birth cohorts respectively. These effects are small, affecting 5–9% of people in these birth cohorts who had ever used ecstasy, and they had little impact on aggregate prevalence rates.

Summary

In summary, the incidence of ecstasy use rose sharply through the late teens and twenties, with little evidence of people initiating ecstasy use beyond their twenties. While there was some evidence of a small up-take in ecstasy use among adults in their thirties between 2001 and 2004, this did not have a measurable impact on the current prevalence of ecstasy use. Desistance from ecstasy use increases steadily as ecstasy users age, with little evidence of subsequent re-initiation of use. Women are more likely to desist from using ecstasy at a younger age than men, who are more likely to continue using into their twenties and thirties.

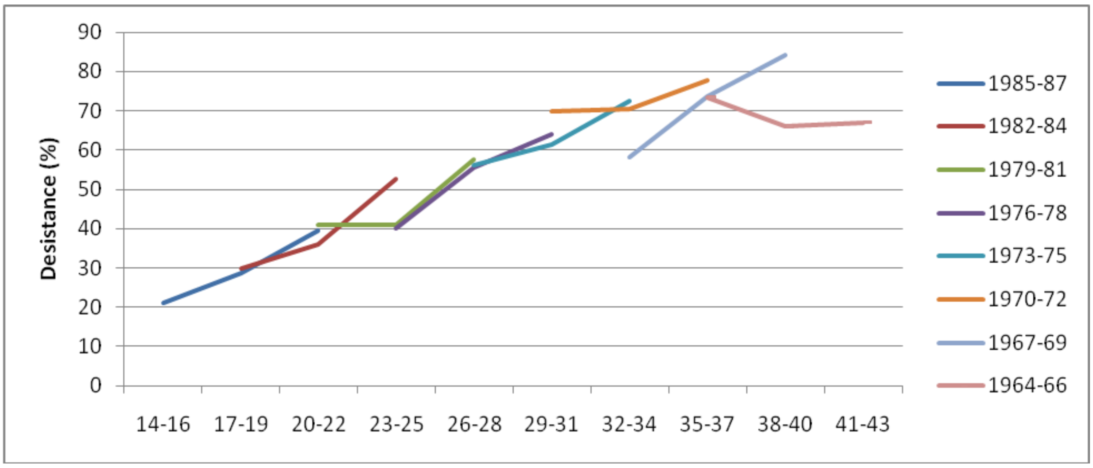


Figure 8. **Birth cohort trends in desistance from ecstasy use by age, 2001–2007**

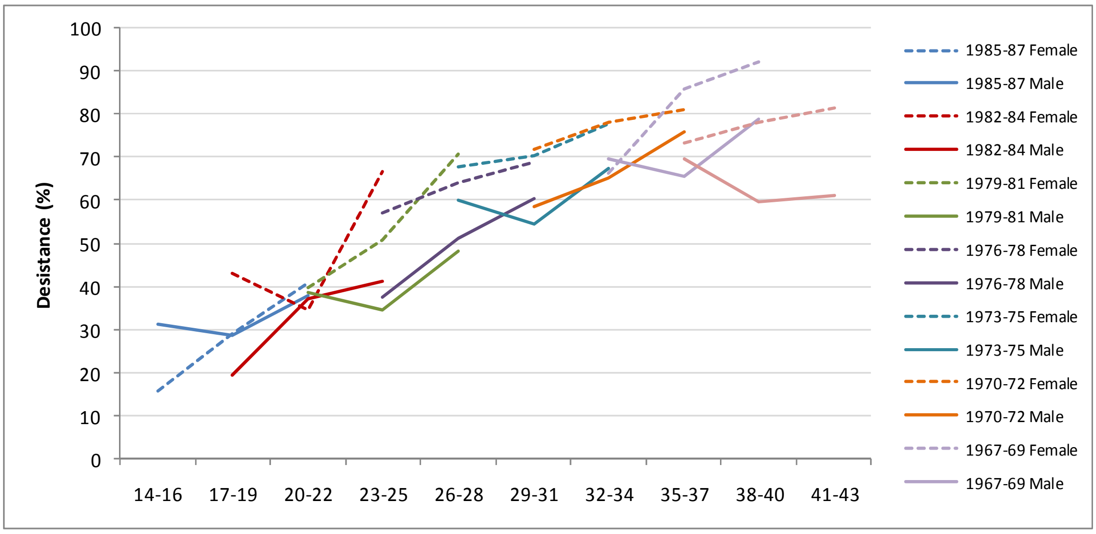


Figure 9. **Desistance from ecstasy for men and women by age and birth cohort, 2001–2007**

3.3 Trends in the use of other drugs

The previous sections support the hypothesis that a birth cohort effect was responsible for increasing ecstasy use in the 26–37 year age bracket between 2001 and 2007. As described in the introduction to this report, trends are declining for most other forms of drug use. This begs the question why ecstasy use is increasing and not other drug use. To answer this question, we have examined birth cohort trends for two other drugs: cannabis and methamphetamine.

Cannabis is the most common illicit drug in Australia, and it is the major driver of reduced illicit drug use in Australia. Examination of birth cohort trends for cannabis (Figure 10) show that there is no increase in cannabis exposure through successive birth cohorts as seen for ecstasy. In fact, the contrary is evident, with recent birth cohorts (1979–87) being less likely to have tried cannabis (Figure 10A). Within all but the very youngest birth cohort there has been a reduction in cannabis use over the 2001 to 2007 period (Figure 10B).

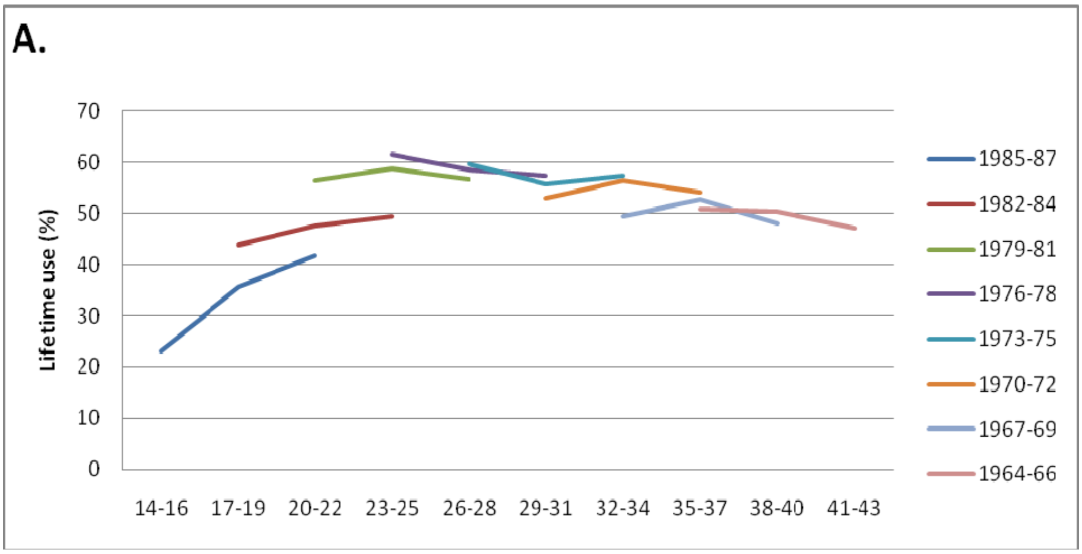
A further interesting trend is an increase in desistance from cannabis use between 2004 and 2007, which can be seen across almost all birth cohorts, irrespective of their age. Specifically, looking between cohorts we see that, for almost every age category, the desistance rates of each cohort was higher in 2007 than in either 2004 or 2001. This implies a period effect, whereby there was an increase in desistance from cannabis use between 2004 and 2007.

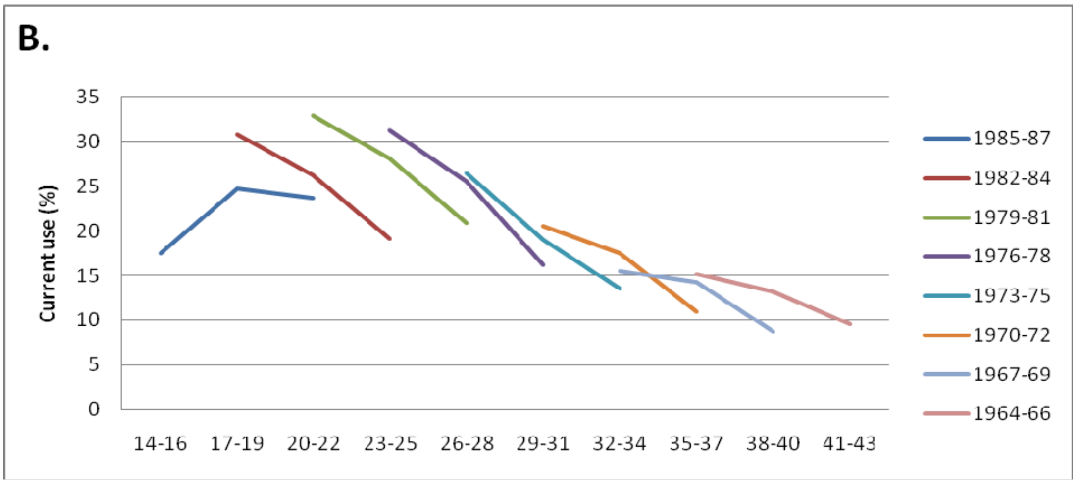
Methamphetamine makes an interesting comparison drug to ecstasy in that it is also a stimulant drug, and it was more popular than ecstasy until the 2007 NDSHS survey. However, similar to cannabis, there has been a decrease in use of methamphetamine in the youngest birth cohorts (Figure 11). Methamphetamine use remained reasonably consistent in older birth cohorts between 2001 and 2007 (i.e., those birth cohorts in their thirties). Similar to cannabis and ecstasy, methamphetamine use declined within each birth cohort as they aged through their thirties. Desistance increased steadily as birth cohorts aged, which is again similar to the trend seen for ecstasy and cannabis. There is no evidence of an overall increase in desistance between 2004 and 2007 as seen for cannabis. However, there is evidence of an increase in desistance in the very youngest birth cohort during this time period.

Taken together, there has been a decrease in the use of cannabis and methamphetamine among younger birth cohorts, and an additional increase in desistance in cannabis use between 2004 and 2007 across all birth cohorts. These trends would have led to a downward trend in the prevalence of these drugs. Ecstasy use, by contrast, has only seen a downward trend among men in younger birth cohorts, which has been offset by stable to increasing trends among women in these cohorts. Therefore, younger birth cohorts are reducing their use of cannabis and methamphetamine compared to their older peers, but these reductions have not been seen for ecstasy (specifically, they have not been seen for ecstasy use among women).

Cannabis and methamphetamine use was relatively stable across the older birth cohorts, meaning that replacement of one birth cohort for another, as these birth cohorts age, would not change the prevalence of drug use in older age brackets. Rather, decreases in cannabis and methamphetamine use will be seen in older age brackets in subsequent surveys as these younger age cohorts age. As explained earlier in this report, ecstasy contrasts this situation, with increasing ecstasy use among successive birth cohorts until around 1981. As these younger birth cohorts matured into their adulthood, they replaced their older peers who had comparatively low rates of ecstasy use, and this inflected the prevalence of ecstasy use in the older age brackets.

In summary, these findings indicate that there was increasing ecstasy use among birth cohorts from 1964 to 1981, but the use of other drugs was relatively stable in these birth cohorts, and this has led to an increase in the use of ecstasy (but not other drugs) in older age brackets over time. Second, the popularity of cannabis and methamphetamine has declined in recent years, particularly in more recent (younger) birth cohorts, whereas this decline has not been seen for ecstasy use among women.





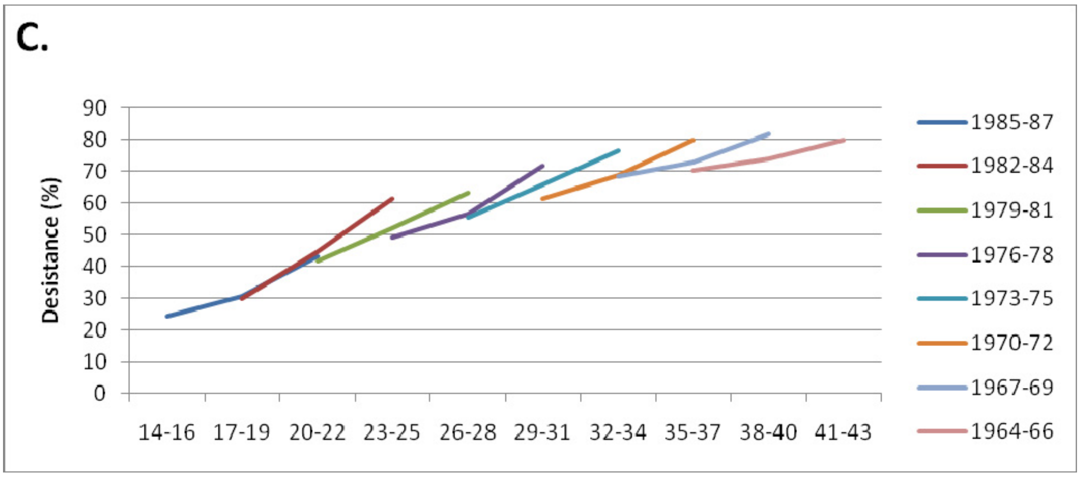


Figure 10. Birth cohort trends in lifetime use (A), past year use (B) and desistance (C) for cannabis, 2001–2007

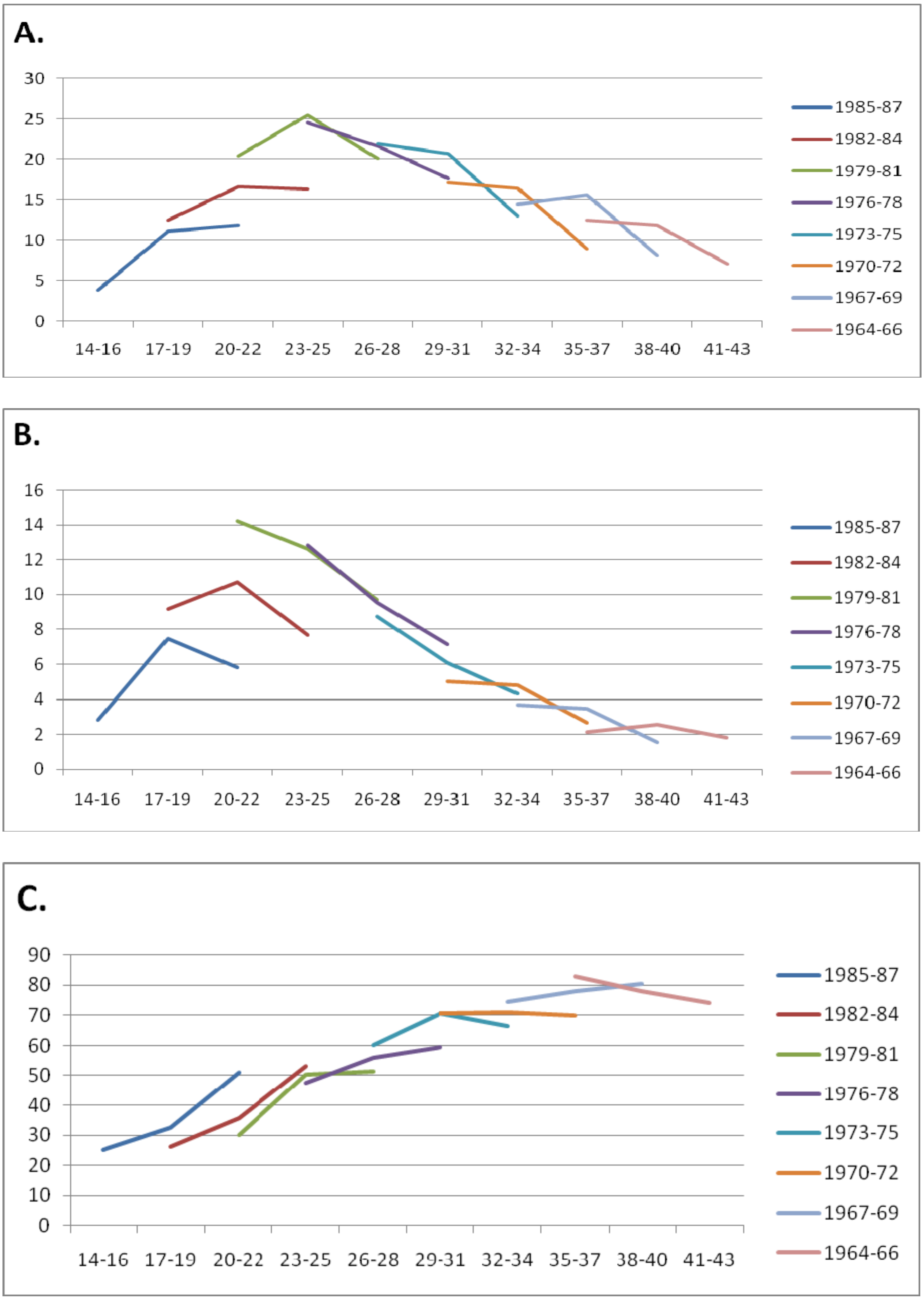


Figure 11. Birth cohort trends in lifetime use (A), past year use (B) and desistance (C) for methamphetamine, 2001–2007

4 DISCUSSION

4.1.1 Summary of findings

The main aim of this report was to identify which sub-groups of the Australian population were affected by increasing levels of ecstasy use, and to subsequently indentify what strategies might be helpful in circumventing these trends.

We found that ecstasy use was continuing to increase in two parts of the population:

- the 26–37 year age bracket, an increase that was apparent for both men and women, and
- 14–16 year old girls.

Ecstasy use in other sub-groups of the population was reasonably stable.

We also found that the increase in the use of ecstasy in the 26–37 year age bracket was due to an ageing cohort of ecstasy users. Essentially, levels of ecstasy use have increased in more recent birth cohorts (i.e., younger generations). As these cohorts have aged, they have moved into the 26–36 year age bracket, displacing older birth cohorts who had comparatively low levels of ecstasy use. This has increased the prevalence of ecstasy use in the 26–36 year age bracket.

This same trend was not seen for the other illicit drugs (cannabis and methamphetamine). This was because the use of these drugs had not increased in more recent birth cohorts (at least not during the period of examination). In fact, in contrast to our findings for ecstasy use, there was a trend toward lower levels of cannabis and methamphetamine use in more recent birth cohorts. There were also increases in the rate at which people were desisting from using cannabis and methamphetamine, which had not occurred for ecstasy.

There were also important disparities in ecstasy use trends for men and women. While ecstasy use was roughly similar for the genders through the teens, women were more likely to desist from using ecstasy in their early twenties than men, and this led to lower levels of ecstasy use among women than men throughout their adulthood. This gender difference in ecstasy use was enhanced by a birth cohort effect, whereby women born prior to 1979 were less likely to use ecstasy than their male counterparts.

In the beginning of this report, we noted an ongoing increase in ecstasy use among women, which was not apparent among men. Examination of ecstasy trends within birth cohorts revealed little evidence of an increase in ecstasy use among women, except in the youngest birth cohort, namely 14–16 year olds who were born in 1991–93. The level of ecstasy in this birth cohort was almost double that seen among either their female predecessors or their male peers. It is also noteworthy that there has been a gradual decline in ecstasy use among men in recent birth cohorts which has not occurred among women. These trends combined are likely to explain why ecstasy use has stabilised among men but not among women.

In summary, ongoing increases in ecstasy use in Australia can be explained by two main factors:

(a) an ageing population of ecstasy users, and

(b) increasing use of ecstasy among women in recent birth cohorts, who are currently in their teens.

4.1.2 The ageing of ecstasy users

A major finding of this study was that increases in the prevalence of ecstasy use could be largely accounted for by the ageing of birth cohorts with high levels of ecstasy use. The ageing of drug-using cohorts is becoming an increasingly recognised phenomenon, which has important implications for drug policy and practice (Boeri et al., 2006).

Trends in ecstasy use, more so than for other drugs, are subject to this ageing cohort effect because ecstasy is a relatively 'new' drug, and significant levels of use have only been apparent since the 1990s. This was borne out in the current study, which found increasing use of ecstasy in more recent birth cohorts from 1964 through to 1981 (a trend that was not apparent for other drugs). These people would have been going through their adolescence primarily during the 1980s and 1990s, at a time when ecstasy use was increasing in popularity. Many of these people continued to use the drug through their adulthood, thereby increasing the number of older ecstasy users in the population.

This change in the age distribution of ecstasy users over the 2001 to 2007 period is depicted in Figure 12. The grey shaded area represents ecstasy users in 2001, most of whom were in their late teens or early twenties. The area under the solid curve represents ecstasy users in 2007, and it can be seen that a greater proportion of ecstasy users are now in their late twenties to early thirties, and the 'peak' age of ecstasy use now extends across this entire age range. The levels of use in the teens and early twenties have remained high, reflecting the ongoing up-take of ecstasy in more recent generations of Australians.

Because there were increased levels of ecstasy use in birth cohorts from 1964 to 1981, ecstasy use in the 30 to 40 age bracket will continue to increase as these birth cohorts move into this age bracket — that is, up until the youngest birth cohort turn 40, which will be in 2019. This prediction of ongoing increases in the use of ecstasy in the 30 to 40 year age bracket assumes that the 1964–81 birth cohorts show similar rates of desistance/continuation of ecstasy use as previous generations.

Preventing the perpetuation of this cycle can be done by preventing the up-take of ecstasy use in younger generations of Australia as they enter their teens/adulthood, and by increasing desistance rates in ecstasy users as they move into their adulthood. As discussed earlier, decreases in the use of other drugs have been seen in more recent birth cohorts (methamphetamine and cannabis) and a similar trend has occurred for ecstasy among men, but this trend has not occurred among women. Similarly, there are signs that desistance has increased for other drugs, but not for ecstasy. The following section will consider what measures might be put in place to try and reduce the up-take of ecstasy in younger generations of Australians and increase their desistance from ecstasy use as they move into adulthood.

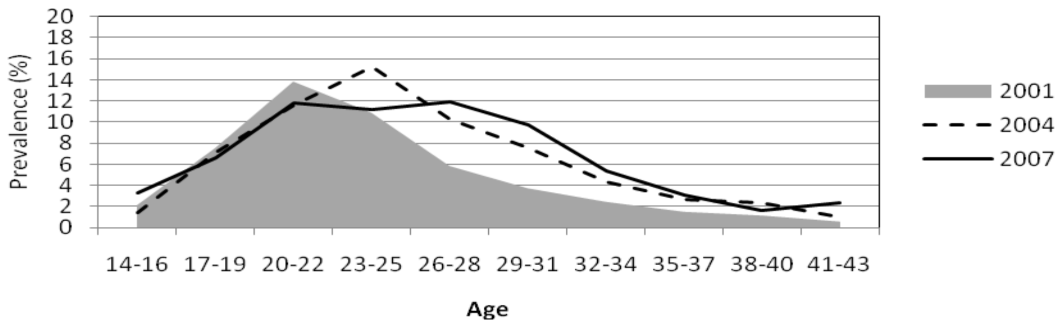


Figure 12. Age distribution for current (past year) ecstasy users in 2001, 2004 and 2007

4.1.3 Implications and recommended interventions

The current trend toward an ageing population of ecstasy users, and renewed increases in use among young cohorts of teenage girls, suggests a need for two strategies to reduce ongoing increases in ecstasy use:

(1) Interventions to prevent the up-take of ecstasy use; these interventions need to particularly address ecstasy use among 14–16 year old girls.

(2) Interventions to increase desistance from ecstasy use during adulthood; such interventions need to target men in particular because men show lower levels of desistance from ecstasy use than women.

Reducing the up-take of ecstasy use among teens

A school-based intervention would be appropriate to reduce drug use in the 14–16 year age bracket. Although the evidence-base for drug prevention is limited, current best practice involves social skills programs, which have been found to effectively decrease drug use and to increase drug knowledge, decision-making skills, self-esteem and resistance to peer pressure (Faggiano et al., 2005).

A social influence approach could be used to target women in particular. It has been suggested that the effects of ecstasy may appeal more to women than men. Specifically, one of the short-term effects of ecstasy is to make a person feel closer and more accepted by those around them. This effect may be more desirable to young females than males, as female relationships are more heavily based around social and emotional relationships, rather than physicality and power, which is the case for males (De Goede et al., 2009). Social influence interventions provide the ideal avenue to target prevention efforts as they incorporate a heavy influence on the impact of drugs on social relationships. This type of intervention has been formulated under the CLIMATE schools program and has been found to successfully reduce ecstasy use among school-going teenagers (Vogl et al., 2009).

Prevention activities during the period of adolescence after leaving school may also be warranted, although currently there is not enough evidence about what works in this context to make any recommendations about appropriate interventions (Gates et al., 2005).

Reducing ongoing use of ecstasy among adults

The second strategy to combat increases in ecstasy use would be to reduce ongoing ecstasy use among adults. Ongoing use of ecstasy into adulthood was more common among men than women, and therefore interventions need to particularly focus on encouraging desistance from ecstasy use among young adult males.

One of the factors associated with desisting from drug use, in so far as such risk factors are understood, is having a negative attitude toward drug use (Sloboda, in press). Inducing a negative attitude toward ecstasy use could be done through early prevention programs (e.g., school-based prevention programs), and this would have a downstream effect on desistance as people move into their adulthood. However, given the current situation in Australia, namely that we have a high level of ecstasy use among adults, it may also be beneficial to develop interventions that induce a negative attitude toward using ecstasy among existing users of the drug. Such strategies would need to target existing ecstasy users, particularly those with a positive attitude toward ecstasy use. This strategy may be particularly effective for reducing ongoing use of ecstasy among men because the social acceptability of ecstasy use is higher among men in Australia than among women (AIHW, 2002, 2005).

A further risk factor for ongoing drug use is failure to make a successful transition into adulthood (i.e., lack of employment, relationship development) (Sloboda, in press). Indeed, there are obvious differences in the developmental trajectory of young men and women that could lead to greater exposure to these risk factors for ongoing drug use among men compared to women. For example, life events such as child birth, and the demands of rearing children, encourage the need to cease substance use among women. Australian men, on the other hand, marry later than women and are therefore more likely to be single during this developmental period (Trewin, 2006). While outside the scope of drug-specific interventions, supporting pro-social roles of men through employment and healthy relationship development may have a beneficial effect in reducing the ongoing use of all drugs (not just ecstasy) and broader societal benefits.

There are a range of other social and community factors that may also sustain drug use, including a culture that is accepting of drug use and a community environment where drugs are readily available (Sloboda, in press). However, at this point it is not entirely clear whether and to what extent these factors, or the factors outlined above, are contributing to ongoing ecstasy use. Further research would be needed to delineate which types of interventions would yield the best gain in terms of reducing ecstasy use.

4.1.4 The implications of an ageing population of ecstasy users

The implications of an ageing population of chronic ecstasy users is also important to consider. In particular, it is not clear what health and social problems might arise with chronic ecstasy use. Most research on ecstasy-related harms focuses on acute toxicity (e.g., hyperthermia, serotonin syndrome, renal failure) in young drug users (O'Leary et al., 2001; Silins et al., 2007). Chronic ecstasy use may be associated with increased harms via the development of tolerance and consequent increased risk of toxicity from exposure to high doses of the drug. Cumulative exposure may also increase the risk of some toxic effects. In particular, there is much concern about the potential neurotoxic effects of ecstasy, and their neurocognitive sequelae (Kalechstein et al., 2007), the potential long-term implications of which remain unclear (Cowan, 2007; Gouzoulis-Mayfrank & Daumann, 2006).

The older age of chronic ecstasy users could in itself increase the risk of health problems. For example, psychostimulant use increases the risk of cardiovascular problems; chronic effects emerge over time (e.g., atherosclerosis, cardiomyopathy) and intoxication can precipitate acute cardiac distress or cardiac arrest (Kaye et al., 2007). The risk of cardiac pathology naturally increases with age. Chronic ecstasy use could therefore be associated with premature cardiac pathology and elevated rates of sudden cardiac death (which is characteristically associated with stimulant use; Kaye et al., 2009) among older users of the drug. Fatal events are uncommon, but cardiovascular pathology is documented as a contributing cause in the higher than expected number of ecstasy-related deaths in Australia (Kaye et al., 2009).

Finally, little is known about the characteristics of people who are in this population of ageing ecstasy users; for example, how often they take ecstasy, how much they take, or the context of their use. Although the dependence liability of ecstasy is low, a proportion of users do report symptoms of dependence and compulsive use (Degenhardt et al., 2010), and it may be that this phenomenon is responsible for long-term ecstasy use. In this case, treatment-style interventions may be warranted. Such brief interventions are under development at NDARC[2]. Alternatively, ongoing ecstasy use among older adults may reflect polydrug use among people who are dependent on other drugs (e.g., regular users of cannabis, methamphetamine and/or cocaine), as the majority of adults who report drug dependence are polydrug users. Finally, the potential range of harms, consequences, and desirable interventions, are likely to vary considerably depending on the demographic characteristics of this group of ageing ecstasy users; indeed, whether these ecstasy users have similar characteristics to other older populations of drug users (i.e., over-representation of single unemployed males) or whether they

---

[2] Copeland, Norberg, Hides & McKetin. The Ecstasy Check-Up: A multi-site trial of a brief intervention for ecstasy use among regular ecstasy users. NHMRC Project Grant No. 630570.

mirror the demographic characteristics of their peers, in which case their ecstasy use would need to be considered in the context of employment and family relationships.

4.1.5 Limitations

The main limitation of this study is that we were only able to examine birth cohort, age and period trends across three surveys (i.e., nine years). Ideally, this type of analysis would involve examining trends over the entire lifetime of successive birth cohorts. This limitation meant that we were only able to compare trends between closely aligned birth cohorts (three successive birth cohorts). Similarly, we were only able to concretely document age-related trends over a nine year period for each birth cohort, that period necessarily being dictated by the age of the birth cohort. This prevented us from being able to detect any period effects outside of the 2001 to 2007 period, which may have impacted on drug trends in a particular birth cohort. For example, it is possible that birth cohort effects observed in this study were a result of period effects, such as increases in the availability of ecstasy, which occurred prior to 2001. We also relied on visual inspection of trends to determine birth cohort, age and period effects, rather than attempting to model trends. Such a limited analysis also meant that we were unable to conclusively disentangle birth cohort trends from period trends and age-related effects.

As noted in the introduction, the pseudo-cohort analysis used in this study relies on survey data being representative of the general population. The current research should be reasonably robust in that the NDSHS includes a large representative sample of the general population. However, there were differences in the weighting procedures used in the 2001 survey and those used in the later surveys, which may have impacted on trends between these periods. The only trend that was systematically observed between 2001 and later surveys was a period effect, whereby there was a slight increase in the incidence of ecstasy use among adults between 2001 and 2004. This finding therefore needs to be considered cautiously.

4.1.6 Conclusion

Australia is currently experiencing the impact of an ageing population of ecstasy users. This trend is due to an increase in ecstasy use among birth cohorts from 1964 to 1981. These people would have initiated ecstasy use during the 1980s and 1990s, and many have continued to use the drug throughout their adulthood. This has had a long-term impact on the overall level of ecstasy use in Australia, and it will continue to inflate the prevalence of ecstasy use in the older age brackets (30+ years) over the coming decade.

While the popularity of other drugs has decreased in more recent birth cohorts, this is less the case for ecstasy. There has been some decline in the popularity of ecstasy among males in recent birth cohorts, but this declining trend has not occurred for women. In fact there has been a resurgence of ecstasy use among women in the very youngest birth cohort, which has led to an increase in ecstasy use among 14–16 year old girls.

We are now facing a situation where we have the capacity to intervene and circumvent a further increase in ecstasy use in Australia. Appropriate prevention strategies exist to reduce the up-take of ecstasy use among school-age teenagers, and these need to be implemented. There are a range of factors that could be manipulated to discourage ongoing ecstasy use through adulthood, and consideration needs to be given to which strategies would be most likely to be effective in the current Australian context.

5 REFERENCES

Australian Bureau of Statistics (2010). Australian Demographic Statistics 3101.0, December Quarter 2009. Table 16 p. 32. Available on the internet: http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0/

Australian Institute of Health and Welfare (2008). 2007 National Drug Strategy Household Survey: Detailed findings. Drug statistics series no. 22. Cat. no. PHE 107. Canberra: AIHW.

Australian Institute of Health and Welfare (2005). 2004 National Drug Strategy Household Survey: Detailed findings. Drug Statistics Series No.16. AIHW cat. no. PHE 66. Canberra: AIHW

Australian Institute of Health and Welfare (2002). 2001 National Drug Strategy Household Survey: Detailed findings. Drug Statistics Series No.11. AIHW cat. no. PHE 41. Canberra: AIHW.

Boeri MW, Sterk CE, Elifson KW. (2006). Baby Boomer Drug Users: Career Phases, Social Control and Social Learning Theory. Sociological Inquiry 76: 264-91.

Compton W, Thomas YF, Conway KP, Colliver JD. (2005). Developments in the Epidemiology of Drug Use and Drug Use Disorders. American Journal of Psychiatry 162: 1494-502

Cowan RL. (2007). Neuroimaging research in human MDMA users: A review. Psychopharmacology 189: 539-56

Australian Bureau of Statistics (2010). Access Census Data Online. Updated 29 January 2010, http://www.abs.gov.au/websitedbs/d3310114.nsf/home/census+data

Degenhardt L, Lynskey M, Hall W. (2000). Cohort trends in the age of initiation of drug use in Australia. Australian & New Zealand Journal of Public Health 24: 421-6

Degenhardt L, Bruno R, Topp L. (2010). Is ecstasy a drug of dependence? Drug & Alcohol Dependence 107:1-10

De Goede IHA., Branje SJT, Meeus WHJ. (2009). Developmental changes and gender differences in adolescents' perception of friendships. Journal of Adolescence 32: 1105-23

Faggiano F, Vigna-Taglianti F, Versino E, Zambon A, Borraccino A, Lemma P. (2005). School-based prevention for illicit drug use. Cochrane Database of Systematic Reviews 2005, Issue 2. Art. No.: CD003020. DOI: 10.1002/14651858.CD003020.pub2.

Gates S, McCambridge J, Smith LA, Foxcroft D. (2006). Interventions for prevention of drug use by young people delivered in non-school settings. Cochrane Database of

Systematic Reviews 2006, Issue 1. Art. No.: CD005030. DOI: 10.1002/14651858.CD005030.pub2.

Gouzoulis-Mayfrank E, Daumann J (2006). Neurotoxicity of methylenedioxyamphetamines (MDMA; ecstasy) in humans: How strong is the evidence for persistent brain damage? Addiction 101: 348-61

Grucza RA. Norberg K. Bucholz KK. Bierut LJ. (2008) Correspondence between secular changes in alcohol dependence and age of drinking onset among women in the United States. Alcoholism: Clinical & Experimental Research 32: 1493-501

Grucza RA. Bucholz KK. Rice JP. Bierut LJ. (2008). Secular trends in the lifetime prevalence of alcohol dependence in the United States: A re-evaluation. Alcoholism: Clinical & Experimental Research 32: 763-70

Hall, W.D., Degenhardt, L.J. & Lynskey, M.T. (1999). Opioid overdose mortality in Australia, 1964–1997: birth-cohort trends. Medical Journal of Australia 171: 34-7

Helakorpi S, Martelin T, Torppa J, Patja K, Vartiainen E, Uutela A. (2004). Did Finland's Tobacco Control Act of 1976 have an impact on ever smoking? An examination based on male and female cohort trends. Journal of Epidemiology and Community Health 58: 649–54

Kalechstein AD, De La Garza R, Mahoney JJ, Fantegrossi WE, Newton TF. (2007). MDMA use and neurocognition: A meta-analytic review. Psychopharmacology 189: 531-7

Kaye S, Darke S, Duflou J. (2009). Methylenedioxymethamphetamine (MDMA)-related fatalities in Australia: Demographics, circumstances, toxicology and major organ pathology. Drug and Alcohol Dependence 104: 254-61

Kaye S, McKetin R, Darke S, Duflou J. (2007). Methamphetamine and cardiovascular pathology: A review of the evidence. Addiction 102: 1204-11

Lynskey, M., Degenhardt L, Hall W. (2000). Cohort trends in youth suicide in Australia 1964–1997. Australian & New Zealand Journal of Psychiatry 34: 408-12

O'Leary G, Nargiso J, Weiss RD (2001). 3,4-methylenedioxymethamphetamine (MDMA): A review. Current Psychiatry Reports 3: 477-83

Roxburgh A, Hall D, Degenhardt L, McLaren J, Black E, Copeland J Mattick RP. (in press). The epidemiology of cannabis use and cannabis-related harm in Australia 1993–2007. Addiction

Sloboda Z. (in press). Vulnerability to drug abuse: Revisiting risk and protection. NDARC Technical Report. National Drug and Alcohol Research Centre, Sydney.

Silins E, Copeland J, Dillon P (2007). Qualitative review of serotonin syndrome, ecstasy (MDMA) and the use of other serotonergic substances: Hierarchy of risk. Australian & New Zealand Journal of Psychiatry 41: 649-55

Trewin D. (2006). The Australian Yearbook, 2006. Australian Bureau of Statistics Catalogue No. 1301.0. Available on the internet: http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1301.02006?OpenDocument Commonwealth of Australia, Canberra.

Vogl LE, Newton N, Teesson M, Swift W, Karageorge A, Deans C, McKetin R, Steadman B, Jone J, Dillon P, Havard A, Andrews G. (2009). CLIMATE Schools: Drug Prevention Programs. Report prepared for the Australian Government Department of Health and Ageing.

6 APPENDIX

Table A1. Past year ecstasy use by gender and age, 2001, 2004 and 2007

	Past year ecstasy use						Change in past year ecstasy use (percentage points)		
	2001		2004		2007				
	%	95% CI	%	95% CI	%	95% CI	2001 to 2004	2004 to 2007	2001 to 2007
Total									
14+	2.9	(2.6-3.2)	3.4	(3.1-3.7)	3.5	(3.2-3.9)	0.5*	0.1	0.6*
14-16	2.1	(1.2-3.1)	1.5	(0.8-2.1)	3.3	(1.9-4.7)	-0.7	1.8	1.2
17-19	7.6	(5.9-9.2)	7.1	(5.4-8.9)	6.6	(4.6-8.7)	-0.4	-0.5	-0.9
20-22	12.9	(10.6-15.2)	11.6	(9.5-13.8)	11.8	(9.0-14.7)	-1.3	0.2	-1.1
23-25	13.4	(11.0-15.9)	15.2	(12.5-18.0)	11.2	(8.7-13.7)	1.8	-4.0*	-2.2
26-28	7.6	(5.7-9.4)	10.3	(8.2-12.4)	11.9	(9.1-14.8)	2.7*	1.7	4.4*
29-31	3.6	(2.5-4.7)	7.5	(5.8-9.2)	9.7	(7.6-11.8)	3.9*	2.2*	6.1*
32-34	3.5	(2.4-4.7)	4.3	(3.1-5.6)	5.4	(3.9-6.9)	0.8	1.1	1.9*
35-37	1.5	(0.9-2.1)	2.6	(1.6-3.6)	3.1	(2.0-4.2)	1.1*	0.5	1.6*
38-40	1.3	(0.3-2.4)	2.4	(1.4-3.3)	1.7	(0.9-2.5)	1.0*	-0.7	0.3
41-43	0.6	(0.2-1.0)	1.0	(0.5-1.5)	2.4	(1.3-3.4)	0.4	1.4*	1.8*

*$p < 0.05$

Table A1. Past year ecstasy use by gender and age, 2001, 2004 and 2007 cont.

	Past year ecstasy use						Change in past year ecstasy use (percentage points)		
	2001		2004		2007				
	%	95% CI	%	95% CI	%	95% CI	2001 to 2004	2004 to 2007	2001 to 2007
Females									
14+	2.3	(2.0-2.5)	2.4	(2.1-2.7)	2.7	(2.3-3.0)	0.2	0.3	0.4*
14-16	3.0	(1.4-4.6)	2.3	(1.3-3.4)	5.0	(2.8-7.3)	-0.7	2.7*	2.0
17-19	5.5	(3.7-7.3)	7.0	(4.8-9.1)	7.0	(3.9-10.2)	1.5	0.1	1.5
20-22	11.7	(8.8-14.5)	10.5	(8.0-13.1)	11.7	(8.3-15.1)	-1.1	1.2	0.0
23-25	11.0	(8.1-13.9)	11.2	(8.2-14.2)	7.8	(5.2-10.4)	0.2	-3.4*	-3.2*
26-28	4.5	(2.8-6.2)	6.1	(4.0-8.3)	6.4	(4.0-8.7)	1.7	0.3	1.9*
29-31	2.5	(1.5-3.6)	4.8	(3.1-6.4)	7.4	(5.1-9.7)	2.2*	2.6*	4.9*
32-34	2.7	(1.5-3.9)	2.6	(1.4-3.7)	4.1	(2.5-5.7)	-0.1	1.6*	1.5*
35-37	1.1	(0.5-1.8)	1.1	(0.3-1.9)	2.0	(1.0-3.0)	0.0	0.9*	0.9*
38-40	0.9	(0.1-1.6)	1.1	(0.4-1.7)	0.6	(0.1-1.2)	0.2	-0.5	-0.2
41-43	0.6	(0.0-1.1)	0.4	(0.1-0.7)	0.7	(0.0-1.5)	-0.2	0.3	0.2

*p < 0.05

Table A1. Past year ecstasy use by gender and age, 2001, 2004 and 2007 cont.

	Past year ecstasy use						Change in past year ecstasy use (percentage points)		
	2001		2004		2007				
	%	95% CI	%	95% CI	%	95% CI	2001 to 2004	2004 to 2007	2001 to 2007
Males									
14+	3.6	(3.1-4.0)	4.4	(3.9-4.9)	4.4	(3.8-5.0)	0.8*	0.0	0.8*
14-16	1.3	(0.3-2.4)	0.6	(0.0-1.4)	1.6	(0.0-3.1)	-0.7	0.9	0.2
17-19	9.6	(6.7-12.4)	7.3	(4.4-10.1)	6.3	(3.6-9.0)	-2.3	-1.0	-3.3*
20-22	14.0	(10.5-17.6)	12.8	(9.4-16.3)	11.9	(7.4-16.4)	-1.2	-0.9	-2.1
23-25	15.8	(11.9-19.7)	18.5	(14.3-22.8)	14.1	(10.1-18.2)	2.7	-4.4*	-1.7
26-28	10.7	(7.4-13.9)	14.4	(10.8-18.0)	17.9	(12.7-23.1)	3.7*	3.6	7.3*
29-31	4.6	(2.8-6.5)	10.6	(7.6-13.6)	12.0	(8.5-15.5)	5.9*	1.4	7.4*
32-34	4.5	(2.5-6.4)	6.1	(3.9-8.4)	6.8	(4.4-9.2)	1.7	0.6	2.3*
35-37	1.9	(0.8-3.0)	4.3	(2.4-6.2)	4.2	(2.3-6.0)	2.4*	-0.1	2.2*
38-40	1.9	(0.0-3.8)	3.6	(1.9-5.3)	2.8	1.2-4.4)	1.8	-0.8	0.9
41-43	0.6	(0.0-1.3)	1.6	(0.7-2.6)	4.2	(2.1-6.4)	1.0	2.6*	3.6*

*p < 0.05

Table A2. Lifetime ecstasy use by gender and age, 2001, 2004 and 2007

	Lifetime year ecstasy use						Change in past year ecstasy use (percentage points)		
	2001		2004		2007				
	%	95% CI	%	95% CI	%	95% CI	2001 to 2004	2004 to 2007	2001 to 2007
Total									
14+	6.1	(5.7-6.4)	7.5	(7.1-7.9)	8.9	(8.4-9.4)	1.4*	1.4*	2.8*
14-16	2.7	(1.6-3.8)	2.4	(1.5-3.3)	3.3	(2.0-4.7)	-0.3	0.9	0.6
17-19	10.8	(8.8-12.7)	10.0	(7.8-12.2)	8.5	(6.3-10.8)	-0.8	-1.5	-2.2*
20-22	21.8	(18.8-24.8)	18.1	(15.5-20.8)	19.5	(16.0-22.9)	-3.7*	1.3	-2.3
23-25	22.5	(19.6-25.3)	25.8	(22.6-29.0)	23.7	(20.5-27.0)	3.4*	-2.1	1.3
26-28	17.3	(14.8-19.8)	23.2	(20.3-26.1)	28.1	(24.3-31.9)	5.9*	4.9*	10.8*
29-31	12.0	(9.9-14.0)	19.5	(16.9-22.0)	27.1	(23.8-30.4)	7.5*	7.6*	15.1*
32-34	8.5	(6.8-10.1)	14.6	(12.6-16.7)	19.6	(16.9-22.2)	6.2*	4.9*	11.1*
35-37	5.7	(4.5-6.9)	10.0	(8.3-11.8)	14.0	(11.7-16.3)	4.3*	4.0*	8.3*
38-40	4.7	(3.3-6.0)	7.0	(5.5-8.5)	10.5	(8.5-12.4)	2.3*	3.5*	5.8*
41-43	3.0	(2.0-4.0)	4.2	(3.2-5.2)	7.2	(5.6-8.8)	1.2*	2.9*	4.2*

*$p < 0.05$

Table A2. Lifetime ecstasy use by gender and age, 2001, 2004 and 2007 cont.

	Lifetime year ecstasy use						Change in past year ecstasy use (percentage points)		
	2001		2004		2007				
	%	95% CI	%	95% CI	%	95% CI	2001 to 2004	2004 to 2007	2001 to 2007
Females									
14+	5.1	(4.6-5.5)	6.0	(5.5-6.4)	7.6	(7.1-8.2)	0.9*	1.7*	2.6*
14-16	3.6	(1.8-5.3)	3.7	(2.2-5.2)	5.1	(2.9-7.4)	0.1	1.4	1.6
17-19	9.6	(7.3-12.0)	9.8	(7.3-12.4)	9.3	(5.8-12.7)	0.2	-0.6	-0.4
20-22	19.4	(15.6-23.3)	16.1	(13.0-19.1)	19.8	(15.4-24.2)	-3.4	3.7*	0.4
23-25	20.7	(17.1-24.2)	22.8	(19.0-26.6)	23.4	(19.3-27.6)	2.1	0.6	2.8
26-28	14.0	(11.2-16.9)	17.0	(13.8-20.3)	22.0	(18.1-25.8)	3.0*	4.9*	7.9*
29-31	8.0	(6.2-9.8)	16.0	(13.4-18.7)	23.8	(19.8-27.8)	8.0*	7.8*	15.8*
32-34	7.5	(5.7-9.4)	11.6	(9.5-13.8)	18.5	(15.4-21.5)	4.1*	6.8*	10.9*
35-37	5.0	(3.6-6.4)	7.7	(5.8-9.6)	10.5	(8.1-12.9)	2.7*	2.8*	5.5*
38-40	3.5	(2.1-4.9)	4.9	(3.5-6.4)	8.0	(5.9-10.1)	1.4*	3.0*	4.4*
41-43	2.1	(1.1-3.1)	2.9	(1.7-4.0)	3.9	(2.5-5.4)	0.7	1.1	1.8*

*$p < 0.05$

Table A2. Lifetime ecstasy use by gender and age, 2001, 2004 and 2007 cont.

	Lifetime year ecstasy use						Change in past year ecstasy use (percentage points)		
	2001		2004		2007				
	%	95% CI	%	95% CI	%	95% CI	2001 to 2004	2004 to 2007	2001 to 2007
Males									
14+	7.1	(6.5-7.7)	9.1	(8.4-9.8)	10.2	(9.4-11.0)	2.0*	1.1*	3.1*
14-16	1.9	(0.6-3.2)	1.3	(0.3-2.2)	1.6	(0.0-3.1)	-0.6	0.3	-0.3
17-19	11.8	(8.7-15.0)	10.2	(6.9-13.5)	7.9	(4.9-10.8)	-1.7	-2.3	-4.0*
20-22	24.0	(19.5-28.5)	20.5	(16.1-24.9)	19.1	(13.9-24.4)	-3.5	-1.3	-4.8
23-25	24.2	(19.7-28.7)	28.3	(23.5-33.1)	24.0	(19.0-29.0)	4.1	-4.3	-0.2
26-28	20.5	(16.5-24.6)	29.3	(24.6-34.0)	34.7	(28.4-41.0)	8.8*	5.4*	14.2*
29-31	15.8	(12.2-19.5)	23.3	(19.0-27.6)	30.3	(25.0-35.6)	7.4*	7.0*	14.4*
32-34	9.5	(6.7-12.2)	17.7	(14.3-21.1)	20.7	(16.6-24.9)	8.2*	3.1	11.3*
35-37	6.4	(4.5-8.4)	12.5	(9.5-15.5)	17.2	(13.4-20.9)	6.1*	4.6*	10.7*
38-40	5.8	(3.4-8.2)	9.0	(6.5-11.5)	13.2	(9.9-16.5)	3.2*	4.2*	7.4*
41-43	3.8	(2.2-5.5)	5.6	(3.9-7.4)	10.9	(7.9-13.9)	1.8*	5.3*	7.1*

*$p < 0.05$

Table A3. Past year ecstasy use within birth cohorts from 2001 to 2007 by gender

Age at 2007 survey	Birth cohort	Past year ecstasy use (%)						Change in past year ecstasy use (percentage points)		
		2001		2004		2007		2001 to 2004	2004 to 2007	2001 to 2007
		%	95% CI	%	95% CI	%	95% CI			
Total population										
14-16	1991-93					3.3	(1.9-4.7)			
17-19	1988-90			1.5	(0.8-2.1)	6.6	(4.6-8.7)		5.2*	
20-22	1985-87	2.1	(1.2-3.1)	7.1	(5.4-8.9)	11.8	(9.0-14.7)	5.0*	4.7*	9.7*
23-25	1982-84	7.6	(5.9-9.2)	11.6	(9.5-13.8)	11.2	(8.7-13.7)	4.1*	-0.4	3.7*
26-28	1979-81	12.9	(10.6-15.2)	15.2	(12.5-18.0)	11.9	(9.1-14.8)	2.3	-3.3*	-0.9
29-31	1976-78	13.4	(11.0-15.9)	10.3	(8.2-12.4)	9.7	(7.6-11.8)	-3.2*	-0.6	-3.7*
32-34	1973-75	7.6	(5.7-9.4)	7.5	(5.8-9.2)	5.4	(3.9-6.9)	-0.1	-2.1*	-2.2*
35-37	1970-72	3.6	(2.5-4.7)	4.3	(3.1-5.6)	3.1	(2.0-4.2)	0.7	-1.2*	-0.5
38-40	1967-69	3.5	(2.4-4.7)	2.6	(1.6-3.6)	1.7	(0.9-2.5)	-0.9	-1.0	-1.9*
41-43	1964-66	1.5	(0.9-2.1)	2.4	(1.4-3.3)	2.4	(1.3-3.4)	0.9	0.0	0.9
	1961-63	1.3	(0.3-2.4)	1.0	(0.5-1.5)			-0.3		
	1958-60	0.6	(0.2-1.0)							

*p < 0.05

Table A3. Past year ecstasy use within birth cohorts from 2001 to 2007 by gender cont.

Age at 2007 survey	Birth cohort	Past year ecstasy use (%)						Change in past year ecstasy use (percentage points)		
		2001		2004		2007		2001 to 2004	2004 to 2007	2001 to 2007
		%	95% CI	%	95% CI	%	95% CI			
Females										
14-16	1991-93					5.0	(2.8-7.3)			
17-19	1988-90			2.3	(1.3-3.4)	7.0	(3.9-10.2)		4.7*	
20-22	1985-87	3.0	(1.4-4.6)	7.0	(4.8-9.1)	11.7	(8.3-15.1)	4.0*	4.7*	8.7*
23-25	1982-84	5.5	(3.7-7.3)	10.5	(8.0-13.1)	7.8	(5.2-10.4)	5.0*	-2.7*	2.3
26-28	1979-81	11.7	(8.8-14.5)	11.2	(8.2-14.2)	6.4	(4.0-8.7)	-0.4	-4.8*	-5.3*
29-31	1976-78	11.0	(8.1-13.9)	6.1	(4.0-8.3)	7.4	(5.1-9.7)	-4.9*	1.3	-3.6*
32-34	1973-75	4.5	(2.8-6.2)	4.8	(3.1-6.4)	4.1	(2.5-5.7)	0.3	-0.6	-0.3
35-37	1970-72	2.5	(1.5-3.6)	2.6	(1.4-3.7)	2.0	(1.0-3.0)	0.0	-0.6	-0.5
38-40	1967-69	2.7	(1.5-3.9)	1.1	(0.3-1.9)	0.6	(0.1-1.2)	-1.6*	-0.5	-2.1*
41-43	1964-66	1.1	(0.5-1.8)	1.1	(0.4-1.7)	0.7	(0.0-1.5)	-0.1	-0.4	-0.4
	1961-63	0.9	(0.1-1.6)	0.4	(0.1-0.7)			-0.5		
	1958-60	0.6	(0.0-1.1)							

*p < 0.05

Table A3. Past year ecstasy use within birth cohorts from 2001 to 2007 by gender cont.

Age at 2007 survey	Birth cohort	Past year ecstasy use (%)						Change in past year ecstasy use (percentage points)		
		2001		2004		2007		2001 to 2004	2004 to 2007	2001 to 2007
		%	95% CI	%	95% CI	%	95% CI			
Males										
14-16	1991-93					1.6	(0.0-3.1)			
17-19	1988-90			0.6	(0.0-1.4)	6.3	(3.6-9.0)		5.6*	
20-22	1985-87	1.3	(0.3-2.4)	7.3	(4.4-10.1)	11.9	(7.4-16.4)	6.0*	4.6*	10.6*
23-25	1982-84	9.6	(6.7-12.4)	12.8	(9.4-16.3)	14.1	(10.1-18.2)	3.3	1.3	4.5*
26-28	1979-81	14.0	(10.5-17.6)	18.5	(14.3-22.8)	17.9	(12.7-23.1)	4.5*	-0.6	3.9
29-31	1976-78	15.8	(11.9-19.7)	14.4	(10.8-18.0)	12.0	(8.5-15.5)	-1.4	-2.3	-3.8
32-34	1973-75	10.7	(7.4-13.9)	10.6	(7.6-13.6)	6.8	(4.4-9.2)	-0.1	-3.8*	-3.9*
35-37	1970-72	4.6	(2.8-6.5)	6.1	(3.9-8.4)	4.2	(2.3-6.0)	1.5	-2.0	-0.5
38-40	1967-69	4.5	(2.5-6.4)	4.3	(2.4-6.2)	2.8	1.2-4.4)	-0.2	-1.5	-1.7
41-43	1964-66	1.9	(0.8-3.0)	3.6	(1.9-5.3)	4.2	(2.1-6.4)	1.7*	0.6	2.3*
	1961-63	1.9	(0.0-3.8)	1.6	(0.7-2.6)			-0.2		
	1958-60	0.6	(0.0-1.3)							

*p < 0.05

Table A4. Birth cohort effects for current ecstasy use by gender

Birth cohort		Age of birth cohort								
Total population		14-16	17-19	20-22	23-25	26-28	29-31	32-34	35-37	38-40
1991-93	%	3.3								
	(95% CI)	(1.9-4.7)								
1988-90	%	1.5	6.6							
	(95% CI)	(0.8-2.1)	(4.6-8.7)							
1985-87	%	2.1	7.1	11.8						
	(95% CI)	(1.2-3.1)	(5.4-8.9)	(9.0-14.7)						
1982-84	%		7.6	11.6	11.2					
	(95% CI)		(5.9-9.2)	(9.5-13.8)	(8.7-13.7)					
1979-81	%			12.9	15.2	11.9				
	(95% CI)			(10.6-15.2)	(12.5-18.0)	(9.1-14.8)				
1976-78	%				13.4	10.3	9.7			
	(95% CI)				(11.0-15.9)	(8.2-12.4)	(7.6-11.8)			
1973-75	%					7.6	7.5	5.4		
	(95% CI)					(5.7-9.4)	(5.8-9.2)	(3.9-6.9)		
1970-72	%						3.6	4.3	3.1	
	(95% CI)						(2.5-4.7)	(3.1-5.6)	(2.0-4.2)	
1967-69	%							3.5	2.6	1.7
	(95% CI)							(2.4-4.7)	(1.6-3.6)	(0.9-2.5)
1964-66	%								1.5	2.4
	(95% CI)								(0.9-2.1)	(1.4-3.3)
1961-63	%									1.3
	(95% CI)									(0.3-2.4)
1958-60	%									
	(95% CI)									
Change		1.2	-0.9	-2.2	-2.2	4.4*	6.1*	1.9*	1.6*	0.3

* $p < 0.05$

Table 4A. Birth cohort effects for current ecstasy use by gender cont.

Birth cohort		Age of birth cohort								
	Female	14-16	17-19	20-22	23-25	26-28	29-31	32-34	35-37	38-40
1991-93	%	5.0								
	(95% CI)	(2.8-7.3)								
1988-90	%	2.3	7.0							
	(95% CI)	(1.3-3.4)	(3.9-10.2)							
1985-87	%	3.0	7.0	11.7						
	(95% CI)	(1.4-4.6)	(4.8-9.1)	(8.3-15.1)						
1982-84	%		5.5	10.5	7.8					
	(95% CI)		(3.7-7.3)	(8.0-13.1)	(5.2-10.4)					
1979-81	%			11.7	11.2	6.4				
	(95% CI)			(8.8-14.5)	(8.2-14.2)	(4.0-8.7)				
1976-78	%				11.0	6.1	7.4			
	(95% CI)				(8.1-13.9)	(4.0-8.3)	(5.1-9.7)			
1973-75	%					4.5	4.8	4.1		
	(95% CI)					(2.8-6.2)	(3.1-6.4)	(2.5-5.7)		
1970-72	%						2.5	2.6	2.0	
	(95% CI)						(1.5-3.6)	(1.4-3.7)	(1.0-3.0)	
1967-69	%							2.7	1.1	0.6
	(95% CI)							(1.5-3.9)	(0.3-1.9)	(0.1-1.2)
1964-66	%								1.1	1.1
	(95% CI)								(0.5-1.8)	(0.4-1.7)
1961-63	%									0.9
	(95% CI)									(0.1-1.6)
1958-60	%									
	(95% CI)									
Change		2.0*	1.5	0.0	-3.2*	1.9	4.9*	1.5	0.9	-0.3

* $p < 0.05$

Table 4A. Birth cohort effects for current ecstasy use by gender cont.

Birth cohort		Age of birth cohort								
	Male	14-16	17-19	20-22	23-25	26-28	29-31	32-34	35-37	38-40
1991-93	%	1.6								
	(95% CI)	(0.0-3.1)								
1988-90	%	0.6	6.3							
	(95% CI)	(0.0-1.4)	(3.6-9.0)							
1985-87	%	1.3	7.3	11.9						
	(95% CI)	(0.3-2.4)	(4.4-10.1)	(7.4-16.4)						
1982-84	%		9.6	12.8	14.1					
	(95% CI)		(6.7-12.4)	(9.4-16.3)	(10.1-18.2)					
1979-81	%			14.0	18.5	17.9				
	(95% CI)			(10.5-17.6)	(14.3-22.8)	(12.7-23.1)				
1976-78	%				15.8	14.4	12.0			
	(95% CI)				(11.9-19.7)	(10.8-18.0)	(8.5-15.5)			
1973-75	%					10.7	10.6	6.8		
	(95% CI)					(7.4-13.9)	(7.6-13.6)	(4.4-9.2)		
1970-72	%						4.6	6.1	4.2	
	(95% CI)						(2.8-6.5)	(3.9-8.4)	(2.3-6.0)	
1967-69	%							4.5	4.3	2.8
	(95% CI)							(2.5-6.4)	(2.4-6.2)	1.2-4.4)
1964-66	%								1.9	3.6
	(95% CI)								(0.8-3.0)	(1.9-5.3)
1961-63	%									1.9
	(95% CI)									(0.0-3.8)
1958-60	%									
	(95% CI)									
Change		0.2	-3.3*	-1.7	-1.7	7.3*	7.4*	2.3	2.2*	0.9

* $p < 0.05$