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Understanding and describing Australian illicit drug markets

Drug price variations and associated changes in a cohort of people who inject drugs

N Scott, J P Caulkins, A Ritter and P Dietze

Monograph Series No. 58

Funded by the National Drug Law Enforcement Research Fund
An Initiative of the National Drug Strategy

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Nick Scott
Burnet Institute, Centre for Population Health
Melbourne, Vic, Australia

Jonathan P Caulkins
Carnegie Mellon University Heinz College
Pittsburgh, PA, USA

Alison Ritter
National Drug and Alcohol Research Centre
University of New South Wales, NSW, Australia

Paul Dietze
Burnet Institute, Centre for Population Health
Melbourne, Vic, Australia

Funded by the National Drug Law Enforcement Research Fund, an initiative of the National Drug Strategy

Produced by the National Drug Law Enforcement Research Fund (NDLERF)
GPO Box 2944, Canberra, Australian Capital Territory 2601

ISSN: 1449-7476

The research on which this report is based was funded by the National Drug Law Enforcement Research Fund, an initiative of the National Drug Strategy.

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Acknowledgements

The research staff would like to thank and acknowledge the following:

- the Melbourne Injecting Drug User Cohort Study participants and fieldwork team;
- Catherine Quinn and the Victoria Police Forensic Services Department for facilitating access to drug seizure purity data; and
- the contribution to this work of the Victorian Operational Infrastructure Support Program.

The Melbourne Injecting Drug User Cohort Study is funded through a variety of National Health and Medical Research Council grants and untied philanthropic contributions.

Abbreviations

A$	Australian dollar
CI	confidence interval
CPI	consumer price index
IDRS	Illicit Drug Reporting System
IQR	interquartile range
LGA	local government area
MIX	Melbourne Injecting Drug User Cohort Study
OST	opioid substitution therapy
PWID	people who inject drugs
VPFSD	Victoria Police Forensic Services Department
WCCS	Washington Cannabis Consumption Survey

Executive summary

This project was undertaken to provide a detailed understanding of the interface between the price of drugs and the behaviour of people who inject drugs (PWID) and other drug-market changes. Specifically, three major aims were to:

1. understand the drug purchase patterns of a large cohort of PWID, and how these change over time;
2. understand how price relates to drug use and drug preferences; and
3. determine the likely effects of changes in drug prices on PWID.

Data on drug purchases and drug use were obtained from the Melbourne Injecting Drug User Cohort Study (MIX). MIX is a prospective cohort study of young PWID who were recruited between April 2008 and January 2010. Individuals were eligible for the study if they reported being aged between 18 and 30 years old and had injected either heroin or methamphetamine at least six times in the previous six months.

Data on drug purity were obtained from the Victoria Police Forensic Services Department (VPFSD) so that price, purity and purity-adjusted price time series could be created for heroin, powder methamphetamine and crystal methamphetamine. Trends in purchase and use patterns were analysed for heroin, powder methamphetamine and crystal methamphetamine. Where sufficient observations were available, trends for the illicit use of benzodiazepines and other opioids were also examined.

Frequency of drug use:

- the frequency of heroin use decreased within the cohort at each interview wave—at baseline, nearly 75 percent of the cohort reported weekly or more frequent heroin use, but that fell to less than 50 percent at follow-up three (approximately three years after baseline data collection);
- total methamphetamine use remained steady; however, there was a transition from the powder to crystal form. Weekly or more frequent powder methamphetamine use declined from 17 percent of the cohort at baseline to 4 percent at follow-up three, while weekly or more frequent crystal methamphetamine use increased from 8 percent of the cohort at baseline to 18 percent at follow-up three; and
- overall drug use declined slightly, with the average number of reported injections (all drugs, combined) in the past week declining from approximately nine per week at the start of 2009 to approximately six per week in mid-2010, before remaining steady up to the start of 2014.

Main illicit drug of choice:

- the drug of choice for the cohort was overwhelmingly heroin; however, this decreased over time, with increasing preference for cannabis or other drugs:
  - of all interviews in 2009, the drug of choice for participants was heroin (73%), methamphetamine (12%), cannabis (7%) and other drugs (8%); and
  - of all interviews in 2013, the drug of choice for participants was heroin (64%), methamphetamine (12%), cannabis (17%) and other drugs (8%).[1]
- differences were observed according to geographic location, drug first injected, injection frequency, opioid substitution therapy (OST) status, age, sex and season.

1 Values do not add to 100 percent due to rounding.

Illicit drug used most:

- the drug used most by the majority of the cohort was heroin; however, this decreased over time, with increasing reports of cannabis or other drugs being used the most:
  - of all interviews in 2009, the drug used most by participants was heroin (60%), methamphetamine (7%), cannabis (19%) and other drugs (14%); and
  - of all interviews in 2013, the drug used most by participants was heroin (30%), methamphetamine (7%), cannabis (28%) and other drugs (35%).
- differences were observed according to geographic location, drug first injected, injection frequency, OST status, age, sex and season.

Heroin and methamphetamine purity

Between 2009 and mid-2013:

- the average purity of heroin remained consistent and low at approximately 15 percent;
- the average purity of powder methamphetamine increased from approximately 10 percent to 30 percent and the average purity of crystal methamphetamine increased from approximately 20 percent to 70 percent;
- crystal methamphetamine purity was highly bimodal throughout the period, with observations generally less than 20 percent or greater than 70 percent pure. In particular, purity variations were the highest throughout 2010; and
- the composition of methamphetamine seizures evolved over time, from the majority being powder to the majority being crystal, probably reflecting increased availability.

Heroin and methamphetamine price, before adjusting for purity

In 2014 Australian dollars, the average price per gram not adjusted for purity of:

- heroin decreased from a little less than $400 per gram in 2009 to approximately $300 per gram in mid-2013 mostly due to inflation (ie the nominal price changed little, but the real cost fell in constant dollar terms);
- powder methamphetamine remained steady between 2009 and mid-2013 at approximately $250 per gram; and
- crystal methamphetamine increased substantially in 2010 from approximately $450 per gram to approximately $800 per gram, where it remained until mid-2013.

Heroin and methamphetamine purity-adjusted price

In 2014 Australian dollars, between 2009 and mid-2013, the purity-adjusted price per gram of:

- heroin remained steady on average, but variation increased after 2011;
- powder methamphetamine steadily declined; and
- crystal methamphetamine steadily declined.

The purity-adjusted prices of the two methamphetamine forms were very similar.

Trends in use and harms related to purity and purity-adjusted price:

- that purity-adjusted prices of powder and crystal methamphetamine were equal and fell in parallel suggests they were driven by a common increase in supply;

- decreases in methamphetamine purity-adjusted price along with the bimodality of crystal methamphetamine purity may account for some of the changes apparent in methamphetamine consumption and related harms, in particular increased overdoses; and
- between the third and fourth interview waves (approximately between October 2011 and July 2013), the percentage of participants reporting more than one recent methamphetamine purchase increased from 12 percent (steady for the first three interview waves) to 17 percent, while the percentage not reporting any purchases remained steady, indicating that those already using methamphetamine were starting to purchase more frequently.

Types of deals:

- most drug purchases occurred in houses. This became increasingly so over time, with fewer reports of drugs being purchased on the street:
  - of all purchases reported in 2009, 46 percent were made in a house, 28 percent in the street and 25 percent from a mobile dealer;
  - of all purchases reported in 2013, 59 percent were made in a house, 15 percent in the street and 26 percent from a mobile dealer.
- methamphetamine was more likely than heroin to be purchased in houses (between April 2008 and March 2014, 74% of powder methamphetamine purchases and 76% of crystal methamphetamine purchases were made in houses, compared with 47% of heroin purchases); and
- street deals were less likely in winter (accounting for 17% of all purchases in winter compared with 22% in summer).

Amount being spent on purchases

The values below represent adjusted average amounts spent per purchase in 2014 Australian dollars (not controlled for purchase size or purity):

- the average amount spent on each heroin purchase increased from approximately $120 at the start of 2009 to approximately $175 at the start of 2012, before steadily declining to approximately $160 by the start of 2014;
- the average amount spent on each powder methamphetamine purchase fluctuated around $150 between 2009 and 2012 before decreasing to approximately $75 by January 2014;
- the average amount spent on each crystal methamphetamine purchase decreased from more than $250 at the start of 2009 to approximately $140 in mid-2012, where it remained until the start of 2014;
- the majority of heroin or methamphetamine purchases of less than $100 were made on the street and not shared;
- the initial increase in average spending per heroin purchase stemmed from two factors—1) more being spent per purchase from a mobile dealer; and 2) street purchases becoming both smaller and less common; and
- trends observed in average methamphetamine expenditure were consistent across all purchase types for both powder and crystal forms. Due to the low percentage of street methamphetamine purchases, the market transition away from street purchases had little effect on changes to average spending.

Time taken to obtain drugs:

- the time taken to obtain drugs was typically short, with a median of 15 minutes—interquartile range (IQR) of 5–30 minutes;
- fewer than 10 percent of participants had median heroin search times of more than 30 minutes (median 15 minutes, IQR 10–30 minutes);

- fewer than 10 percent of participants had median methamphetamine search times greater than 90 minutes (powder: median 20 minutes, IQR 5–32 minutes; crystal: median 20 minutes, IQR 10–30 minutes); and
- search time for heroin and methamphetamine was slightly longer in Central and Outer-Urban regions than in the Inner West.

Purchase sharing/pooling money to buy drugs:

- about 40 percent of all reported purchases have some percentage shared—typically 50/50—with a partner or friend; and
- sharing is more likely to occur among females, as purchase size increases, as frequency of use increases and for participants on a government allowance rather than a salary.

Where drugs are being used:

- most reported drug use occurred in houses. This became increasingly so over time, with fewer reports of drugs being used on the street:
  - of all purchases reported in 2009, 43 percent were used in houses, 27 percent in streets, 15 percent in cars and 10 percent in public toilets; and
  - of all purchases reported in 2013, 58 percent were used in houses, 13 percent in streets, 15 percent in cars and 11 percent in public toilets.
- methamphetamine was more likely than heroin to be used in houses (between April 2008 and March 2014, 68% of powder methamphetamine purchases and 69% of crystal methamphetamine purchases were used in houses, compared with 46% of heroin purchases); and
- use on the street was less likely in winter (accounting for 14% of all use location types in winter compared with 22% in summer).

The time of day drugs are being used:

- the time of day that drugs were used followed an asymmetric triangle distribution, peaking about midday and trailing off into the evening, with heroin, methamphetamine, benzodiazepines and other opioids all most likely to be used between 10am and 2pm;
- these distributions of times of use did not vary substantially by drug type, and there was no difference depending on use location type, geographic location or OST status; and
- these distributions of times of use were consistent with ambulance and hospital data describing peak periods of callouts and admissions for drug overdoses.

The time between purchasing and using drugs:

- the time between purchasing and first using each drug was generally very short;
- more than three-quarters of drug purchases were first used within 10 minutes, and fewer than 10 percent of purchases had more than a 30-minute gap;
  - the time of day purchases were used appears to be an excellent proxy for purchase time and peak market activity; and
  - short times between purchasing and using help explain local community concerns about drugs being purchased in the neighbourhood, as the location of drug use was highly correlated with the location of drug sales.

Price responsiveness between drugs:

- the responsiveness of drug use to changes in methamphetamine price was low, given that changes in preference for and use of methamphetamine were confined to a small number of participants despite large declines in purity-adjusted methamphetamine prices (alongside steady purity-adjusted price of heroin and steady price and potency of cannabis);[2] and
- the responsiveness of drug use to changes in heroin price could not be assessed because purity-adjusted heroin prices were stable.

Implications for policy and practice

Purchase characteristics:

- better understanding of deals occurring in houses is required, as they represent the largest market component in terms of percentage of deals and size of deals;
- the shift to more clandestine dealing may have produced benefits in terms of public amenity in drug-market areas; and
- short search times imply that even if enforcement were able to double or triple search times, the increased inconvenience to dealers would still be minor relative to the amounts of money spent on a typical purchase.

Interventions:

- the high proportion of shared purchases may present an opportunity for peer-oriented harm-reduction interventions;
- services related to heroin and methamphetamine dealing and the acute consequences of use are needed most between 10am and 2pm;
- short times between purchasing and using drugs indicate that they are occurring in close geographic locations; and
- drug use in public places has been declining over time, highlighting the need for innovative education and outreach strategies to minimise the risks of use in private locations.

Education:

- the shift from powder to crystal methamphetamine implies a dramatic increase in the purity of the drug used by participants, which can affect the way in which people present to services (including police); and
- variations in purity can lead to variations in drug effects for people who use drugs, highlighting the need for targeted education of consumers about the effects of crystal methamphetamine and mechanisms to control their use.

Surveillance and data collection:

- drug-market surveillance can provide valuable insight and increased understanding of drug-market dynamics; and
- both datasets (MIX and VPFSD) offer unique information and should be continued.

2 The Illicit Drug Reporting System (IDRS) *(Cogger, Dietze & Lloyd 2013; Stafford & Burns 2013)* reports that the median price of both a gram and an ounce of hydroponic cannabis (the most common) in Victoria were steady between 2008 and 2012 at $20 and $250 respectively, with the majority of respondents reporting stable potency.

Introduction

Aims of this study

This project was designed to provide a detailed understanding of the interface between the price of drugs and other drug-market changes and the behaviour of people who inject drugs (PWID). Specifically, three major aims of the project were to:

1. understand the drug purchase patterns of a large cohort of PWID, and how these change over time;
2. understand how price relates to drug use and drug preferences; and
3. determine the likely effects of changes in drug prices on PWID.

Further, the cohort study used for this analysis was unique in its design as participants were asked detailed questions about not only their most recent, but also their second and third most recent drug purchases. This provided a valuable opportunity to determine:

4. whether there is significant within-person variation in purchase habits and, hence, whether the methods used in the MIX, in which data on three recent purchases of various drugs are collected, are a superior way to study drug markets to relying on single-purchase data alone.

Data used for this study

We used data on drug purchases and drug use obtained from the Melbourne Injecting Drug User Cohort Study (MIX). MIX is a prospective cohort study of 688 young PWID who were recruited into the study between April 2008 and January 2010 from three locations across Melbourne: Inner West (Footscray), Central (CBD, Fitzroy, St Kilda, Richmond, Collingwood) and Outer-Urban (Dandenong, Frankston) (Horyniak et al. 2013). An additional 69 participants—members of another cohort known as Networks II—were rolled into the study in 2011. Individuals were eligible for the study if they reported being aged between 18 and 30 years old and had injected either heroin or methamphetamine at least six times in the previous six months. Experienced fieldworkers interview participants face-to-face approximately annually, and obtain detailed information on several recent purchases of heroin, methamphetamine, benzodiazepines and other opioids. Further details on survey questions and how they have been prepared for this analysis are provided in Appendix A.

Structure of the report

This report is divided into four chapters that detail the main empirical findings:

- Chapter 1—describes typical characteristics of drug purchases in terms of type of deal, search times, purchase sharing and typical expenditure;
- Chapter 2—describes typical characteristics of drug use in terms of use location, time of day and time between purchasing and use, and explores changes in the frequency of heroin, methamphetamine and other opioid use, as well as overall levels of drug use within the cohort;
- Chapter 3—develops high-frequency price, purity and purity-adjusted price time series for heroin and methamphetamine (powder and crystal) in order to inform economic analysis of trends in drug use and explanations for trends in drug harms; and
- Chapter 4—examines how the drug preferences and drug use behaviours of PWID changed over time, how they varied by geographic location and the extent to which market prices were associated with these changes.

Additional information is presented in two appendices:

- Appendix A—describes the MIX; and
- Appendix B—compares the methods used in the MIX, in which participants' three most recent purchases are reported, with typical study designs used to obtain information on drug purchases. The assumption of typical study designs—that the most recent purchase is representative of more general purchases—is tested by comparing the amount spent and the deal location type of the most recent purchase reported by MIX participants with the details of three or more purchases.

Chapter 1: Illicit drug purchase patterns

1.1 Objectives

To describe typical characteristics of drug purchases in terms of:

1. deal location type (street, mobile or house);
2. search times;
3. purchase sharing; and
4. typical expenditure on a purchase.

1.2 Background

Drug dealing and purchasing are clandestine behaviours in that the people involved seek to limit or avoid exposure to police and other security measures; however, the literature suggests that these behaviours follow recurring patterns (Decker 2005). Knowledge of these patterns can assist police to develop targeted and more effective approaches to policing. For example, knowing the setting of deals (eg street deals, house deals or organised drop-offs) and other characteristics of purchases, such as the time it takes users to buy their drugs, can suggest effective points of intervention. Further, the typical amount spent on each drug provides information on the availability of certain drugs, and can provide information on how market conditions are changing over time. This may serve as an indicator of the outcomes of police operations that are generally poorly understood.

One of the non-monetary costs associated with drug dealing is the risk associated with holding drugs for a period while identifying a buyer. At least since Moore (1973), drug policy researchers have understood that drug users pay at least two types of costs in order to obtain drugs—not only the usual dollar cost but also the cost of the time and inconvenience of locating a supplier. These are often called search-time costs (Rocheleau & Boyum 1994). Indeed, this concept is in no way unique to illegal drugs; it is part and parcel of the proper definition of price in a careful statement of the law of demand. Search costs are sometimes also significant for certain legal goods, which helps explain why internet searching has transformed the shopping experience for certain tangible, not just digital, goods. But illegality makes it difficult for sellers to advertise or to maintain a fixed business address, both of which tend to make search-time costs more prominent in illegal markets than in most conventional markets. Given the high relative expense of drugs in Australia compared with the United States or other international markets (Roddy & Greenwald 2009), analysis of the typical search time reported for each purchase may provide insight into how much of this cost is attributable to risk compensation at the lowest market level (ie dealer selling to user).

Sharing drugs or pooling money to make purchases is an aspect of drug markets that remains largely unstudied and is of particular interest in the Australian context due to the relative expense and high average spending on each purchase, as mentioned above. As we will see in the next chapter, drugs are generally used almost immediately after their acquisition. In this sense, shared purchases may identify a point of peer-oriented harm-reduction interventions—for example, the distribution of Naloxone among PWID to prevent opioid overdose or ensuring adequate coverage of needles and syringes (Lenton et al. 2015)—which may benefit from a greater understanding of purchase-sharing characteristics.

In this chapter, the detailed descriptions of each of the purchases in the MIX are used to give an overview of typical patterns of purchases that occur throughout Melbourne.

1.3 Methods

Responses to questions on the location type, search times, sharing patterns and amount spent on drug purchases across Melbourne were analysed as follows.

1.3.1 Types of purchase locations

All purchases of heroin, methamphetamine, benzodiazepines and other pharmaceutical opioids were pooled across individuals and interview waves for each day between 1 January 2009 and 1 March 2014. A rolling 60-day period was used to determine the percentage of drugs purchased on the street, from a mobile dealer, in a house or from another location type. To distinguish the different markets for each drug type, the percentage of deals occurring in each location type was calculated for each drug by interview wave using all available interviews from April 2008 to March 2014.

To determine the significance of any changes over time and to quantify the differences between drugs, a multinomial logistic regression was undertaken, fitting a linear time trend and including controls for seasonal variation, whether a participant lives in the same local government area (LGA) as that in which the purchase occurred[3] and drug type. To control for repeated measurements, standard errors were clustered on participants. The predicted values and marginal effects of each of the variables are reported, with the reference outcome being heroin purchases, made in a different LGA to residence, in summer and at the start of January 2009.

1.3.2 Search time for purchases

All purchases between April 2008 and March 2014 were pooled by drug type. Histograms of the search times for heroin and methamphetamine (powder and crystal) purchases were generated, along with a table of percentiles describing the distributions. Cumulative distributions were then calculated for the time taken to obtain heroin, methamphetamine (powder and crystal), benzodiazepines and other opioids. To control for repeated measurements and to determine the variation between individuals, participants' median time to obtain each drug was calculated and used to produce cumulative distributions.

Linear regression was used for heroin, powder methamphetamine and crystal methamphetamine to investigate whether search time was related to a linear time trend, purchase size, time of day the drugs were used (12am–5am, 6am–11am, 12pm–5pm, 6pm–11pm), geographic location (Inner West, Central, Outer-Urban), deal location type (street, house, mobile), whether any of the purchase was shared, OST status (on, off), number of times the drug was used in the past week, drug used most in the past month (heroin, methamphetamine, cannabis, other), length of injecting career, age, sex, country of birth (Australia versus other), language (English versus other), accommodation type (owner-occupied, private rental, public housing, other) and income type (none, wage, government allowance, other). Regressions were then rerun for each drug after removing non-significant covariates to determine the size of any correlations. Categorical variables were determined to be non-significant if—1) none of the outcomes had significant coefficients; and 2) a composite Wald test combining all outcomes was non-significant.

1.3.3 Sharing money for purchases

The distributions of the percentage of purchases shared, and with whom they were shared, were calculated for each drug and for all drugs combined by interview wave.

3 A drug purchase is considered local if it occurred in the same council area—defined by the Department of Transport, Planning and Local Infrastructure (2014)—as the one in which the participant currently lives.

Initial observations suggested that sharing was almost all binary, with the most common sharing pattern being 50 percent with one other individual (73% of shared purchases), and consequently a logistic regression was used for each drug type to determine whether the likelihood of sharing a purchase was related to interview wave, sex, income, language spoken, recruitment site, times used in the past week and purchase size.

1.3.4 Amount spent on each purchase

All purchases of heroin, powder methamphetamine and crystal methamphetamine between January 2009 and March 2014 were pooled. After inflating to 2014 dollars using the all groups consumer price index (CPI) (ABS 2014), the average amount spent per purchase and 95 percent confidence intervals (based on two standard errors of the mean) were calculated for each four-month period. To avoid distortion from the tail of larger purchases, Winsorised averages were used with an upper limit of $500. Purchases were also disaggregated by location type (house, mobile dealer and street purchases) to compare the average expenditures in each location. Due to the smaller number of benzodiazepine and other opioid observations, spending on these drugs was not considered.

Histograms of the amounts spent on each purchase were then developed and compared by geographic location (Inner West, Central, Outer-Urban), whether a purchase was shared, interview wave and purchase location type (street, mobile dealer, house).

1.4 Results

1.4.1 Purchase location types

Figure 1 shows the location types from which drugs were purchased by participants from all suburbs of Melbourne between January 2009 and March 2014. Of all purchases made in 2009, 46 percent were made in a house, 28 percent in the street and 25 percent from a mobile dealer. Between January 2009 and March 2014, there was a gradual decline in the percentage of street deals, a decline in mobile deals until mid-2013, after which they increased, and an overall increase in the percentage of house deals. There were some oscillations over time in the percentage of house deals that, although not exclusive to one season, may be the result of some underlying seasonal variation (over all of the data from April 2008 to March 2014, street deals accounted for 17% of the purchases made in winter compared with 22% in summer). Of all purchases made in 2013, 59 percent were made in a house, 15 percent in the street and 26 percent from a mobile dealer.

Figure 1 The percentage of drug purchases made in each location type, all reported purchases, January 2009 – March 2014

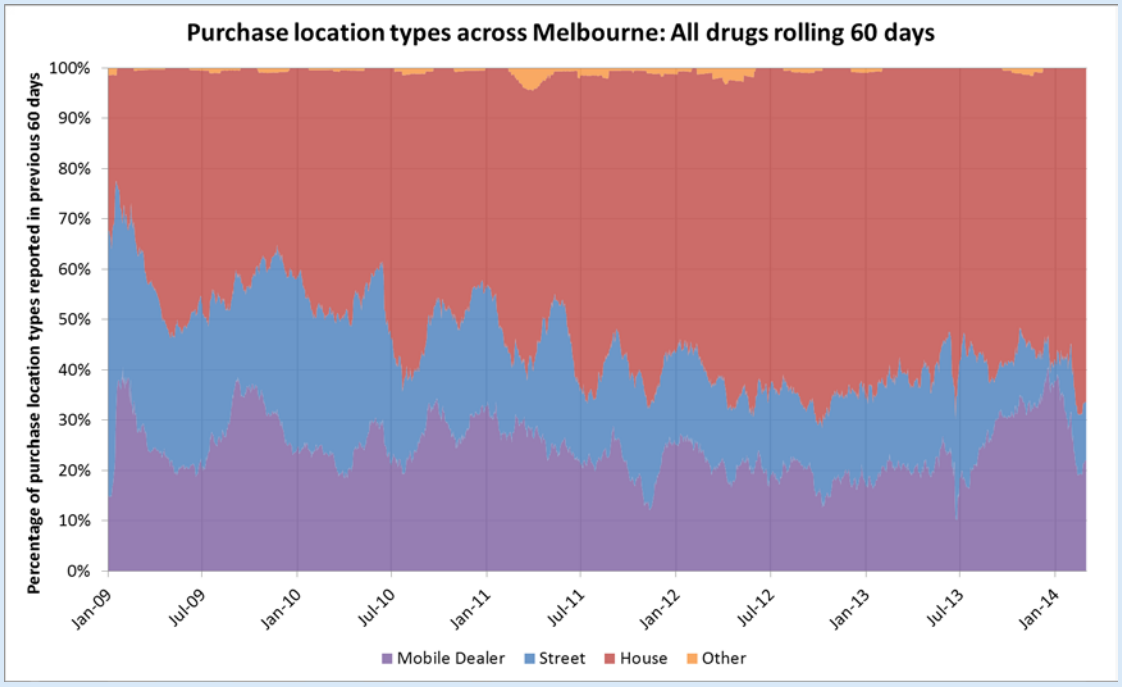


Figure 2 shows the percentage of deals occurring in each location type by interview wave and drug type. Methamphetamine was more likely than the other drugs to be purchased in a house: of all reported purchases between April 2008 and March 2014, houses made up 47 percent, the street 21 percent and mobile dealers 32 percent of heroin purchases; for powder methamphetamine purchases, houses accounted for 74 percent, the street 10 percent and mobile dealers 15 percent; for crystal methamphetamine purchases, houses accounted for 76 percent, the street 6 percent and mobile dealers 17 percent; for benzodiazepine purchases, house accounted for 45 percent, the street 48 percent and mobile dealers 4 percent; and for other opioid purchases, houses accounted for 71 percent, the street 17 percent and mobile dealers 9 percent. Much of the increase evident in house purchases has come from shifts in the heroin market.

Figure 2 Percentage of purchases in each location type by interview wave and drug type, all reported purchases, April 2008 – March 2014

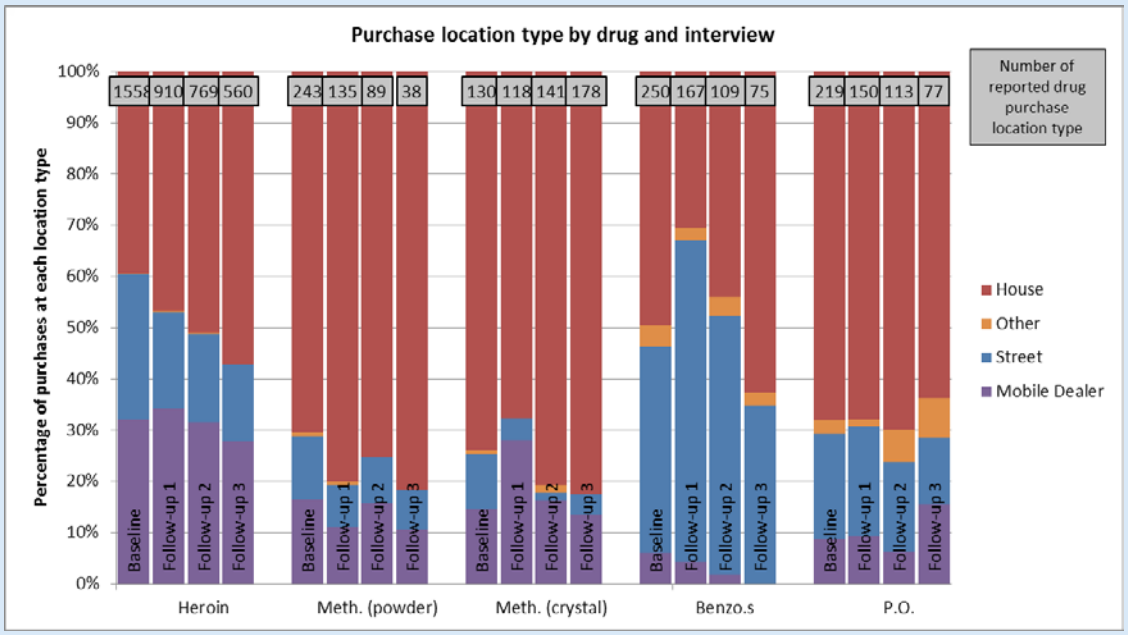


Table 1 presents the estimated model parameters for street, mobile dealer and house drug purchases relative to heroin purchases made in summer, at the start of 2009 and outside the LGA of residence. For example, at the start of 2009 and in summer, 30 percent of heroin purchases made outside the LGA of residence were on the street, 34 percent were from a mobile dealer and 35 percent were in a house. In comparison, for local purchases (of heroin, at the start of 2009 and in summer), 22 percent were made on the street, 36 percent were from a mobile dealer and 42 percent were in a house.

The decline in the percentage of street deals (an adjusted decrease of 3% per year) and increase in the percentage of house deals (+4% per year) were statistically significant. Street deals were more likely for those travelling to buy their drugs (+9%) than for those who lived locally, less likely for methamphetamine than for heroin (–14% powder, –17% crystal) and more likely for benzodiazepines than for heroin (+34%).

Table 1 Regression results for trends in purchase location type, using all reported purchases between April 2008 and March 2014

Purchase location type predicted values and marginal effects (%, 95% confidence interval)	Street (% change, 95%CI)	Mobile Dealer (% change, 95%CI)	House (% change, 95%CI)
Predicted values	30.34 (24.72, 35.96)	34.44 (28.83, 40.05)	35.10 (29.88, 40.31)
Purchase date (per 365 days from 1 Jan 2009)	-2.82** (-4.62, -1.02)	-1.31*** (-3.15, 0.53)	4.14*** (2.79, 5.49)
Lives nearby	-8.52** (-13.75, -3.29)	1.21*** (-3.47, 5.89)	7.26*** (3.34, 11.18)
Heroin	0	0	0
Methamphetamine (powder)	-14.40*** (-20.61, -8.19)	-15.87*** (-21.63, -10.11)	29.91*** (23.58, 36.24)
Methamphetamine (crystal)	-16.97*** (-22.40, -11.54)	-10.43** (-16.66, -4.20)	27.20*** (20.54, 33.86)
Benzodiazepines	34.17*** (28.11, 40.23)	-30.50*** (-35.64, -25.36)	-5.43 (-11.49, 0.63)
Pharmaceutical opioids	0.80 (-6.73, 8.33)	-23.55*** (-29.25, -17.85)	20.09*** (12.82, 27.36)
Summer	0	0	0
Autumn	0.04 (-5.88, 5.96)	-1.90 (-8.21, 4.41)	1.80 (-3.61, 7.21)
Winter	-5.68 (-12.56, 1.20)	2.79 (-3.58, 9.16)	2.85 (-2.54, 8.24)
Spring	3.35 (-2.49, 9.19)	-1.26 (-7.71, 5.19)	-2.09 (-7.56, 3.38)

* $p<0.05$, ** $p<0.01$, *** $p<0.001$, (95% CI)

1.4.2 Search times for purchases

Figure 3 shows that purchase times are generally very short. Less than 10 percent of heroin or methamphetamine (crystal) purchases took more than 60 minutes and less than 10 percent of methamphetamine (powder) purchases took longer than 90 minutes (Table 2).

The tail ends of these distributions were not disproportionately skewed by a few 'slow shoppers'. Rather, it appears that many shoppers occasionally experience longer-than-average search times. Purchases longer than 90 minutes included 115 heroin purchases made by 78 different participants, 40 powder methamphetamine purchases made by 31 different participants and 48 crystal methamphetamine purchases made by 32 different participants. These longer purchases were distributed evenly over time and were not correlated with purchase size.

Figure 3 Distributions of search times for heroin and methamphetamine, all reported purchases, April 2008 – March 2014

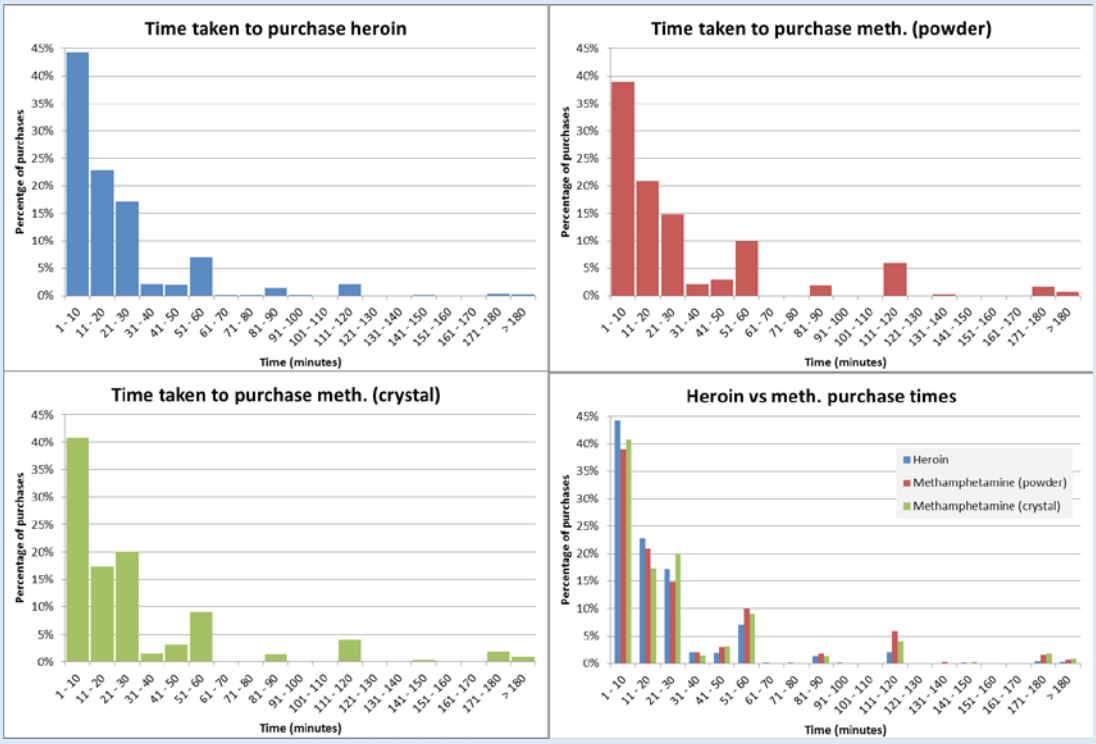
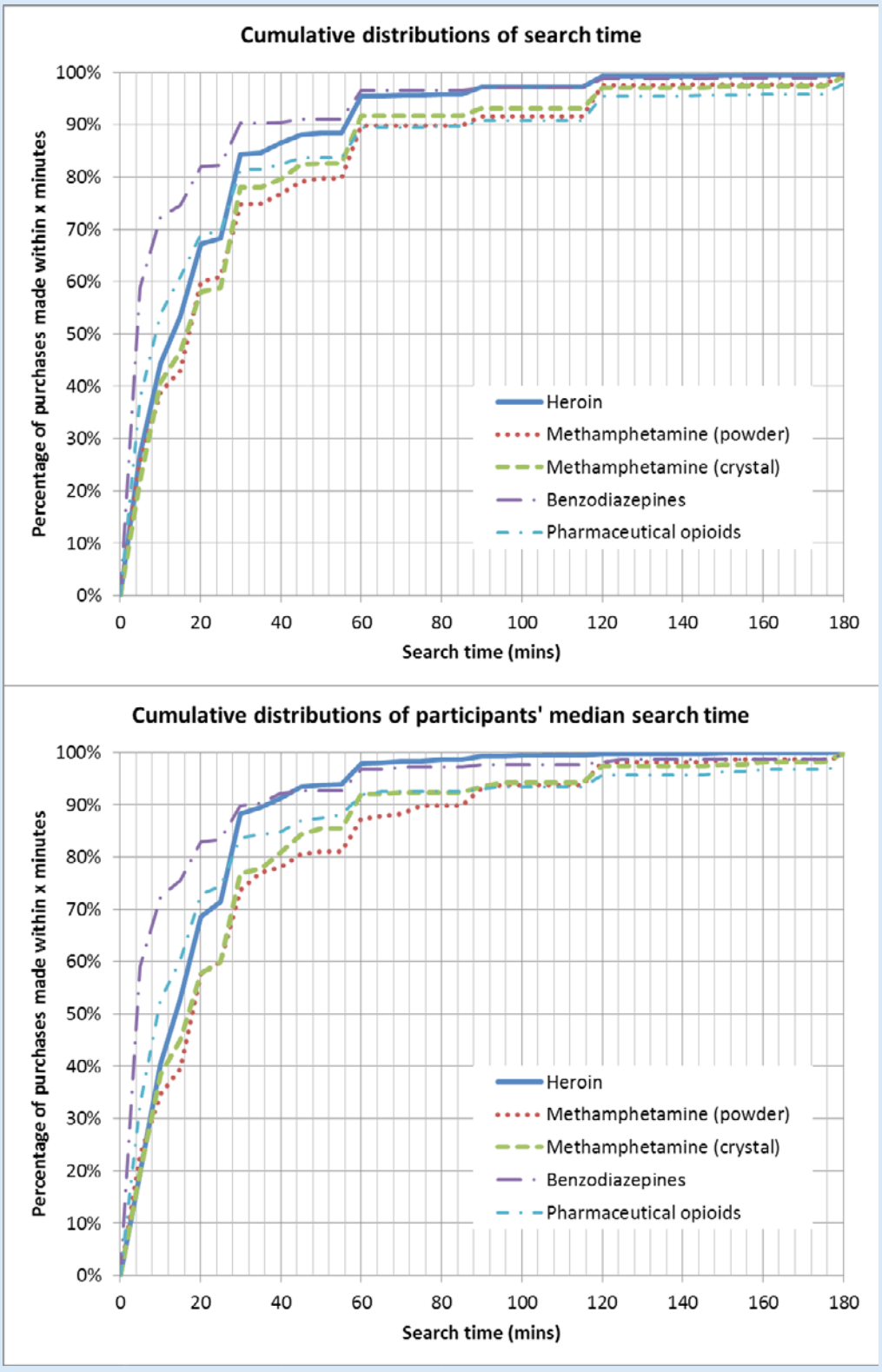


Table 2 Percentiles for heroin and methamphetamine search times, all reported purchases, April 2008 and March 2014

Percentile	Heroin search time (minutes)	Methamphetamine (powder) search time (minutes)	Methamphetamine (crystal) search time (minutes)
5th	2	2	2
10th	5	5	5
25th	5	5	10
50th	15	20	20
75th	30	30	30
90th	60	81	60
95th	60	120	120

Figure 4 shows the cumulative distributions of search times (top) and participants' median search times (bottom) for heroin, methamphetamine (powder and crystal), benzodiazepines and other opioid purchases. Median search time was also very short, with less than 10 percent of participants having median heroin search times greater than 30 minutes and less than 10 percent of participants having median methamphetamine search times greater than 90 minutes.

Figure 4 Cumulative distributions of search time by drug type for all purchases (top) and median search time for individuals (bottom) between April 2008 and March 2014



For heroin, linear regression showed some statistically significant correlations between heroin search times and the adjusted coefficients for:

- time of day—the average search was three minutes faster (95%CI 1–6 minutes, $p<0.01$) for purchases between 6am and 11am than for those between 12pm and 5pm;
- geographic location—on average, Central and Outer-Urban purchases took four minutes longer (95%CI 1–6 minutes, $p<0.01$) and seven minutes longer (95%CI 4–9 minutes, $p<0.001$) respectively than in the Inner West;
- purchase location type—on average, mobile and house deals took seven minutes longer (95%CI 4–10 minutes, $p<0.001$) and five minutes longer (95%CI 3–8 minutes, $p<0.001$) respectively than street deals;
- frequency of heroin use in the past week—on average, participants took one minute less for every additional five times used (95%CI 3–13 times used, $p=0.001$) per week;
- drug used most in the past month—on average, participants who used methamphetamine the most in the past month took nine minutes longer (95%CI 3–16 minutes, $p<0.01$) than those who used heroin the most;
- sex—on average, males took four minutes less (95%CI 2–6 minutes, $p<0.001$) than females; and
- accommodation type—those with accommodation 'other' took, on average, five minutes longer (95%CI 2–8 minutes, $p<0.01$) than those living in owner-occupied premises.

For powder methamphetamine, linear regression showed a statistically significant correlation between search times and the adjusted coefficients for:

- accommodation type—those with accommodation 'other' took, on average, 17 minutes longer (95%CI 5–29 minutes, $p<0.01$) than those living in owner-occupied premises.

For crystal methamphetamine, linear regression showed a statistically significant correlation between search times and the adjusted coefficients for:

- time of day—the average search was 10 minutes faster (95%CI 0.4–20 minutes, $p<0.05$) for purchases between 6am and 11am and 28 minutes slower (95%CI 0.1–36 minutes, $p<0.05$) for purchases between 12am and 5am than for purchases between 12pm and 5pm; and
- geographical location—purchases made in Central took, on average, 18 minutes longer (95%CI 9–28 minutes, $p<0.001$) than purchases made in the Inner West. Note that Outer-Urban deals took, on average, six minutes longer than in the Inner West; however, this was not statistically significant.

Most of these differences were quite small, reflecting the overall short distributions of search times; however, the fact that heroin and crystal methamphetamine were typically faster to obtain in the Inner West is evidence of a larger market concentration in that location.

1.4.3 Characteristics of shared purchases

Figure 5 (top left) shows that about 40 percent of all reported purchases had some percentage shared, and overwhelmingly this was an even 50/50 split. Sharing was more likely to occur with heroin and methamphetamine than with benzodiazepines and other pharmaceutical opioids (top left). This was steady over time and, for any drug type, purchases were most likely to be shared with a partner or friend (bottom left and right).

Given these distributions, sharing was modelled as a dichotomous variable, and the results of logistic models for the likelihood of sharing a purchase are shown for each drug type in Table 3.

For each of the drug types, females were more than twice as likely as males to report sharing purchases, and sharing increased with purchase size. For heroin, sharing also increased with frequency of use, and participants on a government allowance were more likely than those with a salary to share heroin or powder methamphetamine purchases.

Figure 5 Percentage of all purchases that are shared, by interview wave (top left) and drug (top right), and with whom they are shared, by interview wave (bottom left) and drug (bottom right). All reported purchases, April 2008 – March 2014

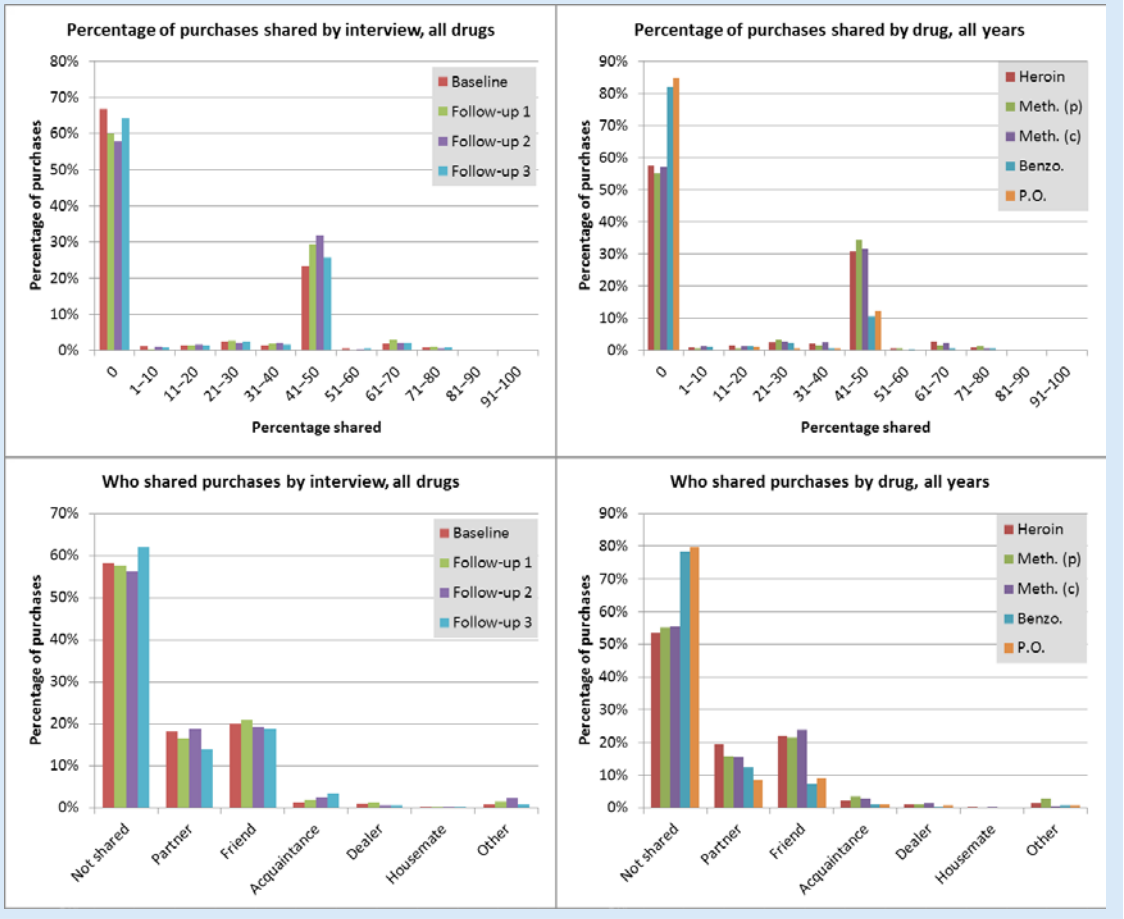


Table 3 Adjusted odds ratios for sharing drug purchases using independent logistic regression models for each drug type. All reported purchases, April 2008 – March 2014

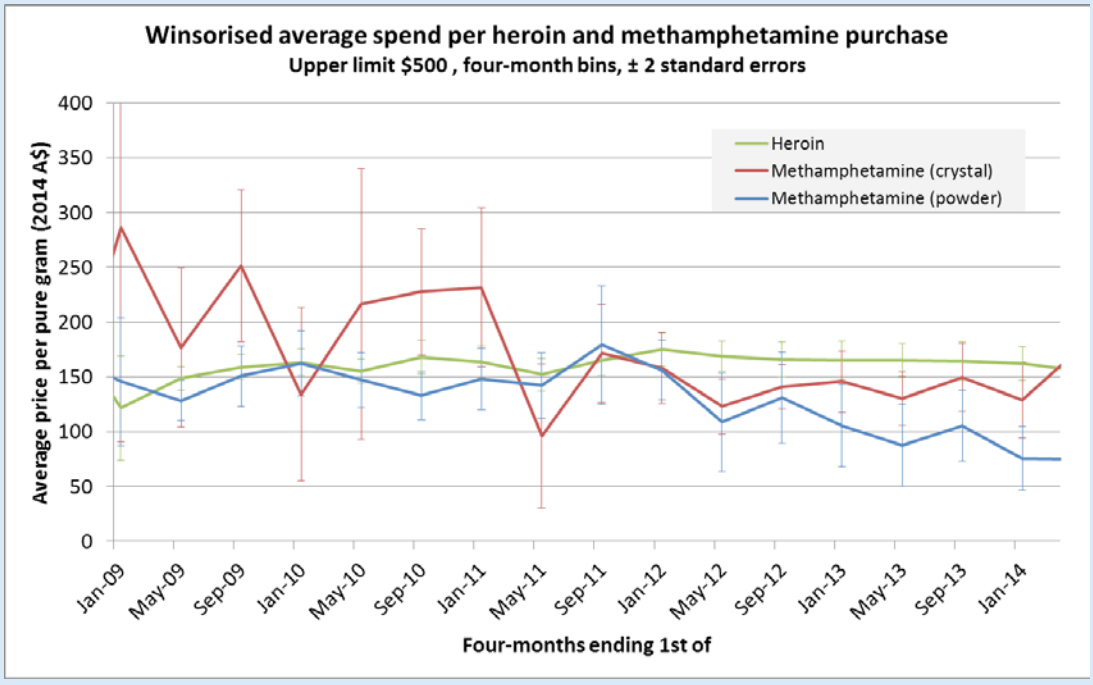
Odds ratios for sharing covariates	Heroin		Methamphetamine (powder)		Methamphetamine (crystal)		Benzodiazepines		Pharmaceutical opioids	
	Adjusted odds ratios	*p* value	Adjusted odds ratios	*p* value	Adjusted odds ratios	*p* value	Adjusted odds ratios	*p* value	Adjusted odds ratios	*p* value
Interview wave versus baseline										
Follow-up 1	1.065	0.545	1.801	0.055	1.069	0.835	0.715	0.228	0.529	<0.05
Follow-up 2	0.955	0.661	3.927	<0.001	0.936	0.833	0.503	<0.05	0.566	0.088
Follow-up 3	0.702	<0.01	0.623	0.376	0.69	0.21	0.728	0.37	0.406	<0.05
Sex versus female										
Male	0.470	<0.001	0.422	<0.01	0.334	<0.001	0.453	<0.001	0.423	<0.001
Main income source versus wage/salary										
Govt allowance	1.277	<0.05	3.677	<0.05	1.35	0.355	0.747	0.57	1.976	0.151
Other	0.912	0.631	5.944	<0.05	0.319	<0.05	0.609	0.459	2.181	0.435
Speaks language other than English versus no										
Yes	0.833	0.102	0.408	0.296	1.004	0.989	0.784	0.589	0.573	0.493
Recruitment site versus Inner West										
Central	1.159	0.126	1.487	0.295	0.621	0.076	0.619	0.172	0.345	<0.05
Outer-Urban	1.276	<0.05	1.017	0.957	0.465	<0.01	1.015	0.956	0.646	0.133
Times used in the past week versus none										
<7	1.665	<0.001	1.197	0.491	1.323	0.32	1.291	0.454	0.305	<0.05
7–13	1.977	<0.001	0.398	0.317	1.49	0.193	0.738	0.465	1.009	0.981
>=14	1.964	<0.001	0.525	0.489	1.073	0.801	0.702	0.436	0.734	0.315
Size of purchase versus (0,0.1] g										
(0.1, 0.5] g	2.486	<0.001	3.999	0.094	2.550	<0.001	3.196	<0.001	1.596	0.103
(0.5, 1] g	4.165	<0.001	9.553	0.063	3.795	0.176	21.083	<0.001	1.381	0.555
(1, 10] g	5.602	<0.001	9.586	<0.05	4.575	<0.05	3.202	0.051	1.126	0.848
Constant	0.232	<0.001	0.051	<0.01	0.883	0.791	0.593	0.403	0.572	0.363
R-squared	0.065		0.105		0.096		0.104		0.083	
N	2932		325		457		491		468	

1.4.4 Distributions of the amount spent on each purchase

Figure 6 shows the average amount spent on each heroin and methamphetamine purchase between 2009 and 2014. These values do not control for purchase size or purity, and so should not be interpreted as a 'market price' for each drug. They represent the typical size, in terms of expenditure, of heroin and methamphetamine purchases. Purchase size and purity will be controlled for in Chapter 3 to calculate typical prices per unit as an estimate of market prices.

The average amount spent on each heroin purchase increased from approximately $121 (95%CI $74–169) in January 2009 to $175 ($160–190) in January 2012, before steadily declining to $162 ($147–178) by January 2014. The average amount spent on each powder methamphetamine purchase fluctuated at approximately $150 between 2009 and 2012, before decreasing to $76 (95%CI $46–105) in January 2014. The average amount spent on each crystal methamphetamine purchase decreased from $286 (95%CI $91–482) at the start of 2009 before remaining stable at approximately $140 from mid-2012 onwards ($129 [$94–163] in January 2014).

Figure 6 Winsorised average spends using an upper limit of $500a for heroin and methamphetamine purchases, for each four-month period between January 2009 and March 2014



[a] Purchases greater than $500 are included in the average as $500 to avoid distortion from the tail

Figure 7 indicates that heroin and methamphetamine are typically purchased in multiples of $50, and the most commonly purchased amount of each is $100–124.

Figure 7 Distribution of the amount spent on each heroin and methamphetamine purchase, April 2008 – March 2014 (2014 A$)

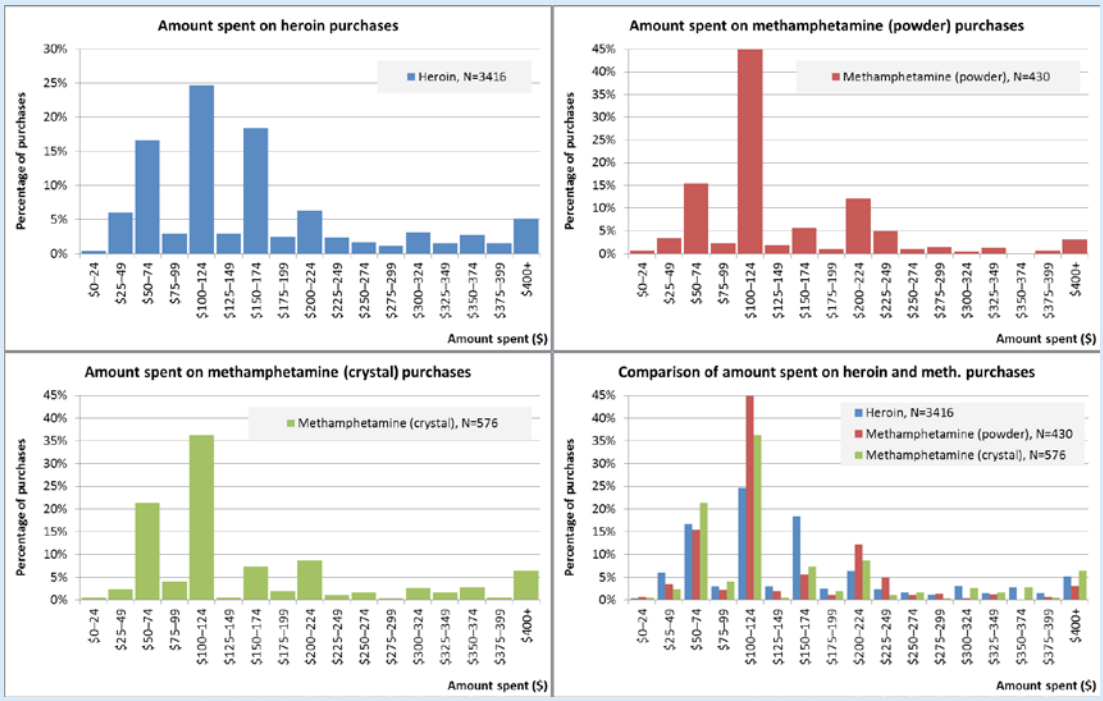


Figure 8 shows that the average spend on street purchases is less than that on house or mobile dealer purchases. Between 2009 and 2012, the average spend per heroin purchase was slightly increasing for mobile dealer purchases, stable for house purchases and slightly declining for street purchases. Although the precision of estimates is less, the average spend per powder methamphetamine purchase was fluctuating but fairly steady until 2012 when all purchase location types started to experience a slight decline, while crystal methamphetamine purchase sizes were decreasing for each purchase location type, before remaining steady from 2012 onwards.

Figure 8 Winsorised average spends using an upper limit of $500 for heroin and methamphetamine purchases, for each four-month period between January 2009 and March 2014, by purchase location type

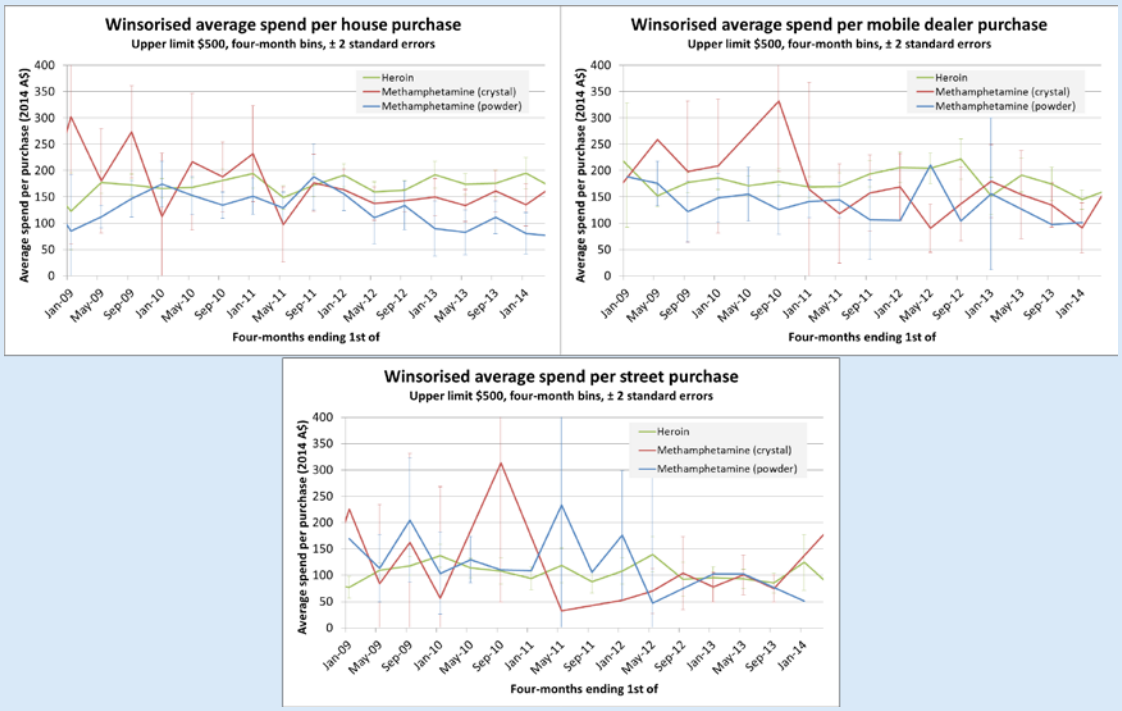


Figure 9 shows the distributions of heroin purchase sizes by geographic location, interview wave, sharing status and purchase location type. Participants from Outer-Urban regions spent slightly more on each purchase (top left), spending distributions have been relatively stable over time (bottom left) and smaller purchases (<$100) were less likely to be shared and more likely to be made on the street (top and bottom right respectively).

Figure 9 Distributions of amount spent on each heroin purchase, by geographic location, sharing status, interview wave and purchase location type. All reported purchases, April 2008 – March 2014 (2014 A$)

Figure 10 shows the distribution of powder methamphetamine purchase sizes by geographic location, interview wave, sharing status and purchase location type. Participants from Outer-Urban regions spent more on each purchase (top left), there was a slight increase in the percentage of purchases that were $200–249 (bottom left), smaller purchases were less likely to be shared (top right) and mobile dealers were used for larger purchases (bottom right).

Figure 10 Distributions of amount spent on each powder methamphetamine purchase, by geographic location, sharing status, interview wave and purchase location type. All reported purchases, April 2008 – March 2014 (2014 A$)

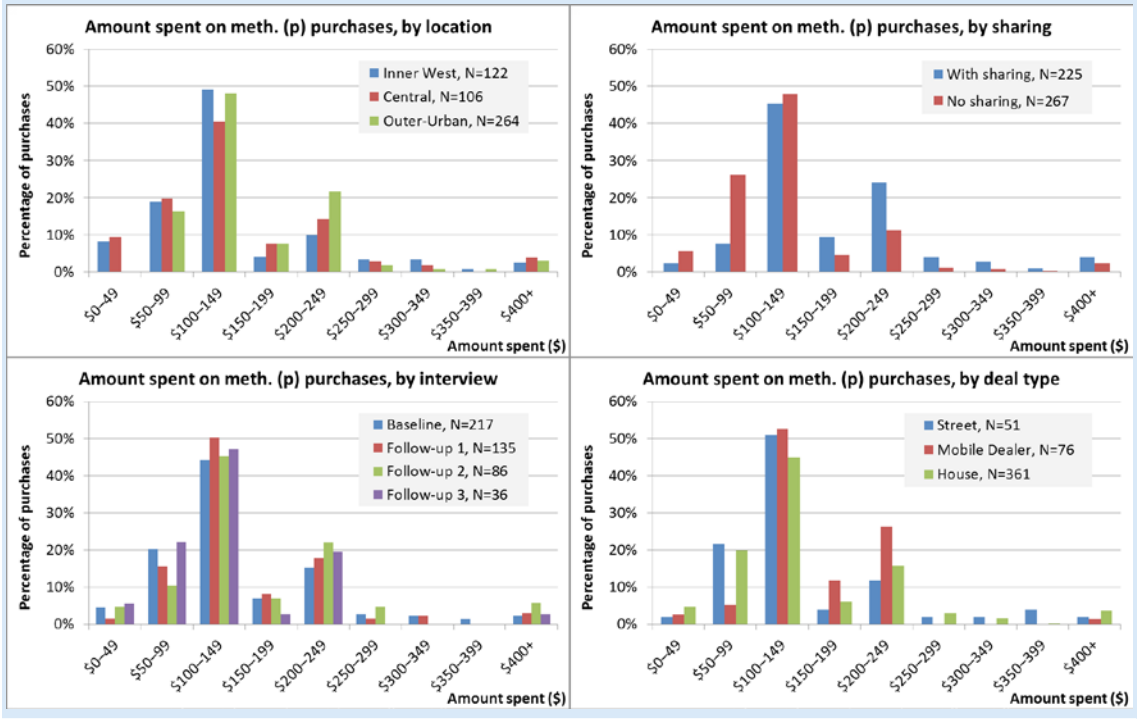
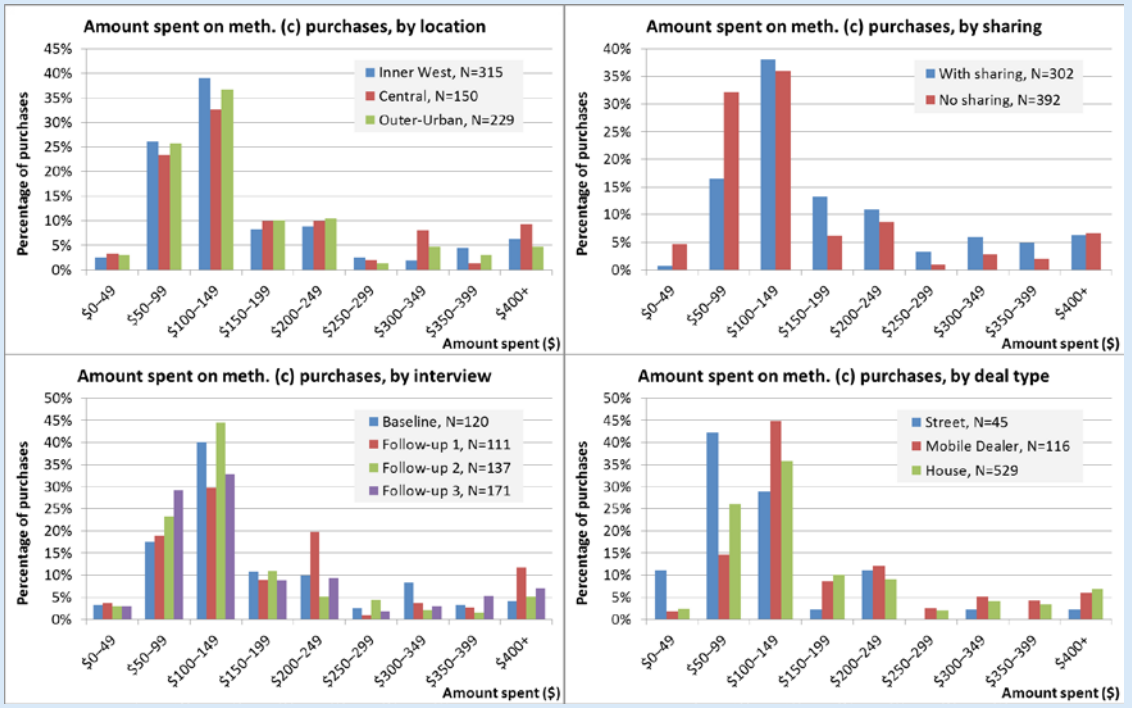


Figure 11 shows the distribution of crystal methamphetamine purchase sizes by geographic location, interview wave, sharing status and purchase location type. Participants from Central spent more on each purchase (top left), there was an increase over time in small purchases (bottom left) consistent with the decrease in the median spend observed in Figure 6, and smaller purchases were less likely to be shared and more likely to be made on the street (top and bottom right respectively).

Figure 11 Distributions of amount spent on each crystal methamphetamine purchase, by geographic location, sharing status, interview wave and purchase location type. All reported purchases, April 2008 – March 2014 (2014 A$)



Discussion

Compared with global drug markets, here the typical expenditure on each heroin or methamphetamine purchase of $100 or more is remarkably high (in the United States the median is approximately $25 for heroin) (Roddy & Greenwald 2009). In addition, the short search times observed suggest that time and inconvenience are modest relative to the monetary cost of a transaction; for example, as 75 percent of all heroin and methamphetamine purchases are made within 30 minutes, any plausible opportunity cost of time multiplied by 30 minutes is much less than the average dollar value of each purchase.

This disparity between the high average spend for each drug purchase in Victoria compared with international markets should be considered in the context of frequent purchase sharing. Sharing or 'pooling money' for purchases effectively reduces the individual spend on each purchase and, although data are limited, having approximately 40 percent of purchases shared is thought to be a unique market characteristic that is much more common than other global studies would suggest (Colón et al. 2001). Further, the government benefit system in which fortnightly payments are made on the basis of when the initial application for payment is requested, rather than having a single 'payday' (as is the case in the United States or Canada), may facilitate, among close friends and partners, an easy system of alternating who pays for drugs. Unfortunately, we are unable to distinguish between pooling money for a purchase and gifting part of a purchase to a partner or friend.

The characteristics of sharing appear logical given the widely documented market discounts that are available when purchasing larger quantities of drugs (Caulkins 2007). If easy to obtain, discounts would encourage individuals to pool their money and make larger purchases, resulting in more sharing as purchase size increases. Further, as drugs are apparently relatively expensive in the Melbourne market, those on a government allowance rather than a wage and those who use more frequently may have further incentive to pool their money and obtain better deals. The fact that purchase time does not increase with purchase size

indicates that finding someone with whom to pool may be even more time-consuming than finding better, discounted deals.

An important feature common to both heroin and methamphetamine purchases was that street deals tended to be smaller than both house and mobile deals. Moreover, Figure 8 indicates that the observed initial overall increase in average spend per heroin purchase was the result of both the increasing expenditure per mobile dealer purchase and the market transition away from street purchases, and that the observed overall decreases in average spend per methamphetamine purchase were the result of decreasing expenditure across all deal types. Due to the low proportion of street methamphetamine purchases, the market transition away from street purchases appears to have had little effect on changes to the average spend.

The inequality between the size of street and other types of purchases is one example of how survey sample recruitment strategy might strongly influence estimates of average purchase size. For example, if a researcher gathered a group of street buyers to estimate average purchase size, but then multiplied by a frequency of purchase that reflected all buyers and not just street buyers, a distorted perception of total spending might result.

Key findings

Types of deals:

- most drug purchases occurred in houses. This became increasingly so over time, with fewer reports of drugs being purchased on the street:
  - of all purchases reported in 2009, 46 percent were made in a house, 28 percent in the street and 25 percent from a mobile dealer; and
  - of all purchases reported in 2013, 59 percent were made in a house , 15 percent in the street and 26 percent from a mobile dealer.
- methamphetamine was more likely than heroin to be purchased in houses (between April 2008 and March 2014, 74% of powder methamphetamine purchases and 76% of crystal methamphetamine purchases were made in houses, compared with 47% of heroin purchases); and
- street deals were less likely in winter (accounting for 17% of all purchases in winter compared with 22% in summer).

Time taken to obtain drugs:

- the time taken to obtain drugs was typically short, with a median of 15 minutes (IQR 5–30 minutes);
- fewer than 10 percent of participants had median heroin search times of more than 30 minutes (median 15 minutes, IQR 10–30 minutes);
- fewer than 10 percent of participants had median methamphetamine search times greater than 90 minutes (powder: median 20 minutes, IQR 5–32 minutes; crystal: median 20 minutes, IQR 10–30 minutes); and
- search time for heroin and methamphetamine was slightly longer in Central and Outer-Urban regions than in the Inner West.

Purchase sharing/pooling money to buy drugs:

- about 40 percent of all reported purchases have some percentage shared—typically 50/50—with a partner or friend; and
- sharing is more likely to occur among females, as purchase size increases, as frequency of use increases and for participants on a government allowance rather than a salary.

Amount being spent on purchases:[4]

- the average amount spent on each heroin purchase increased from approximately $120 at the start of 2009 to approximately $175 at the start of 2012, before steadily declining to approximately $160 by the start of 2014;
- the average amount spent on each powder methamphetamine purchase fluctuated around $150 between 2009 and 2012, before decreasing to approximately $75 by January 2014;
- the average amount spent on each crystal methamphetamine purchase decreased from more than $250 at the start of 2009 to approximately $140 in mid-2012, where it remained until the start of 2014;
- the majority of heroin or methamphetamine purchases of less than $100 were made on the street and not shared;
- the initial increase in average spending per heroin purchase stemmed from two factors—1) more being spent per purchase from a mobile dealer; and 2) street purchases becoming both smaller and less common; and
- trends observed in average methamphetamine expenditure were consistent across all purchase types for both powder and crystal forms. Due to the low percentage of street methamphetamine purchases, the market transition away from street purchases had little effect on changes to the average spending.

Implications for policy and practice:

- better understanding of deals occurring in homes is required, as they represent the largest market component in terms of percentage and size of deals;
- the shift to more clandestine dealing may have produced benefits in terms of public amenity in drug-market areas;
- short search times imply that even if enforcement were able to double or triple search times, the increased inconvenience to dealers would be minor relative to the amounts of money spent on a typical purchase; and
- the high proportion of shared purchases may present an opportunity for peer-oriented harm-reduction interventions.

4 The values below represent amounts spent per purchase in 2014 Australian dollars (not controlled for purchase size or purity). Averages refer to Winsorised means with an upper limit of $500.

Chapter 2: Illicit drug use patterns

2.1 Objectives

To describe typical characteristics of drug use in terms of:

1. use location type (street, car, public toilet or house);

2. time of day;

3. time between purchasing and using; and

4. frequency of drug use.

2.2 Background

As with drug purchases, knowledge of typical patterns of drug use and differences by area is important in terms of prevention and intervention initiatives (Dietze, Jolley & Cvetkovski 2003). In particular, knowledge of the time of day when and location type (street, house, car, public toilet) where drugs are most likely to be used can inform when and where interventions may be best allocated (Decker 2005). In particular, the scenario of people travelling to purchase drugs in street-based markets offers distinct challenges: if they use the purchase straight away, public amenity can be compromised; however, travelling after purchasing drugs can result in other risks (eg using in very hidden locations raises the risk for overdose mortality) (Dovey, Fitzgerald & Choi 2001; Fitzgerald et al. 2004). One method for measuring how this relationship typically plays out is by analysing the time between purchasing and first using a drug.

2.3 Methods

MIX includes questions on the location types where drugs are used, the time of day they are used and the length of time between purchasing and using ('first use' of a given purchase),[5] as well as the frequency of drug use. These variables were analysed as follows.

2.3.1 Types of use locations

All purchases of heroin, methamphetamine, benzodiazepines and other pharmaceutical opioids were pooled across individuals and interview waves for each day between 1 January 2009 and 1 March 2014. A rolling 60-day period was used to determine the percentage of drugs used in each location type, categorised as streets, cars, public toilets, houses or other locations as shown in Table 4. To determine how this differs by drug type, the percentage being used in each location type was calculated for each drug by interview wave.

Table 4 Allocation of use location types from interview responses

Grouped responses	Responses
Street	Street, park
Car	Car
Public toilet	Public toilet
House	House, friend's house, other person's home
Other	Disused building, stairwell, other

5 For each purchase, participants were asked 'how soon after you purchased the drug did you first use it?'.

To establish whether any changes in location type over time were significant and to quantify the differences in location type patterns between drugs, a multinomial logistic regression was undertaken with location type as the outcome of interest, fitting a linear time trend and including controls for seasonal variation, whether a participant reported living in the same LGA ('lives nearby') as the one in which the purchase occurred and drug type. To control for repeated measurements, standard errors were clustered on participants. The predicted values and marginal effects of each of the variables are reported, with the reference outcome being heroin use, in a different LGA to residence, in summer and at the start of January 2009.

2.3.2 Time of day purchases are used

For each drug type and hour of the day, the total number of purchases reported as being 'first used' at this time were counted across all interviews and used to generate distributions for the time of day purchases of each drug were first used. As heroin had the most observations, this was broken down further for heroin purchases by—1) use location type (street, car, public toilet, house); 2) geographic location (Inner West, Central, Outer-Urban); and 3) OST status (on, off)—for the purposes of descriptive comparison.

2.3.3 Time between purchasing and using

Histograms of the time to first use heroin and methamphetamine (powder and crystal) were generated from pooled purchases for each drug type. Cumulative distributions were then produced for the time to first use heroin, methamphetamine (powder and crystal), benzodiazepines and other opioids. As heroin had the most observations, cumulative distributions of time to first use heroin purchases were compared for purchases according to different use location types: streets, cars, public toilets and houses.

Linear regression, in which time to first use heroin, powder methamphetamine and crystal methamphetamine were used as outcome variables, was undertaken to investigate whether search time was related to a linear time trend, purchase size, search time for the purchase, time of day the drugs were used (12am–5am, 6am–11am, 12pm–5pm, 6pm–11pm), geographic location (Inner West, Central, Outer-Urban), deal location type (street, house, mobile), use location type (street, car, public toilet, house), whether any of the purchase was shared, OST status (on, off), number of times the drug was used in the past week, drug used most in the past month (heroin, methamphetamine, cannabis, other), length of injecting career, age, sex, country of birth (Australia versus other), language (English versus other), accommodation type (owner-occupied, private rental, public housing, other) and income type (none, wage, government allowance, other). Regressions were then rerun for each drug after removing non-significant covariates to determine the size of any correlations. Categorical variables were determined to be non-significant if—1) none of the outcomes had significant coefficients; and 2) a composite Wald test combining all outcomes was non-significant.

2.3.4 Frequency of drug use

MIX participants are asked about their recent injection frequency for each recently used drug. Reports from fieldworkers indicate that close to 100 percent of heroin, methamphetamine and opioid use by the cohort is intravenous, so this measure is the most accurate measure of use frequency available from the study.

Changes in reported frequency were examined for heroin, methamphetamine (powder and crystal) and other opioids. The number of injections per week reported for each drug was categorised as either zero, one–two times, three–seven times, eight–14 times or 15 or more times per week for each drug type. For each interview wave and drug type, the percentage of participants who reported injecting at each categorised frequency was calculated. This was repeated considering only responses where use in the past week was reported.

To measure changes to participants' overall frequency of drug use, for each interview a variable 'total injections in the past week' was created by summing responses to the number of injections in the past week of each of the drugs: heroin, methadone, buprenorphine, Suboxone, morphine, oxycodone, other opiates,

powder methamphetamine, base methamphetamine, crystal methamphetamine, prescription stimulants, cocaine, hallucinogens, ecstasy, benzodiazepines, antipsychotics, antidepressants and other drugs. Interviews between January 2009 and December 2013 were pooled into six-month periods, and for each period the mean 'total injections in the past week' was calculated and plotted over time.

For each interview wave, distributions of the new variable 'total injections in the past week' were generated. As a measure of the right-skew of each distribution, the total injections variable was summed over participants for each interview wave, and the percentage of total reported injections attributable to the most frequently injecting 20 percent of the cohort was determined.

2.4 Results

2.4.1 Use location types

Figure 12 shows the location types in which drugs were reported as being used by participants between January 2009 and March 2014. Of all purchases made in 2009, 43 percent, 27 percent, 10 percent and 15 percent were used in house, street, public toilet and car location types respectively. Over time there was a slight decline in the percentage of purchases used on the street, with a corresponding increase in use within houses. As with deal location types, there were some oscillations over time that, although not exclusive to one season, may be the result of some underlying seasonal variation (over all the data from April 2008 to March 2014, use on the street accounted for 14% of location types reported in winter compared with 22% in summer). Of all purchases made in 2013, 58 percent, 13 percent, 11 percent and 15 percent were used in house, street, public toilet and car location types respectively.

Figure 12 The percentage of drugs being used in each location type, all reported purchases, January 2009 – March 2014

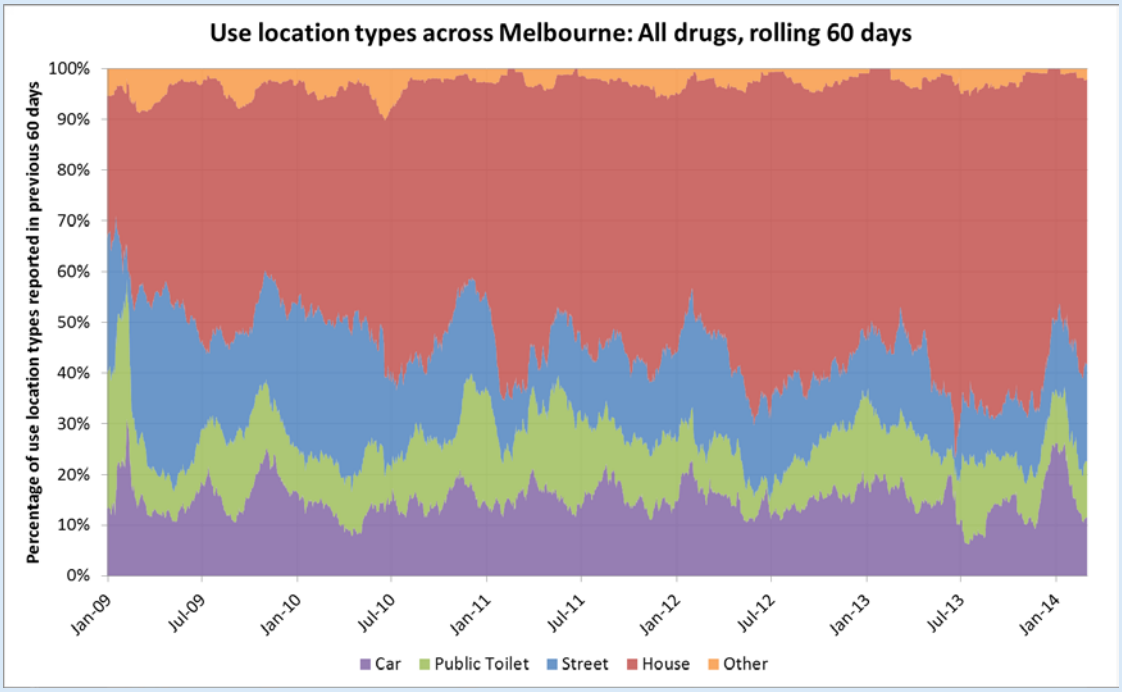


Figure 13 shows the percentage of purchases reported as being used in each location type by interview wave and drug type. Methamphetamine was the drug most likely to be used in houses: of all reported purchases between April 2008 and March 2014, 46 percent of heroin use was in houses, 13 percent in public toilets, 20 percent in cars and 18 percent in the street; 68 percent of powder methamphetamine use was in houses, 8 percent in public toilets, 9 percent in cars and 10 percent in the street; 69 percent of crystal methamphetamine use was in houses, 8 percent in public toilets, 12 percent in cars and 7 percent in the street; 34 percent of benzodiazepine use was in houses, 1 percent in public toilets, 3 percent in cars and 61 percent in the street; and 65 percent of other opioid use was in houses, 18 percent in public toilets, 3 percent in cars and 11 percent in the street. The decrease over time of use on the street noted previously was primarily due to reductions in heroin and other opioid street use.

Figure 13 Percentage of purchases being used in each location type by interview wave and drug type, all reported purchases, April 2008 – March 2014

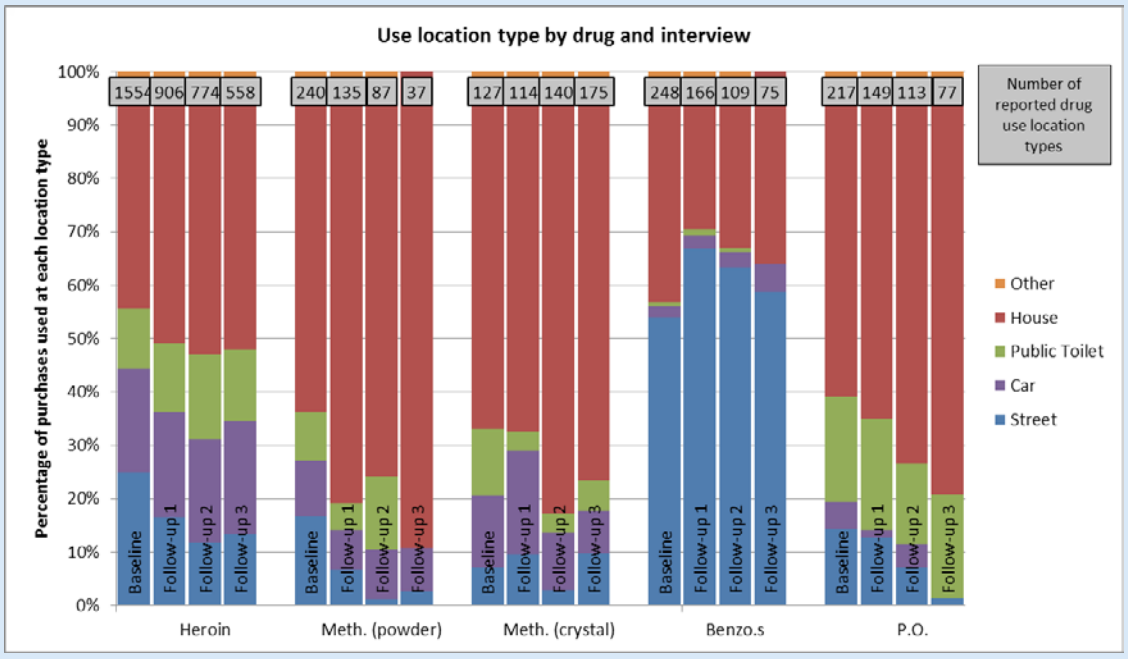


Table 5 presents the estimated model parameters for the use of drugs in streets, cars, public toilets and houses relative to heroin use in summer, at the start of 2009 and when purchased outside the LGA of residence. For example, at the start of 2009 and in summer, 28 percent of heroin, when purchased outside the LGA of residence, was used in streets, 23 percent in cars, 14 percent in public toilets and 29 percent in houses. In comparison, for local purchases (of heroin, at the start of 2009 and in summer), 25 percent was used in streets, 12 percent in cars, 8 percent in public toilets and 52 percent in houses.

The decline in percentage of purchases used on the street (an adjusted decrease in percentage of 4% per year) and the increase in percentage of purchases used in houses (+3% per year) were statistically significant. Public use was less likely for those who lived locally to where the drug was purchased (–3% for street use, –11% for car use and –6% for public toilet use). Use on the street was less likely for methamphetamine and pharmaceutical opioids than for heroin (–10% powder, –12% crystal, –9% opioids) and more likely for benzodiazepines than for heroin (+50%).

Table 5 Regression results for trends in use location type, using all reported purchases between April 2008 and March 2014

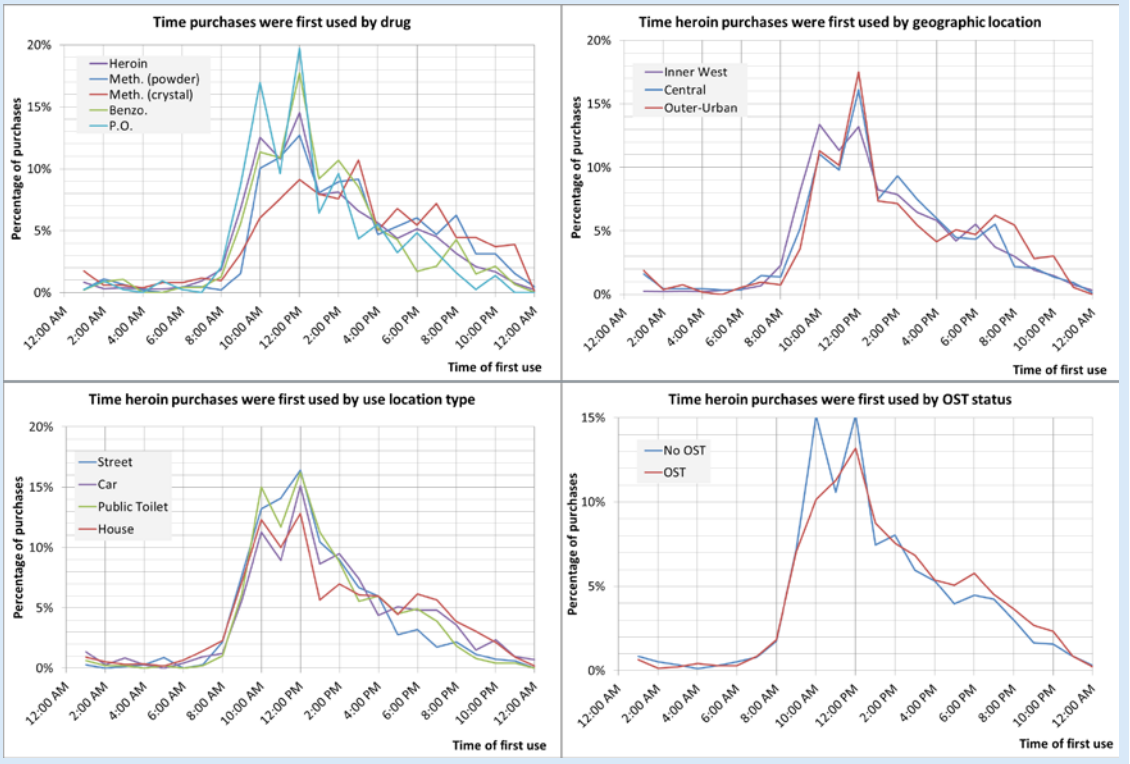
Use location type predicted values and marginal effects (%, 95% confidence interval)	Street (% change, 95%CI)	Car (% change, 95%CI)	Public Toilet (% change, 95%CI)	House (% change, 95%CI)
Predicted values	27.77 (21.95, 33.59)	23.17 (17.89, 28.45)	13.67 (9.76, 17.58)	28.98 (24.10, 33.86)
Purchase date (per 365 days from 1 Jan 2009)	-3.53*** (-5.43, -1.63)	0.82 (-0.61, 2.25)	0.85 (-0.07, 1.77)	2.91*** (1.69, 4.13)
Lives nearby	-2.70 (-8.01, 2.61)	-10.85*** (-16.51, -5.19)	-5.97** (-9.99, -1.95)	23.12*** (19.45, 26.79)
Heroin	0	0	0	0
Methamphetamine (powder)	-10.26** (-16.22, -4.30)	-9.17** (-15.17, -3.17)	-2.47 (-6.84, 1.90)	19.89*** (12.64, 27.14)
Methamphetamine (crystal)	-12.03*** (-18.38, -5.68)	-5.09 (-10.62, 0.44)	-3.63 (-7.61, 0.35)	16.79*** (9.36, 24.22)
Benzodiazepines	49.94*** (44.65, 55.23)	-20.29*** (-25.25, -15.33)	-12.94*** (-16.62, -9.26)	-13.48*** (-18.34, -8.62)
Pharmaceutical opioids	-8.65** (-14.88, -2.42)	-18.06*** (-23.21, -12.91)	12.19** (5.23, 19.15)	11.82** (4.16, 19.48)
Summer	0	0	0	0
Autumn	1.86 (-4.06, 7.78)	-1.61 (-7.90, 4.68)	-0.79 (-5.18, 3.60)	1.20 (-3.95, 6.35)
Winter	-7.22 (-14.88, 0.44)	-0.86 (-7.41, 5.69)	1.89 (-2.05, 5.83)	6.35* (1.45, 11.25)
Spring	-2.42 (-8.99, 4.15)	2.10 (-3.94, 8.14)	3.18 (-0.58, 6.94)	-1.64 (-7.09, 3.81)

* $p<0.05$, ** $p<0.01$, *** $p<0.001$, (95% CI)

2.4.2 Time of day purchases are used

The distributions of participant responses to the time of day heroin, methamphetamine (powder and crystal), benzodiazepines and other opioid drug purchases were first used are shown in Figure 14 (top left panel). Figure 14 also shows the time of day heroin purchases were first used by geographic location (top right panel), use location type (bottom left panel) and whether the participant was on OST (bottom right panel). The time of day that drugs were reported as being used did not vary substantially by drug type, following an asymmetric triangle distribution with a peak around midday that trails off into the evening. For heroin there were also no major variations by use location type, OST status or geographic location, and similar homogeneity was seen for methamphetamine, benzodiazepines and other opioids across these variables.

Figure 14 Time of day drug purchases were first used. Comparison by drug types (top left) and, for heroin purchases, comparisons by geographic location (top right), use location type (bottom left) and OST status (bottom right). All interviews, April 2008 – March 2014



2.4.3 Time between purchasing and using

Figure 15 and Figure 16 (top) show that the time between purchasing and first using each drug was generally short, with more than three-quarters of drug purchases first used within 10 minutes, and less than 10 percent of purchases having more than a 30-minute gap between purchase and first use.

Figure 15 Distributions of time to first use heroin and methamphetamine purchases, April 2008 – March 2014

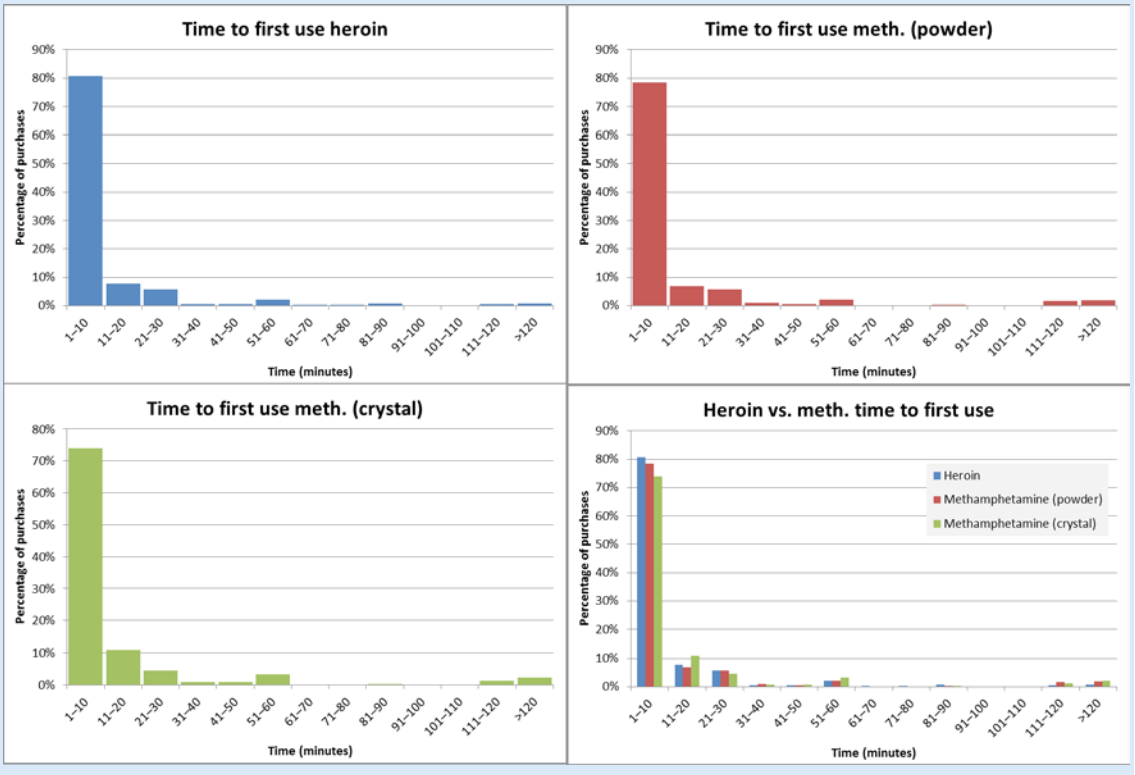
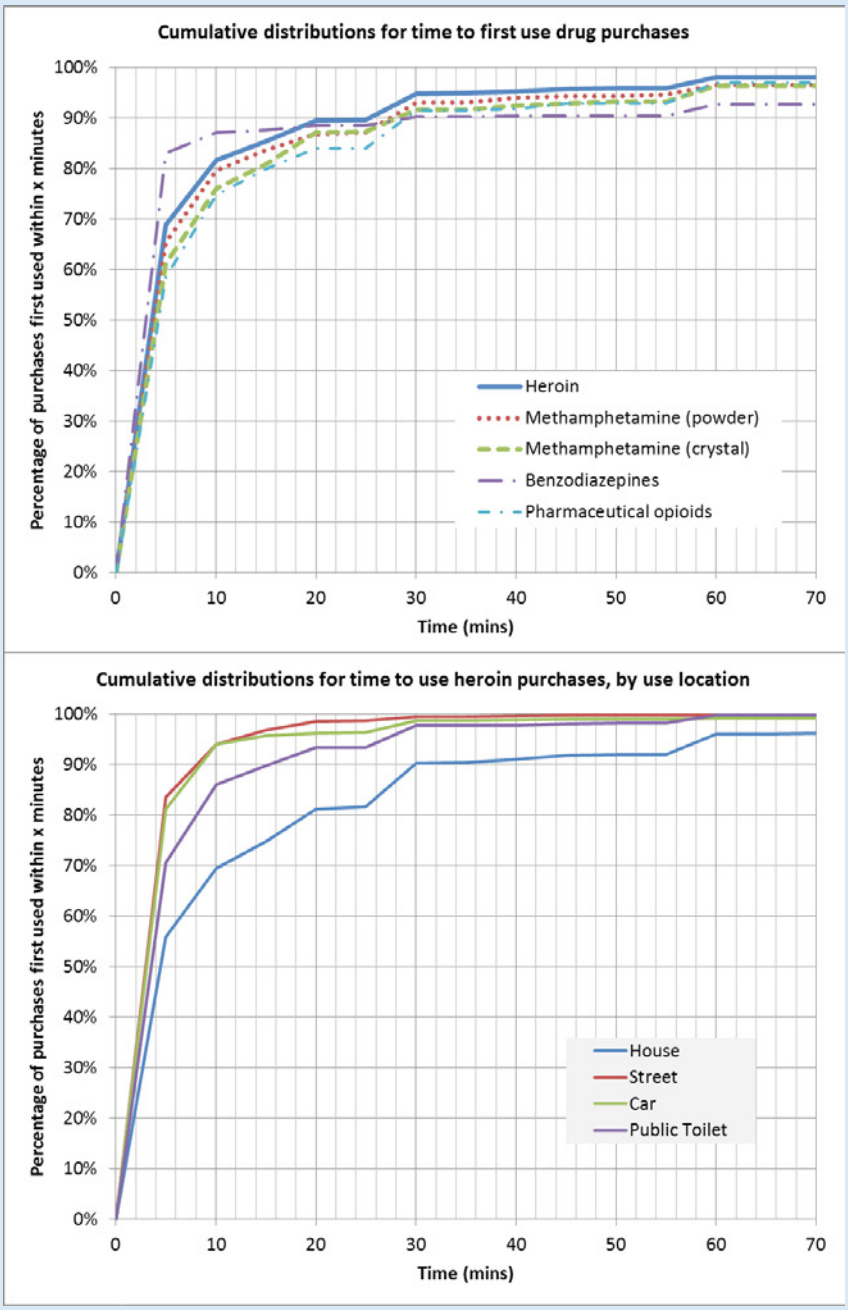


Figure 16 (bottom) shows that, for heroin, if a purchase was used in a house or public toilet, this gap was a bit longer, but still reflects a typical pattern of using purchases at the first opportunity. Similar behaviour is observed for methamphetamine, benzodiazepines and other opioids (not shown).

Figure 16 Cumulative distributions of time to first use purchases by drug (top) and, for heroin purchases only, by use location type (bottom), all reported purchases, April 2008 – March 2014



For heroin, linear regression showed some statistically significant correlations between time to first use and the adjusted coefficients for:

- time—the average time to use increased at a rate of three minutes (95%CI 1–6 minutes, p=0.01) every two years;
- purchase size—on average, time to use increased by three minutes (95%CI 2–4 minutes, p<0.001) for every additional gram;
- search time—the average time to use was a minute longer for every additional 17 minutes (95%CI 9–220 minutes, p<0.05) of search time;
- time of day—the average time to use was seven minutes longer (95%CI 2–12 minutes, p<0.01) for purchases used between 6pm and 11pm than for those between 12pm and 5pm;
- geographic location—the average time to use for Central purchases was 10 minutes less (95%CI 5–14 minutes, p<0.001) than in the Inner West;
- use location type—the average time to use in houses was 10 minutes more (95%CI 5–15 minutes, p<0.001) than on the street;
- drug used most in the past month—the average time to use for participants who used methamphetamine the most in the past month was 22 minutes more (95%CI 10–34 minutes, p<0.001) than those who used heroin the most;
- length of injecting career—the average time to use was two minutes less (95%CI 0.3–3 minutes, p<0.05) for every additional three years of injecting; and
- age—the average time to use was a minute less (95%CI 0.7–3 minutes, p<0.01) for every birthday.

The average time to first use powder and crystal methamphetamine purchases did not change over time, and linear regression did not show any correlation with any of the drug use or demographic variables.

2.4.4 Frequency of drug use

Figure 17 (top panel) shows that among MIX participants there was a transition from powder to crystal methamphetamine: *weekly or more* powder methamphetamine use declined from 17 percent at baseline to 4 percent at follow-up three, while *weekly or more* crystal methamphetamine use increased from 8 percent at baseline to 18 percent at follow-up three. There were also reductions in the (illicit) use of other opioids and of heroin, but approximately 50 percent of the cohort still reported injecting heroin at least weekly at follow-up three.

Figure 17 (bottom panel) shows that among participants reporting use of each drug, frequency of use for heroin, powder methamphetamine and other opioids slightly decreased, while crystal methamphetamine slightly increased.

Figure 17 Categorised weekly injection frequencies across Melbourne, April 2008 – March 2014, for the entire cohort (top) and for participants who report at least one injection in the past week (bottom). For each drug, columns left to right represent baseline to follow-up three percentages

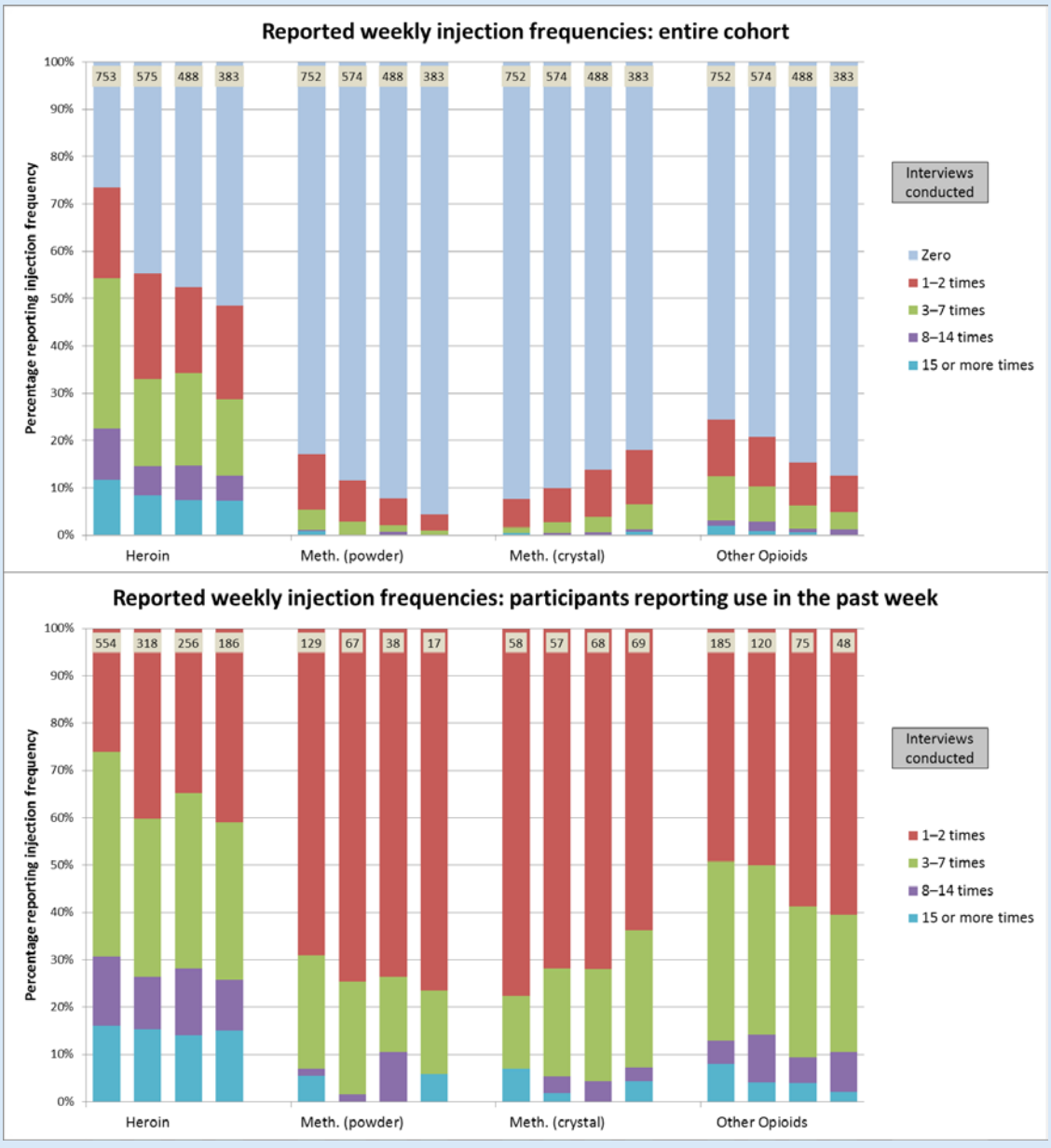


Figure 18 shows that the distribution of total injections per week is right-skewed, and has been shifting towards less use with each interview wave. The top 20 percent most frequent injectors were calculated to account for 39 percent of all reported injections in baseline, 30 percent in follow-up one, 30 percent in follow-up two and 26 percent in follow-up three interview waves.

Figure 18 Distributions of the total injections per week across all drugs, for each interview wave, baseline to follow-up three, all interviews, April 2008 – March 2014

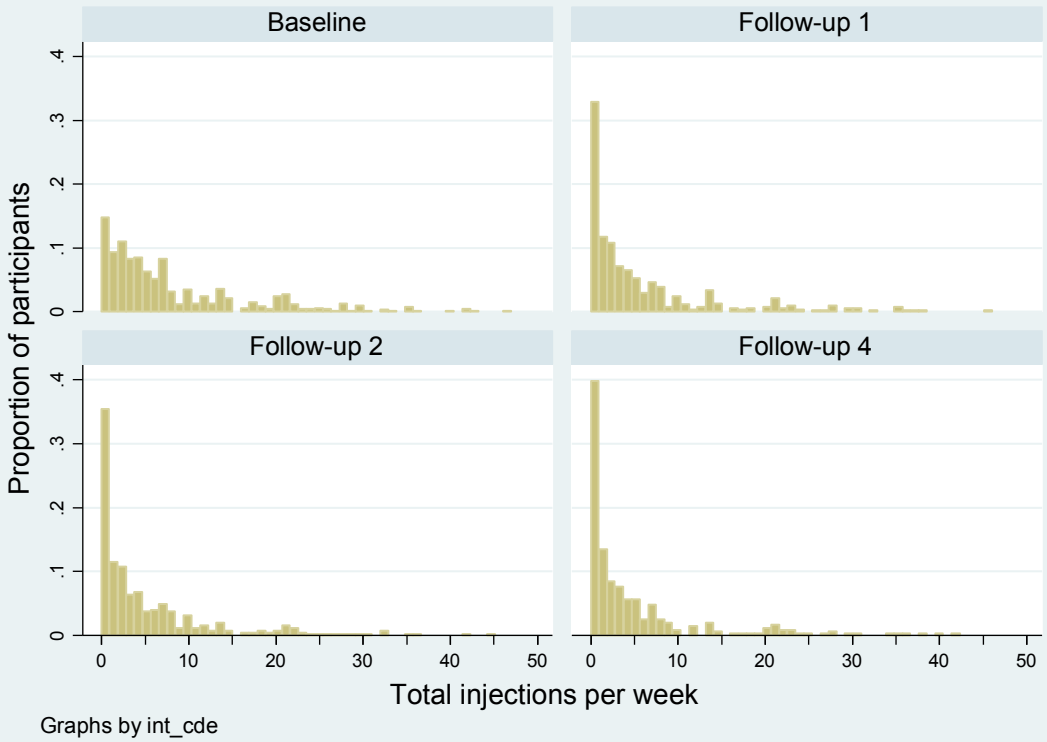
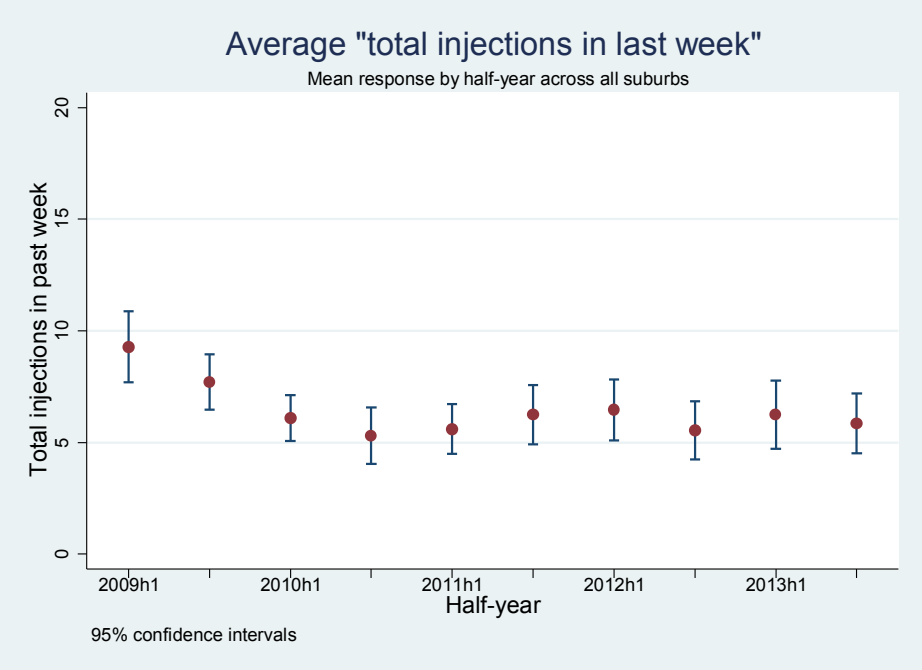


Figure 19 shows that the cohort's overall frequency of use declined between 2009 and mid-2010, before remaining steady through to 2014. Figure 18 shows that this decline was the result of a reduction across all levels of injectors—namely, both frequent and infrequent users starting to inject less. The shift to less frequent injecting can also be seen in Figure 17 (the top panel shows an increase in participants who did not report use, and the bottom panel shows a reduction in frequency among those who reported use), where the most dramatic increase in *no reported use* was between baseline and follow-up interview wave one. This is consistent with the decline between 2009 and mid-2010 in Figure 19.

Figure 19 Average injections per week reported across Melbourne between January 2009 and December 2013



2.5 Discussion

We found distributions of time of day of drug purchases that are largely consistent with published ambulance and hospital data describing peak periods of callouts and admissions for drug overdoses (Lloyd 2013). When considered in relation to the extremely short time between purchasing and using (Figure 15), we can conclude that the time of day distribution shown in Figure 14 provides an equally reasonable estimate for purchase times and peak drug-market activity. This finding is of practical importance for the provision of all services related to the drug market. Further, the short time between purchasing and using explains local communities' concerns about drugs being sold in their neighbourhood, as it implies that drug purchases and drug use occur in close proximity to one another. One further issue is the situation of drugs being purchased and immediately used in a nearby car, creating potential for further harms through road accidents. There are various ways in which these risks might be mitigated; for example, through the provision of supervised injecting facilities.

The measure of overall frequency of use (Figure 19) can be used to overcome limitations of the models in Table 1 and Table 5 that measure changes to purchase and use location types. These logistic models are unable to account for simultaneous reductions or increases in market size. For example, the proportion of drugs that were purchased on the street decreased over time, yet if the total amount of drugs being purchased had increased by a greater amount, this would be evidence that the overall street market had

actually increased in size. The reduction in overall frequency of use observed in Figure 19 shows that this was not the case, and that street activity (both purchasing and using) has been decreasing over time. The reduction in frequency of use, and its relation to street-based market activity, is a positive outcome for social amenity. It may also represent a positive outcome for the MIX cohort more generally, although it is not clear what may have caused such changes, and there are risks to individuals such as overdose that go with use in more private locations (Darke & Zador 1996).

2.6 Key findings

Where drugs are being used:

- most reported drug use occurred in houses. This became increasingly so over time, with fewer reports of drugs being used on the street:
  - of all purchases reported in 2009, 43 percent were used in houses, 27 percent in the street, 15 percent in cars and 10 percent in public toilets; and
  - of all purchases reported in 2013, 58 percent were used in houses, 13 percent in the street, 15 percent in cars and 11 percent in public toilets.
- methamphetamine was more likely than heroin to be used in houses (between April 2008 and March 2014, 68% of powder methamphetamine purchases and 69% of crystal methamphetamine purchases were used in houses, compared with 46% of heroin purchases); and
- use on the street was less likely in winter (accounting for 14% of all use location types in winter compared with 22% in summer).

The time of day drugs are being used:

- the time of day that drugs were used follows an asymmetric triangle distribution, peaking around midday and trailing off into the evening, with heroin, methamphetamine, benzodiazepines and other opioids all most likely to be used between 10am and 2pm;
- distributions of times of use did not vary substantially by drug type, and there was no difference depending on use location type, geographic location or OST status; and
- distributions of times of use were consistent with ambulance and hospital data describing peak periods of callouts and admissions for drug overdoses.

The time between purchasing and using drugs:

- the time between purchasing and first using each drug was generally very short;
- more than three-quarters of drug purchases were first used within 10 minutes, and fewer than 10 percent of purchases had more than a 30-minute gap;
- if a purchase was used in a house, this gap was a bit longer, but still reflects a typical pattern of using purchases at the first opportunity;
- the time of day purchases were used appears to be an excellent proxy for purchase time and peak market activity; and
- short times between purchasing and using help explain local community concerns about drugs being purchased in the neighbourhood, as the location of drug use was highly correlated with the location of drug sales.

Frequency of drug use:

- the frequency of heroin use decreased within the cohort at each interview wave—at baseline, nearly 75 percent of the cohort reported weekly or more frequent heroin use, but that fell to less than 50 percent at follow-up three (approximately three years after baseline data collection);
- total methamphetamine use remained steady; however, there was a transition from the powder to the crystal form. Weekly or more frequent powder methamphetamine use declined from 17 percent of the cohort at baseline to 4 percent at follow-up three, while weekly or more frequent crystal methamphetamine use increased from 8 percent of the cohort at baseline to 18 percent at follow-up three;
- overall drug use declined slightly, with the average number of reported injections (all drugs, combined) in the past week declining from approximately nine per week at the start of 2009 to approximately six per week in mid-2010, before remaining steady up to the start of 2014; and
- this decline and then steady overall use indicate that the percentage declines in street deals and public use reflect changes in the amount of street activity by the cohort across Melbourne.

Implications for policy and practice:

- services related to heroin and methamphetamine dealing and the acute consequences of use are needed most between 10am and 2pm;
- short times between purchasing and using drugs indicate that these activities are occurring in close geographic locations;
- drug use in public places has been declining over time, highlighting the need for innovative education and outreach strategies to minimise the risks of use in private locations;
- the shift from powder to crystal methamphetamine implies a dramatic increase in the purity of the drug used by participants (see next chapter), which can impact on the way in which people present to services (including police), highlighting the need for appropriate skills in managing people who are affected by methamphetamine.

Chapter 3: Price and purity time series

3.1 Objectives

This chapter develops high-frequency price, purity and purity-adjusted price time series for heroin and methamphetamine in Melbourne. We achieve this by examining—1) MIX purchase data alone (price series); 2) Victoria Police Forensic Services Department (VPFSD) drug seizure purity data alone (purity series); and 3) combined MIX data and VPFSD drug seizure purity data (purity-adjusted price) for the period 1 January 2009 to 30 June 2013. These series provide valuable insight into the Melbourne drug market. They offer a possible explanation for the transition from powder to crystal methamphetamine observed within the cohort that was described in the previous chapters. We also suggest that the series could explain some of the increases in methamphetamine-related harms that have been reported recently in Victoria (Heilbronn et al. 2013).

3.2 Background

Epidemiological indicators suggest that there has been an increase in methamphetamine consumption and related harms in Victoria, with methamphetamine-related ambulance attendances, methamphetamine-related treatment service presentations and methamphetamine-related calls to telephone helplines all increasing over the financial years 2010–11 to 2011–12 (Heilbronn et al. 2013). However, frequency of use among the MIX cohort (Chapter 2, Figure 17) shows that increased crystal methamphetamine use has been offset, to a large extent, by declines in powder methamphetamine use. This offsetting corresponds with relative stability or declines in the prevalence of any methamphetamine use observed through household surveys (AIHW 2011), surveys of school students (Victorian Department of Health 2013) and surveys of young people more broadly (Victorian Drug and Alcohol Prevention Council 2010).

To reconcile the apparent inconsistencies of increasing harms and declining or stable frequency of use, further data are required. Previous studies have found associations between heroin purity and heroin harms (Darke 1999), which suggest that a methamphetamine purity analysis may provide this missing insight.

The VPFSD analyses the majority of drug seizures made in the state to determine the size and purity of seizures, among other characteristics. This information is entered onto a database that can be used to generate a high-frequency purity series by drug and drug form (Moore et al. 2005). Combining this information with reports of drug prices from MIX allows the generation of a high-frequency purity-adjusted price series that can be used to explore the markets for drugs consumed by PWID in Melbourne and how they change over time.

This chapter estimates and compares variations in the average unadjusted and purity-adjusted prices paid for methamphetamine and heroin by the MIX cohort in order to provide an economic perspective on the divergent trends in consumption and harm indicators for methamphetamine. It is based largely on a paper that was published in the journal Addiction, before the production of this report (Scott et al. 2015).

3.3 Methods

3.3.1 Heroin and methamphetamine purity series

Since 1998 the majority of Victorian drug seizures of heroin and methamphetamine have been analysed by the VPFSD. The seizures' characteristics are entered into a database managed by the Forensic Drug Branch and each observation includes records of the type of drug, the purity of the sample and an assessment

of the 'form' of the seizure. We obtained an extract on 16 September 2013 covering the period 1 January 2008 to 30 June 2013, and considered only observations for seizures weighing 10 grams to form a dataset comparative to MIX purchase sizes (99.6% of methamphetamine purchases and 99.7% of heroin purchases in MIX are of 10 g or less).

During this period, the VPFSD recorded 3,539 heroin seizures, 1,490 powder methamphetamine seizures and 5,516 crystal methamphetamine seizures of 10 grams or less.[6] Rolling 60-day averages were calculated to approximate trends in the purity of heroin, powder methamphetamine and crystal methamphetamine.

3.3.2 Heroin and methamphetamine price and purity-adjusted series

MIX purchases with a price per gram less than $50 or more than double that of a 'point' reported in the Illicit Drug Reporting System (IDRS) between 2008 and 2012 were removed as outliers (>$1,000 for heroin, >$2,000 for crystal methamphetamine and >$1,000 for powder methamphetamine); reported prices paid were inflated to 2014 dollars using the all groups CPI (ABS 2014); and rolling 60-day averages were calculated to approximate trends in the price per gram of heroin, methamphetamine (powder) and methamphetamine (crystal).

Each valid price per gram observation in MIX was purity-adjusted by dividing by the value of the corresponding purity series on the purchase date (Caulkins, Rajderkar & Vasudev 2010), and rolling 60-day averages were calculated using these purity-adjusted data points. Due to a pilot phase followed by a gap in observations in 2008, price and purity-adjusted price series were developed for the period 2009 to the end of June 2013.

3.4 Results

3.4.1 Prices not adjusted for purity

Figure 21 (left panel) shows the average price per gram (not adjusted for purity) for heroin, powder methamphetamine and crystal methamphetamine between January 2009 and July 2013. During this period, the unadjusted price of heroin decreased from a little less than $400 per gram in 2009 to approximately $300 per gram in mid-2013, mostly due to an increasing CPI; powder methamphetamine was steady at approximately $250 per gram; and crystal methamphetamine increased substantially throughout 2010 from approximately $450 per gram to approximately $800 per gram, where it remained until mid-2013.

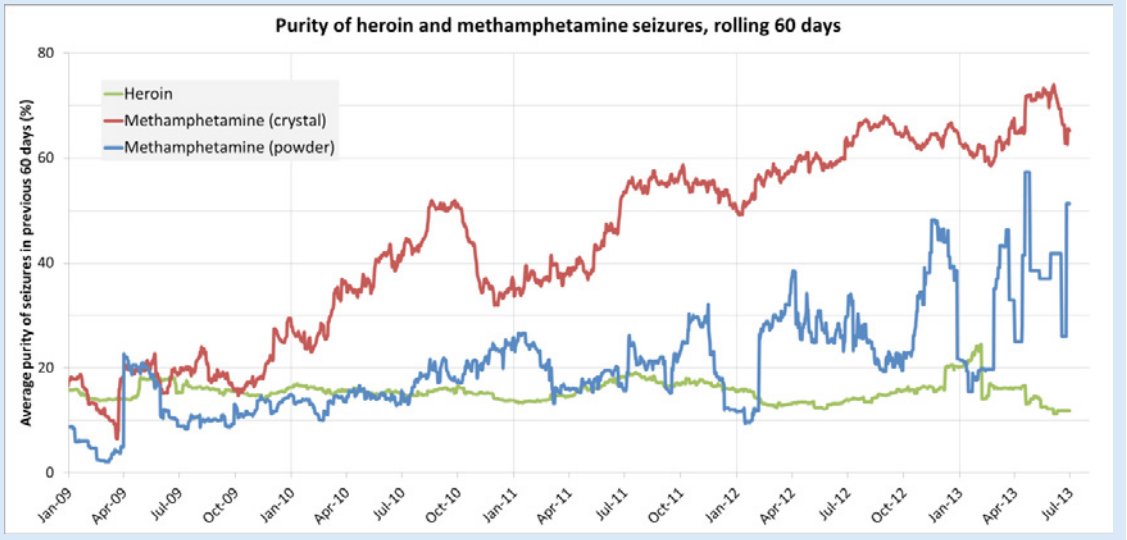
The price gap between the two forms of methamphetamine has grown over time; the average price per gram of crystal methamphetamine has increased from double that of powder methamphetamine (in 2009) to more than three times as much (2011 until mid-2013).

3.4.2 Purity

Figure 20 shows the purity of VPFSD seizures of heroin and methamphetamine between January 2009 and July 2013. During this period, the average purity of heroin remained fairly steady (approximately 15%), with only small decreases in January 2011 and May 2012 and a small increase in July 2011. The average purity of crystal methamphetamine rose from approximately 20 percent to 70 percent, and the average purity of powder methamphetamine rose from approximately 10 percent to 30 percent, with variations increasing due to the smaller number of observations in 2013.

6 A seizure is considered valid if VPFSD chemists record the form of a heroin seizure as powder, and of methamphetamine as either powder or crystal (Scott et al. 2015).

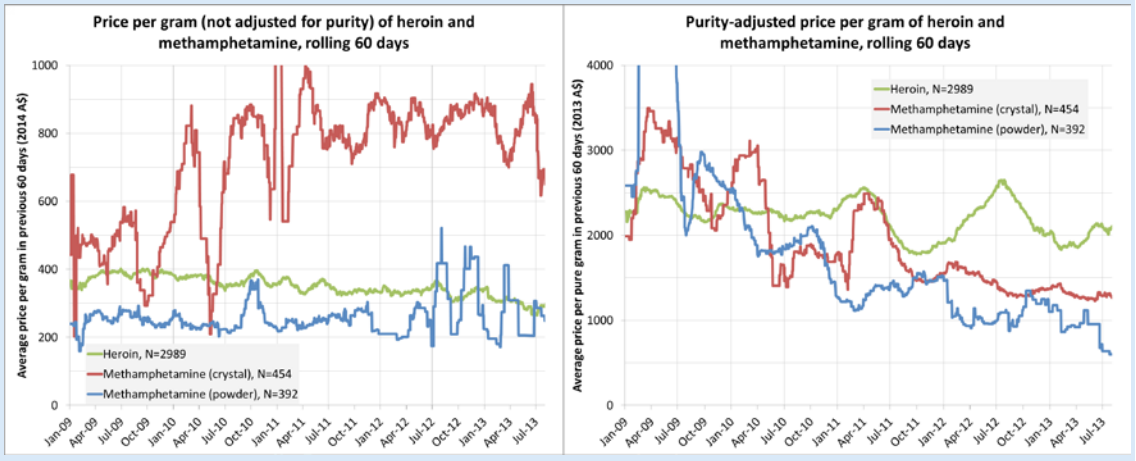
Figure 20 Average purity of heroin and methamphetamine VPFSD seizures, January 2009 – July 2013



3.4.3 Purity-adjusted prices

Figure 21 (right panel) shows the purity-adjusted price series for heroin and methamphetamine between January 2009 and July 2013. The previously steady price per gram of heroin has changed, with mini peaks in purity-adjusted price at the start of 2011 and the middle of 2012, and about six months of reduced purity-adjusted price between July 2011 and January 2012. For methamphetamine, the apparent price disparity between the powder and crystal forms disappeared, and the purity-adjusted prices of both forms have been decreasing in parallel throughout this period.

Figure 21 Average price (MIX) and purity-adjusted price (MIX prices adjusted by average VPFSD seizure purities) per gram of heroin and methamphetamine, January 2009 – July 2013



3.4.4 Interpreting trends in use and use-related harms

The analysis above suggests a rather simple explanation for the increase in methamphetamine-related harms in Victoria—namely, that greater harms may be following from greater pure-gram consumption. Between January 2009 and July 2013, the average amount spent on each powder methamphetamine purchase declined from approximately $150 at the start of 2009 to approximately $100 at the start of 2013, and each crystal methamphetamine purchase declined from more than $250 at the start of 2009 to approximately $140

in 2013 (Figure 6). Since price per pure gram fell by an even greater amount (Figure 21 shows the pure price of methamphetamine decreasing by 60–70% between 2009 and 2013), this amount of spending leads to larger (pure) quantities purchased.

Figure 22 shows that between follow-up two and follow-up three (roughly October 2011 to July 2013), the number of participants reporting more than one recent methamphetamine purchase increased from 12 percent (steady for the first three interview waves) to 17 percent (^{2}=7.3, p<0.01), and those not reporting a recent purchase remained at 73 percent. This suggests that those using methamphetamine may also have been purchasing more frequently.

Figure 22 Number of recent methamphetamine purchases reported by participants in each interview wave, April 2008 – March 2014

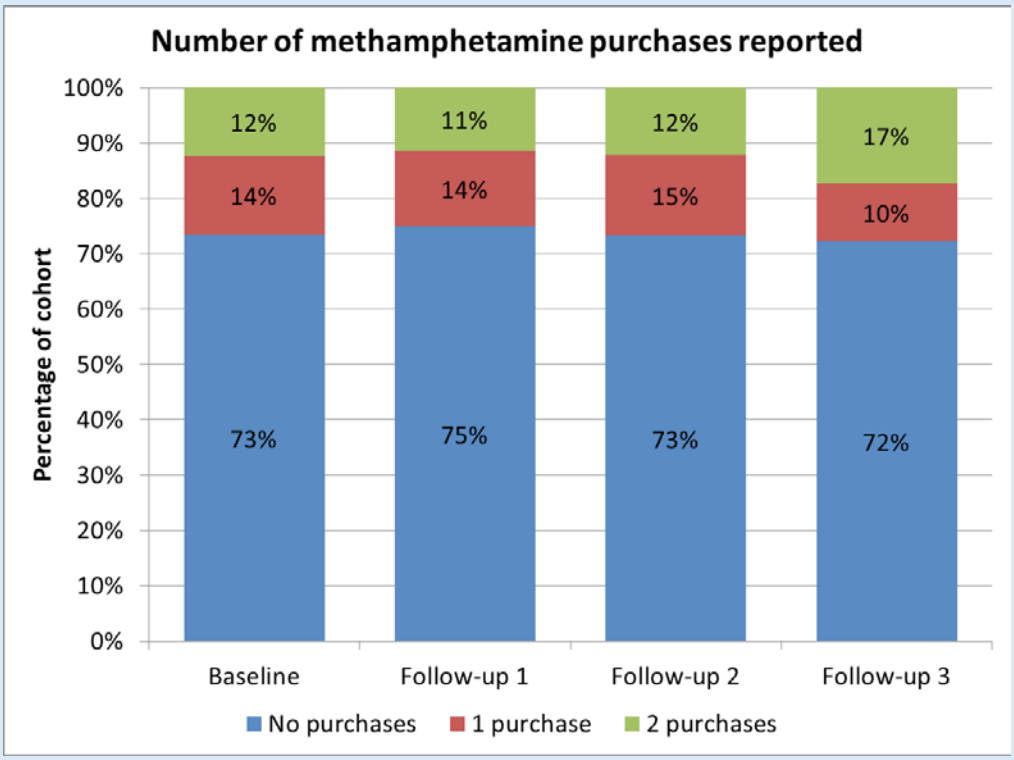
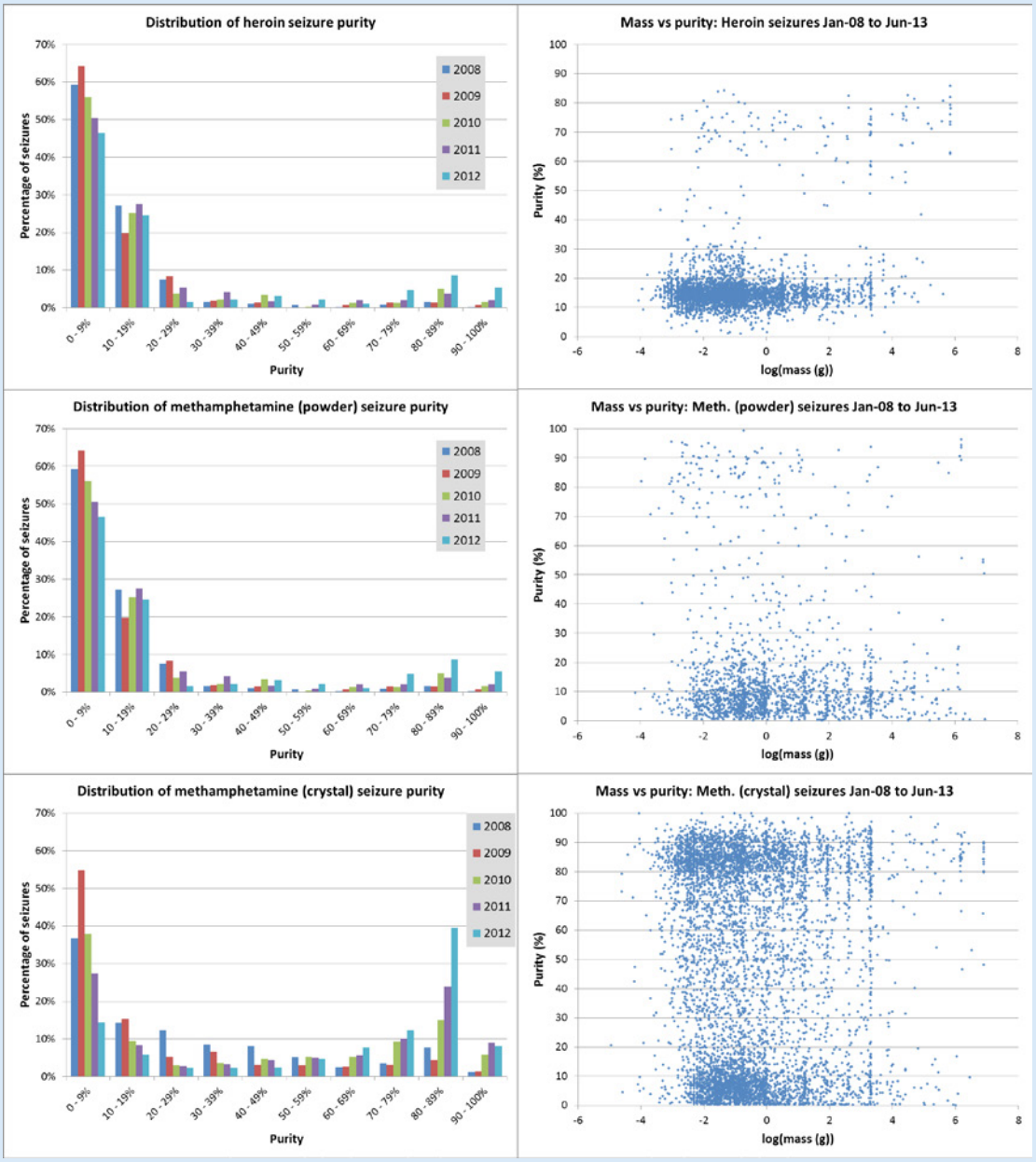


Figure 23 shows that heroin and powder methamphetamine are consistently low in purity but crystal methamphetamine is highly bimodal, with seizures tending to be very high or very low, rather than evenly distributed. This bimodality was the highest in 2010.

Figure 23 Distributions of VPFSD seizure purities by year (left) and all observations, January 2008 – June 2013, by mass (right)[a]



a The vertical lines of higher density in the left-hand panels indicate the presence of some common purchase sizes for each drug market, in particular for larger purchases

This bimodality means that a 'random' purchase could result in consumption of more than five times the amount intended. For example, the average purity of crystal methamphetamine was 79 percent for observations at least 50 percent pure, and 14 percent for those less than 50 percent pure. The ratio of 79:14 is a measure of the potential surprise—and thus potential variation in drug effect—if someone accustomed to purchasing from the low-purity submarket unwittingly obtains a sample of methamphetamine from the high-purity submarket. This effect may be enhanced in circumstances where users and dealers are not aware of the content of their drugs or the range of purities that form the current market (Reuter & Caulkins 2004).

3.5 Discussion

We have shown that user self-reports of drug-market purchases can be combined with data from forensic analysis of drug seizures to produce high-frequency series for price per gram, purity and purity-adjusted price per gram series for heroin, powder methamphetamine and crystal methamphetamine. Doing so between January 2009 and June 2013 offers a plausible explanation for two puzzles concerning drug-market trends.

First, the law of one price suggests that the prices of equivalent products ought to be the same. While powder and crystal methamphetamine are not identical, both contain similar chemicals with similar central nervous system effects, so they should be close substitutes, in the economic sense of the term. Hence, one would expect their prices to move together. That expectation appeared to be contradicted by the data. Crystal methamphetamine prices rose from approximately $450 to $800 per gram between January 2009 and July 2013, even though powder methamphetamine prices were stable at approximately $250 per gram, so it would at first seem odd that crystal methamphetamine was gaining market share. Factoring in purity, however, resolves this issue as both drug forms exhibit the same purity-adjusted price,[7] and the increase in crystal relative to powder methamphetamine seizures suggests a parallel increase in availability of the crystal form. This increase in availability is consistent with the increase in local methamphetamine production suggested by the Australian Crime Commission (ACC 2014). The equal unit cost of the higher-purity and increasingly available crystal form of methamphetamine provides a rational explanation for this trend.

Second, various indicators of methamphetamine use and harm were increasing during this period of increasing price. This paradox is again readily explained by factoring in trends in purity. Between 2009 and 2013, the price per pure gram of both methamphetamine forms was falling both in absolute terms and relative to the steady purity-adjusted prices in the coexisting heroin market, and in the same period the distribution of crystal methamphetamine had become increasingly bimodal, with a cluster of very high purities (more than 80%), a cluster of very low purities (less than 20%) and relatively fewer observations in between. To the extent that users habitually purchase from the same areas and markets, it seems plausible that PWID accustomed to obtaining lower-purity methamphetamine may suddenly and unwittingly obtain much higher-purity methamphetamine—perhaps three or four times as potent—increasing the risk of harms relative to a circumstance in which the distribution of purities is unimodal and fairly tight. This has been observed for heroin, where both higher purity and greater purity variance have been independently associated with increased overdose (Darke et al. 1999). In contrast, both the heroin purity and the purity variation that we observed were stable between 2009 and mid-2013, consistent with reports of heroin-related harms (Lloyd 2013).

3.6 Key findings

Heroin and methamphetamine purity

Between 2009 and mid-2013:

- the average purity of heroin remained consistent and low over time at approximately 15 percent;
- the average purity of powder methamphetamine increased from approximately 10 percent to 30 percent, and the average purity of crystal methamphetamine increased from approximately 20 percent to 70 percent;
- crystal methamphetamine purity was highly bimodal throughout the period, with observations generally less than 20 percent or greater than 70 percent pure. In particular, purity variations were the highest throughout 2010; and
- the composition of methamphetamine seizures evolved over time, from the majority being powder to the majority being crystal—probably reflecting increased availability.

7 This similarity in price per pure unit, after adjusting for quantity discounts, has also been observed for crack and powder cocaine in the United States (Caulkins 1997).

Heroin and methamphetamine price, before adjusting for purity

In 2014 Australian dollars, the average price per gram not adjusted for purity of:

- heroin decreased from a little less than $400 per gram in 2009 to approximately $300 per gram in mid-2013, mostly due to inflation (ie nominal price changed little, but real cost fell in constant dollar terms);
- powder methamphetamine remained steady between 2009 and mid-2013 at approximately $250 per gram; and
- crystal methamphetamine increased substantially in 2010, from approximately $450 per gram to approximately $800 per gram, where it remained until mid-2013.

Heroin and methamphetamine purity-adjusted price

In 2014 Australian dollars, between 2009 and mid-2013, the purity-adjusted price per gram of:

- heroin remained steady, on average, but variation increased after 2011;
- powder methamphetamine steadily declined; and
- crystal methamphetamine steadily declined.

The purity-adjusted prices of the two methamphetamine forms were very similar.

Trends in use and harms related to purity and purity-adjusted price:

- that purity-adjusted prices of powder and crystal methamphetamine were equal and fell in parallel suggests they were driven by a common increase in supply;
- decreases in methamphetamine purity-adjusted price along with the bimodality of crystal methamphetamine purity may account for some of the changes apparent in methamphetamine consumption and related harms, in particular increased overdoses; and
- between the third and fourth interview waves (approximately between October 2011 and July 2013), the percentage of participants reporting more than one recent methamphetamine purchase increased from 12 percent (steady for the first three interview waves) to 17 percent, while the percentage not reporting any purchases remained steady, indicating that those already using methamphetamine have been purchasing more frequently.

Implications for practice and policy:

- the shift from powder to crystal methamphetamine implies a dramatic increase in the purity of the drug used by participants, which can affect the way in which people present to services (including police);
- variations in purity can lead to variations in drug effects for people who use drugs, highlighting the need for targeted education of consumers about the effects of crystal methamphetamine and mechanisms to control their use;
- drug-market surveillance can provide valuable insight and increased understanding of drug market dynamics; and
- both datasets (MIX and VPFSD) offer unique information and should be continued.

Further details of this analysis can be found in Scott et al. (2015).

Chapter 4: Changes in drug preference and drug use over time

4.1 Objectives

To determine:

1. whether the preferences and behaviours of PWID have changed over time;

2. whether these preferences and behaviours varied by demographic and geographic location; and

3. the extent to which market prices may have influenced any changes.

4.2 Background

Economists distinguish between demand and consumption. Demand reflects consumers' preference. Consumption results from the intersection of demand and supply, so it reflects both consumer preferences and market conditions (Caulkins & Nicosia 2010; Gallet 2014). For smoothly functioning markets for conventional goods, this distinction mostly plays out in terms of price. For example, I might prefer a steak to a hamburger, but if the steak costs three times as much, I might eat the hamburger—perhaps almost exclusively if money were tight. Price—or perhaps more accurately, purity-adjusted price—could likewise affect which drug is used. There is a small but growing literature on so-called 'cross-price elasticities of demand', measuring how a change in the price of one drug affects use of another substance (Jofre-Bonet & Petry 2008; Petry 2000; Petry & Bickel 1998; Sumnall et al. 2004).

However, markets for illegal drugs—unlike markets for steak and hamburger in developed economies—are also occasionally subject to reductions in availability, making it harder, or in extreme circumstances actually impossible, for a user to locate and obtain their preferred drug, even if they have cash in hand. It is quite rare for a grocery store to sell out of either steak or hamburger; it is exceedingly rare for all the stores in a city to sell out simultaneously. Relative to this standard for common legal consumer goods, for consumers of illegal products, availability can be a greater concern.

The drug research literature is not always so careful to distinguish between demand and consumption. In this chapter, we can take a step in that direction by contrasting respondents' answers to questions 'what is your main illicit drug of choice' and 'what drug did you use most during the past month'. While these two questions are not perfect in examining the distinction between demand and consumption, they can be used to approximate both and can provide estimates of changes over time and differences across demographics or geographic locations. In particular, identifying geographic differences (possibly due to differing availabilities of particular drugs or the demographic and social norms of residents) is important, as such differences can introduce sampling bias to studies where data collection is pooled across multiple regions. They may also offer clues as to where law enforcement is meaningfully impacting on availability.

In this chapter, we are particularly interested in how the changes in market conditions described in previous chapters correlate with changes in the relationship between which drugs are preferred and which are used. In the period covered by our data, the heroin and cannabis markets were relatively stable, but there were dramatic declines in the purity-adjusted price of powder and crystal methamphetamine—presumably reflecting greater supply and/or improvements in local manufacturing processes (ACC 2014). This change allows for examination of the possibilities that—1) increasing supply of methamphetamine may have induced some people who prefer another drug, such as heroin, to use methamphetamine instead; and/or 2) led, over time, to more people citing methamphetamine as their drug of choice.

4.3 Methods

Responses to the questions 'what drug did you use most during the past month' and 'what is your main illicit drug of choice' have been used to look at continuous trends over time as well as by geographic location and interview wave as follows.

4.3.1 Drug of choice and drug used most trends over time

A rolling 60-day period was used to determine the percentage of responses to drug of choice and drug used most in the past month outcomes between January 2009 and March 2014.

4.3.2 Drug of choice and drug used most by interview wave and geographic location

For each of the recruitment sites (Inner West, Central and Outer-Urban), the percentages of responses were examined for the baseline and first three follow-up interview waves between April 2008 and March 2014. This allows differences between geographic locations to be examined, and uses the longitudinal nature of the MIX to look at discrete changes over time.

4.3.3 Modelling the significance of changes over time

To determine the significance of any changes to main drug of choice and drug used most in the past month, multinomial logistic regressions were undertaken, fitting a linear time trend and including controls for geographic location (Inner West, Central, Outer-Urban), whether a participant was on OST (on, off), drug first injected[8] (heroin, methamphetamine, other), weekly injection frequency, age, sex and seasonal variation. To control for repeated measurements, standard errors were clustered on participants. The predicted values and marginal effects of each of the variables are reported, relative to those of a 20 year old female, from the Inner West, in summer, at the start of 2009, whose first injected drug was heroin and who injects seven times per week.

4.3.4 Drug used most for a given drug of choice

To measure the disjunction between the reported drug of choice and the drugs that were used the most, for each of the first four interview waves the percentage of participants nominating each drug as the one used most, conditional on their nominated drug of choice, was cross-tabulated. This was repeated separately for each geographic location (Inner West, Central, Outer-Urban).

4.4 Results

4.4.1 Main illicit drug of choice

Figure 24 shows the percentage of participants nominating each drug as their main illicit drug of choice. Of all interviews in 2009, heroin was the drug of choice for 73 percent of participants, methamphetamine for 12 percent, cannabis for 7 percent and other drugs for 8 percent. Over time, there was an overall decrease in heroin preference, with corresponding increases in preference for cannabis, and to a lesser degree

8 Drug first injected is used as a proxy for drug-market conditions at the time of recruitment into injecting; for periods where heroin purity and availability were high, drug first injected was more likely to be heroin than when purity and availability were low (Horyniak et al. 2015).

methamphetamine. There were also some oscillations over time, with decreases in heroin preference just before October. Of all interviews in 2013, heroin was the drug of choice for 64 percent of participants, methamphetamine for 12 percent, cannabis for 17 percent and other drugs for 8 percent.[9]

Figure 24 Responses to main illicit drug of choice using a rolling 60-day window, all interviews, January 2009 – March 2014

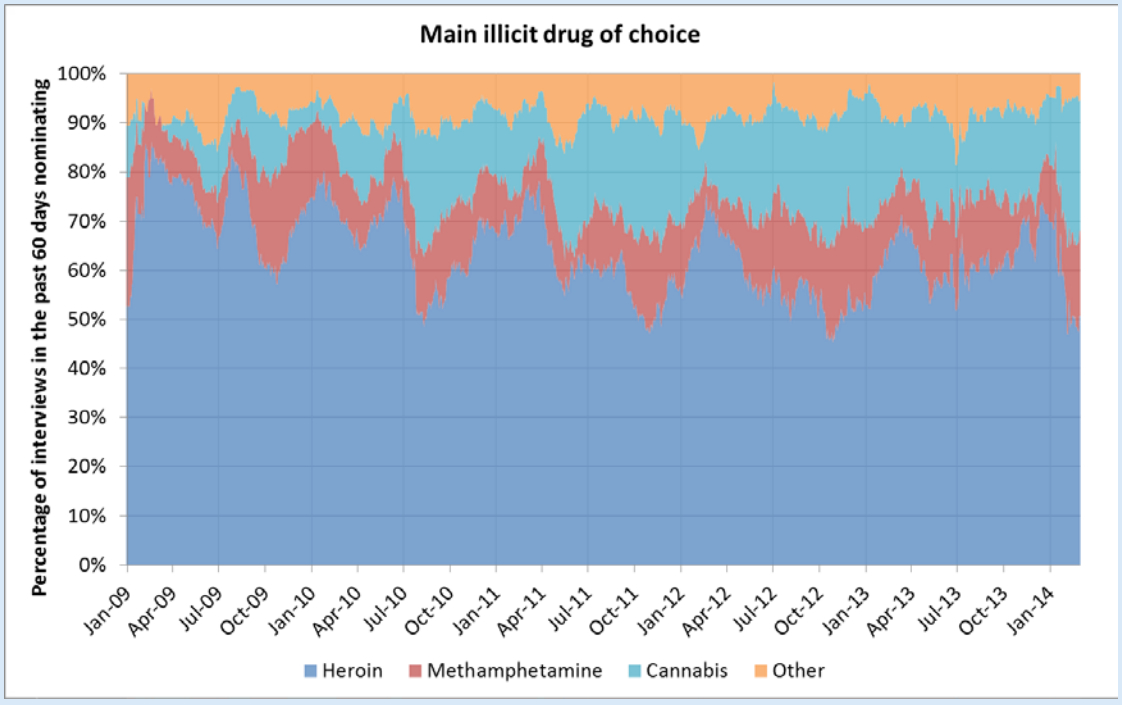


Figure 25 shows the distribution of responses for main illicit drug of choice by interview wave and geographic location. There were some variations between geographic locations: a preference for heroin was cited most frequently in the Inner West compared with Outer-Urban regions (across all interviews, heroin was the drug of choice for 72% of participants from the Inner West, compared with 63% of participants from Central and 51% from Outer-Urban), and methamphetamine preference was more commonly cited in Outer-Urban regions (across all interviews, methamphetamine was the drug of choice for 20% of participants from Outer-Urban regions, compared with 8% of participants from the Inner West and 13% from Central).

9 Values do not add to 100 percent due to rounding.

Figure 25 Distribution of main drug of choice responses by interview wave and geographic location, all interviews, April 2008 – March 2014

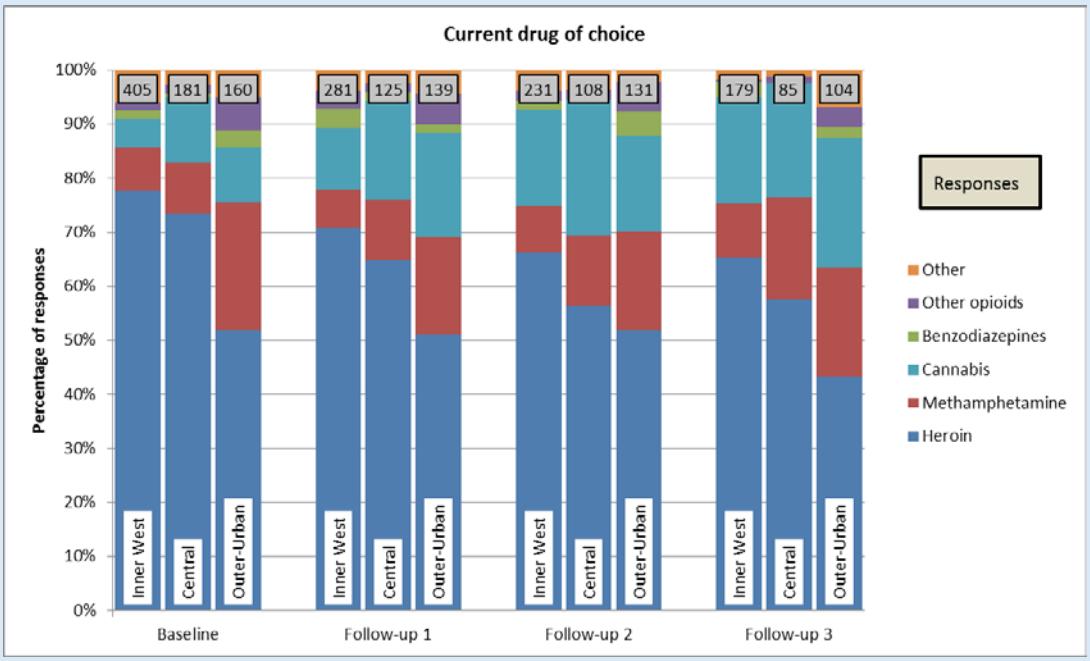


Table 6 presents the estimated model parameters for the likelihood of nominating heroin, methamphetamine, cannabis or other as the main drug of choice:

- over time there was a decreasing percentage of participants nominating heroin as their drug of choice (an adjusted decrease in percentage of 3% per year) and increasing percentages of participants nominating methamphetamine and cannabis as their drug of choice (both +1% per year);
- participants from Outer-Urban regions were more likely to nominate methamphetamine (+11%) and less likely to nominate heroin (–16%) as their drug of choice;
- participants on OST were more likely than those not on OST to nominate heroin (+5%) and less likely to nominate methamphetamine (–3%) as their drug of choice;
- participants whose first injected drug was methamphetamine were less likely than those whose first injected drug was heroin to nominate heroin (–12%) and more likely to nominate methamphetamine (+8%) as their drug of choice;
- more frequent injectors were more likely to nominate heroin (+<1% per additional injection per week) and less likely to nominate cannabis (–<1% per additional injection per week) as their drug of choice;
- older participants were more likely to nominate heroin as their drug of choice (+<1% per birthday) and less likely to nominate methamphetamine (–<1% per birthday) as their drug of choice;
- males were less likely (–5%) than females to nominate heroin and more likely to nominate other (+3%) as their drug of choice; and
- there was also some seasonal variation, with a smaller percentage of participants nominating heroin (–8%) and more nominating methamphetamine or cannabis (+4% and +4% respectively) as their drug of choice in spring.

Table 6 Regression results for trends in drug of choice, using all interviews between April 2008 and March 2014

Main drug of choice predicted values and marginal effects (%, 95% confidence interval)	Heroin (% change, 95%CI)	Methamphetamine (% change, 95%CI)	Cannabis (% change, 95%CI)	Other (% change, 95%CI)
Predicted values	81.39 (75.40, 87.39)	7.55 (3.64, 11.46)	5.62 (2.52, 8.72)	5.43 (2.23, 8.63)
Purchase date (per 365 days from 1 Jan 2009)	-2.57*** (-2.57, -2.570)	1.35** (1.35, 1.35)	1.37** (1.37, 1.37)	-0.31 (-0.310, -0.31)
Inner West	0	0	0	0
Central	-3.57 (-3.57, -3.57)	2.53 (2.53, 2.530)	2.94 (2.94, 2.94)	-2.30 (-2.3, -2.3)
Outer-Urban	-15.80*** (-15.8, -15.8)	10.65** (10.65, 10.65)	2.07 (2.07, 2.07)	2.79 (2.790, 2.79)
On OST	4.59* (4.59, 4.59)	-3.11** (-3.11, -3.11)	-1.66 (-1.66, -1.66)	0.53 (0.53, 0.53)
Drug first injected				
Heroin	0	0	0	0
Methamphetamine	-12.31*** (-12.31, -12.31)	8.14** (8.14, 8.140)	2.10 (2.1, 2.1)	1.74 (1.74, 1.74)
Other	-10.24 (-10.24, -10.24)	1.95 (1.950, 1.950)	3.46 (3.46, 3.46)	4.54 (4.54, 4.54)
Injection frequency	0.61*** (0.61, 0.61)	0.01 (0.01, 0.01)	-0.45** (-0.45, -0.45)	0.01 (0.01, 0.01)
Age	0.57* (0.57, 0.57)	-0.58* (-0.58, -0.58)	-0.05 (-0.050, -0.050)	0.08 (0.08, 0.08)
Female	0	0	0	0
Male	-5.44* (-5.44, -5.440)	2.97 (2.97, 2.97)	-0.65 (-0.65, -0.65)	2.93* (2.93, 2.93)
Summer	0	0	0	0
Autumn	-2.90 (-2.9, -2.9)	0.39 (0.39, 0.39)	1.98 (1.98, 1.98)	0.54 (0.54, 0.54)
Winter	-3.24 (-3.24, -3.24)	2.01 (2.01, 2.01)	1.60 (1.6, 1.6)	-0.14 (-0.14, -0.14)
Spring	-6.30* (-6.3, -6.3)	3.69 (3.69, 3.69)	3.06* (3.060, 3.06)	-0.37 (-0.37, -0.37)

* $p<0.05$, ** $p<0.01$, *** $p<0.001$, (95% CI)

4.4.2 Drug used most in the past month

Figure 26 shows the percentage of participants who reported using each drug the most during the past month. Of all interviews in 2009, heroin was the drug used most by 60 percent of participants, methamphetamine by 7 percent, cannabis by 19 percent and other drugs by 14 percent. The percentage of participants nominating heroin as the drug they used the most decreased over time, with cannabis increasing in its place. As with the main illicit drug, there were some oscillations over time, with decreases in heroin as the drug used most just before October. Of all interviews in 2013, heroin was the drug used most by 30 percent of participants, methamphetamine by 7 percent, cannabis by 28 percent and other drugs by 35 percent.

Figure 26 Responses to drug used most in the past month using a rolling 60-day window, all interviews, January 2009 – March 2014

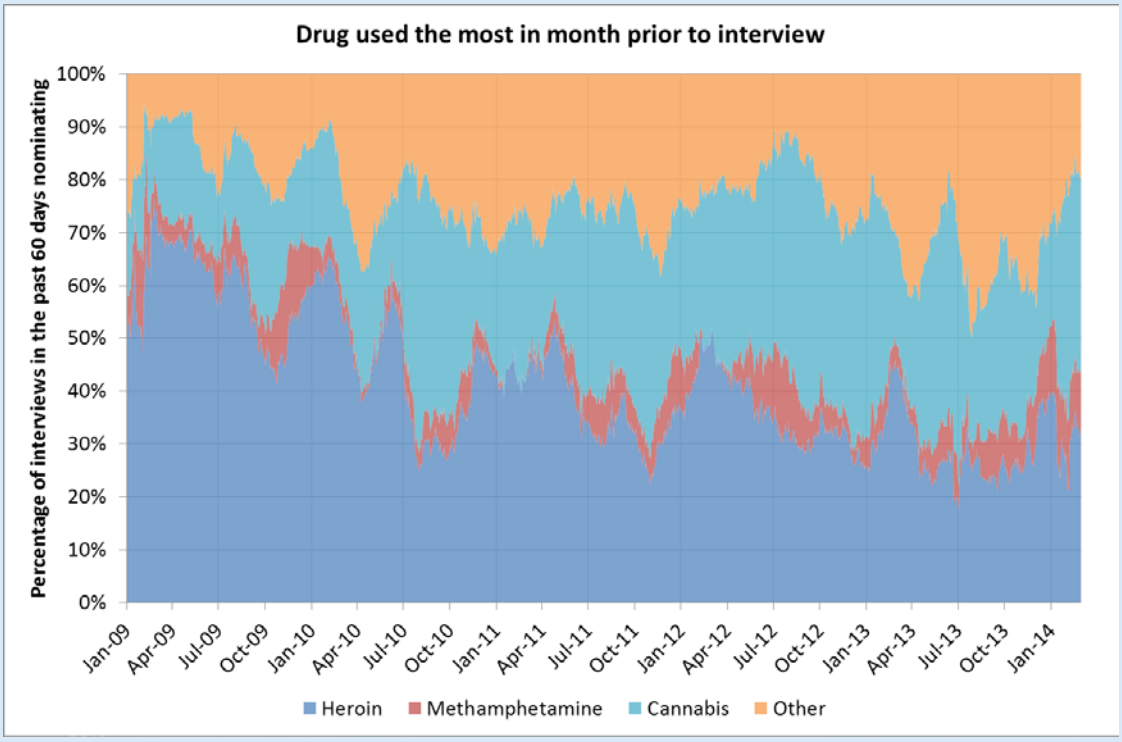


Figure 27 shows the distribution of responses to drug used most in the past month by interview wave and geographic location. Participants from Outer-Urban regions were more likely than participants from the Inner West or Central to report using other opioids or methamphetamine (across all interviews, other opioids were reported as most used by 31% of participants from Outer-Urban regions, compared with 6% from the Inner West and 4% from Central, and methamphetamine was reported as most used by 8% of participants from Outer-Urban regions, compared with 4% of participants from the Inner West and 7% from Central).

Figure 27 Distribution of drug used most in the past month, responses by interview wave and geographic location, all interviews, April 2008 – March 2014

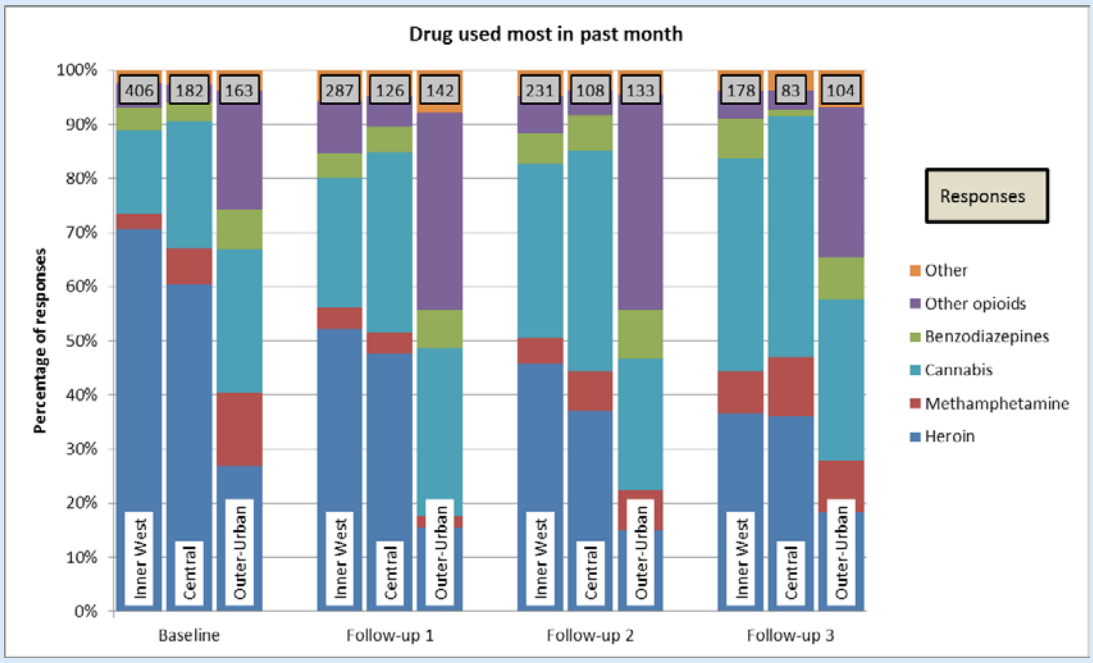


Table 7 presents the estimated model parameters for the likelihood of using heroin, methamphetamine, cannabis or other drugs the most in the month prior to interview:

- over time the percentage of participants who used heroin the most decreased (an adjusted decrease in percentage of 6% per year) and the percentages reported using methamphetamine, cannabis and other drugs the most in the past month increased (+1%, +4% and +1% per year respectively);
- participants from Outer-Urban regions were less likely to have used heroin the most (–33%) and more likely to have used methamphetamine (+4%), cannabis (+7%) or other drugs (+22%) the most;
- participants on OST were more likely than those not on OST to have used other drugs the most (+3%);
- participants whose first injected drug was methamphetamine were less likely than those whose first injected drug was heroin to have used heroin the most (–15%) and more likely to have used methamphetamine (+5%) or cannabis (+8%) the most;
- more frequent injectors were more likely to have used heroin the most (+1% per additional injection per week) and less likely to have used cannabis or other drugs the most (both –<1% per additional injection per week);
- older participants were more likely to have used heroin the most (+<1% per birthday) and less likely to have used cannabis the most (–<1% per birthday);
- males were less likely than females to have used heroin the most (–6%); and
- there was some seasonal variation, with a smaller percentage of participants reporting using heroin the most in winter or spring (–7% and –6% compared with summer) and more reporting using cannabis the most in winter (+4% compared with summer).

Table 7 Regression results for trends in drug used most in the past month, using all interviews between April 2008 and March 2014

Drug used most predicted values and marginal effects (%, 95% confidence interval)	Heroin (% change, 95%CI)	Methamphetamine (% change, 95%CI)	Cannabis (% change, 95%CI)	Other (% change, 95%CI)
Predicted values	77.21 (70.55, 83.86)	2.57 (0.83, 4.31)	13.36 (8.41, 18.31)	6.86 (3.96, 9.77)
Purchase date (per 365 days from 1 Jan 2009)	-6.06*** (-7.78, -4.34)	0.81** (0.20, 1.42)	3.91*** (2.44, 5.38)	1.35*** (0.68, 2.02)
Inner West	0	0	0	0
Central	-3.77 (-9.26, 1.72)	0.83 (-1.09, 2.75)	3.66 (-0.73, 8.05)	-0.72 (-2.92, 1.48)
Outer-Urban	-33.22*** (-42.08, -24.36)	4.08* (0.47, 7.69)	7.15* (1.58, 12.72)	22.00*** (14.32, 29.68)
On OST	-1.58 (-5.72, 2.56)	-0.74 (-1.68, 0.20)	-0.69 (-3.57, 2.19)	3.01* (0.62, 5.40)
Drug first injected				
Heroin	0	0	0	0
Methamphetamine	-15.16*** (-21.75, -8.57)	5.03* (1.09, 8.97)	8.01** (3.21, 12.81)	2.12 (-0.19, 4.43)
Other	-10.65 (-24.21, 2.91)	0.94 (-2.80, 4.68)	3.92 (-4.59, 12.43)	5.79 (-1.17, 12.75)
Injection frequency	1.30*** (0.83, 1.77)	-0.06 (-0.14, 0.02)	-0.91*** (-1.32, -0.50)	-0.32** (-0.52, -0.12)
Age	0.77** (0.18, 1.36)	-0.22 (-0.44, 0.00)	-0.56* (-1.03, -0.09)	0.01 (-0.19, 0.21)
Female	0	0	0	0
Male	-6.49* (-11.45, -1.53)	1.40 (-0.13, 2.93)	3.97 (-0.01, 7.95)	1.11 (-0.83, 3.05)
Summer	0	0	0	0
Autumn	-2.42 (-7.81, 2.97)	-0.02 (-1.41, 1.37)	1.95 (-2.17, 6.07)	0.50 (-1.70, 2.70)
Winter	-6.97* (-12.93, -1.01)	1.70 (-0.34, 3.74)	4.48* (0.13, 8.83)	0.80 (-1.51, 3.11)
Spring	-6.30* (-12.22, -0.38)	1.35 (-0.61, 3.31)	2.75 (-1.35, 6.85)	2.20 (-0.45, 4.85)

* $p<0.05$, ** $p<0.01$, *** $p<0.001$, (95% CI)

4.4.3 Drug used most for a given drug of choice

At baseline, 32 percent of the cohort reported using a drug other than their preferred drug the most in the past month. This percentage was higher for the first three follow-up interview waves, where it was 43 percent, 45 percent and 41 percent of the cohort respectively. Of these participants with a disjunction between drug of choice and drug used most, the most commonly reported drug used most was cannabis, making up 45 percent, 41 percent, 38 percent and 48 percent of cases in the first four interview waves.

Table 8 shows the percentage of participants nominating drugs used most in the past month for a given drug of choice for each of the first four interviews, and how this differs between recruitment sites.

Across all jurisdictions, between interview waves one and four there has been:

1. a decreasing proportion using heroin the most if the drug of choice was heroin (75–53%);

2. increasing proportions using cannabis (14–26%) or other drugs (10–19%) the most if the drug of choice was heroin;

3. a dip and then an increase in the proportion using methamphetamine the most if the drug of choice was methamphetamine (41–21–45%);

4. decreasing proportions using heroin the most if the drug of choice was methamphetamine (15–8%);

5. an increasing proportion using cannabis the most if the drug of choice was cannabis (69–82%); and

6. an increasing proportion using other drugs the most if the drug of choice was other (49–63%).

Observations 1, 2, 3, 5 and 6 are common to all regions; 4 is driven by the Inner West and Outer-Urban regions and is stable in Central.

Table 8 Cross-tabulation of which drug was used most in the past month for a given drug of choice, by interview wave and geographic location, interviews between April 2008 and March 2014

All sites		Baseline				Follow-up 1				Follow-up 2				Follow-up 3			
		Drug used most				Drug used most				Drug used most				Drug used most			
		Heroin	Meth.	Cannabis	Other	Heroin	Meth.	Cannabis	Other	Heroin	Meth.	Cannabis	Other	Heroin	Meth.	Cannabis	Other
Drug of choice	Heroin	75%	1%	14%	10%	59%	1%	19%	21%	53%	3%	22%	23%	53%	2%	26%	19%
	Meth.	15%	41%	21%	23%	16%	21%	33%	31%	14%	31%	21%	34%	8%	45%	23%	25%
	Cannabis	12%	2%	69%	17%	14%	1%	69%	16%	7%	1%	76%	16%	4%	3%	82%	12%
	Other	29%	1%	20%	49%	12%	2%	23%	63%	21%	3%	21%	56%	0%	8%	29%	63%
Inner West		**Heroin**	**Meth.**	**Cannabis**	**Other**	**Heroin**	**Meth.**	**Cannabis**	**Other**	**Heroin**	**Meth.**	**Cannabis**	**Other**	**Heroin**	**Meth.**	**Cannabis**	**Other**
Drug of choice	Heroin	81%	0%	12%	6%	67%	3%	16%	14%	60%	3%	22%	15%	53%	3%	27%	17%
	Meth.	31%	28%	22%	19%	30%	25%	35%	10%	35%	30%	20%	15%	17%	44%	28%	11%
	Cannabis	24%	5%	57%	14%	19%	0%	69%	13%	10%	3%	78%	10%	6%	3%	86%	6%
	Other	41%	0%	14%	46%	13%	3%	23%	60%	35%	0%	24%	41%	0%	22%	22%	56%
Central		**Heroin**	**Meth.**	**Cannabis**	**Other**	**Heroin**	**Meth.**	**Cannabis**	**Other**	**Heroin**	**Meth.**	**Cannabis**	**Other**	**Heroin**	**Meth.**	**Cannabis**	**Other**
Drug of choice	Heroin	79%	0%	14%	7%	69%	0%	22%	9%	62%	2%	22%	14%	62%	2%	28%	9%
	Meth.	6%	65%	12%	18%	8%	31%	46%	15%	7%	43%	21%	29%	7%	53%	33%	7%
	Cannabis	9%	0%	86%	5%	14%	5%	68%	14%	4%	0%	92%	4%	0%	0%	94%	6%
	Other	22%	0%	33%	44%	0%	0%	43%	57%	33%	0%	50%	17%	0%	0%	50%	50%
Outer-Urban		**Heroin**	**Meth.**	**Cannabis**	**Other**	**Heroin**	**Meth.**	**Cannabis**	**Other**	**Heroin**	**Meth.**	**Cannabis**	**Other**	**Heroin**	**Meth.**	**Cannabis**	**Other**
Drug of choice	Heroin	47%	6%	18%	29%	23%	0%	23%	54%	28%	3%	19%	50%	43%	0%	19%	38%
	Meth.	5%	42%	24%	29%	8%	12%	24%	56%	0%	25%	21%	54%	0%	40%	10%	50%
	Cannabis	0%	0%	63%	38%	7%	0%	70%	22%	5%	0%	55%	41%	4%	4%	68%	24%
	Other	13%	4%	26%	57%	13%	0%	13%	73%	0%	6%	6%	88%	0%	0%	31%	69%

4.5 Discussion

These results confirm that the drug preferences of PWID do not always correspond to the drugs most used. During the first four interview waves, between 32 percent and 45 percent of participants used a drug other than their preferred substance most often in the past month. As cannabis is much cheaper than heroin, methamphetamine or most other drugs, it is not surprising that for participants with a disjunction between preference and use, cannabis was the most frequently reported drug used the most, making up between 38 percent and 48 percent of cases. Over time, participants whose drug of choice was heroin became more likely to use cannabis or other drugs the most, and participants whose drug of choice was either cannabis or other drugs became more likely to use cannabis or other drugs respectively.

There is a significant variation of drug markets across three different regions of Melbourne. This illustrates how sampling from several areas in differing proportions can create false or misleading drug-market trends; for example, increases in methamphetamine or other opioid use and preference in Melbourne could be exaggerated if cross-sectional surveys used increasing proportions of individuals from Outer-Urban regions.

In the context of a steady purity-adjusted price of heroin and a decreasing purity-adjusted price of methamphetamine (see Chapter 3), these observations show limited price responsiveness. For example, the increases in the percentages of participants who name methamphetamine as their drug of choice and who report using methamphetamine the most in the month prior to interview, may be a response to the decreasing purity-adjusted methamphetamine price. These changes, though not overwhelmingly large, are nonetheless noteworthy inasmuch as they come from a cohort that began with a strong bias towards heroin use. For example, at the start of 2009, heroin was the drug of choice for 73 percent of the cohort versus methamphetamine (12%), and the drug used most was heroin for 60 percent versus methamphetamine (7%).

Of course these data do not come from a controlled trial, and simple ageing out or regression to the mean are alternative explanations for the respondents shifting away from a near exclusive preference for heroin. That may explain why there were equal and greater increases in the proportions naming cannabis as their drug of choice and using cannabis the most even though cannabis prices were stable. The IDRS (Cogger, Dietze & Lloyd 2013; Stafford & Burns 2013) shows that the median prices of both a gram and an ounce of hydroponic cannabis in Victoria—the most common type—were steady between 2008 and 2012, at $20 and $250 respectively, with the majority of respondents also reporting stable potency. Also, the declining injection frequency (Section 2.3.4) and the correlation between lower injecting frequencies and more cannabis preference and use are consistent with participants maturing out of high-risk behaviours and favouring a ‘softer’ drug such as cannabis.

One limitation of this analysis is that self-reports of the drug used most do not specify the quantity used, nor how consumption may fluctuate in response to price without necessarily passing threshold values to become the ‘most used’.

4.6 Key findings

Main illicit drug of choice:

- the drug of choice for the cohort was overwhelmingly heroin; however, this decreased over time, with increasing preference for cannabis or other drugs:
  - of all interviews in 2009, heroin was the drug of choice for 73 percent of participants, methamphetamine for 12 percent, cannabis for 7 percent and other drugs for 8 percent; and
  - of all interviews in 2013, heroin was the drug of choice for 64 percent of participants, methamphetamine for 12 percent, cannabis for 17 percent and other drugs for 8 percent.

- heroin was more likely to be the drug of choice:
  - in the Inner West (+16% compared with Outer-Urban regions);
  - for those who were on OST (+5% compared with not on OST);
  - for participants whose first injected drug was heroin (+12% compared with methamphetamine);
  - for participants who inject more frequently (+<1% for each additional injection per week);
  - for older participants (+<1% per birthday);
  - for females (+5% compared with males); and
  - in summer (+6% compared with spring).
- methamphetamine was more likely to be the drug of choice:
  - in Outer-Urban regions (+11% compared with the Inner West);
  - for participants whose first injected drug was methamphetamine (+8% compared with methamphetamine);
  - among younger participants (-<1% per birthday); and
  - for participants not on OST (+3% compared with those on OST).
- cannabis was more likely to be the drug of choice:
  - for participants who inject less frequently (–<1% for each additional injection per week); and
  - in spring (+3% compared with in summer).
- other drugs (including other opioids and benzodiazepines) were more likely to be the drug of choice for males (+3% compared with females).

Illicit drug used most:

- the drug used most by the majority of the cohort was heroin; however, this decreased over time, with increasing reports of cannabis or other drugs being used the most:
  - of all interviews in 2009, heroin was the drug used most by 60 percent of participants, methamphetamine by 7 percent, cannabis by 19 percent and other drugs by 14 percent; and
  - of all interviews in 2013, heroin was the drug used most by 30 percent of participants, methamphetamine by 7 percent, cannabis by 28 percent and other drugs by 35 percent.
- heroin was more likely to be used the most:
  - in the Inner West (+33% compared with Outer-Urban regions);
  - by participants whose first injected drug was heroin (+15% compared with methamphetamine);
  - by participants who inject more frequently (+1% for each additional injection per week);
  - by older participants (+1% per birthday);
  - by females (+6% compared with males); and
  - in summer (+7% compared with winter and +6% compared with spring).
- methamphetamine was more likely to be used the most:
  - in Outer-Urban regions (+4% compared with the Inner West); and
  - by participants whose first injected drug was methamphetamine (+5% compared with heroin).
- cannabis was more likely to be used the most:
  - in Outer-Urban regions (+7% compared with the Inner West);
  - by participants whose first injected drug was methamphetamine (+8% compared with heroin);
  - by participants who inject less frequently (–1% for each additional injection per week);
  - by younger participants (–<1% per birthday); and
  - in winter (+4% compared with summer).

- other drugs were more likely to be used the most:
  - in Outer-Urban regions (+22% compared with the Inner West);
  - by participants on OST (+3% compared with those not on OST); and
  - by participants who inject less frequently (–<1% for each additional injection per week).

In general:

- the differences across regions illustrate the importance of controlling for geographic location when sampling drug markets to avoid misinterpreting or presenting false drug-market trends.

Price responsiveness between drugs:

- the responsiveness of drug use to changes in methamphetamine price was low, given that changes in preference for and use of methamphetamine were confined to a small number of participants despite large declines in purity-adjusted methamphetamine prices (alongside the steady purity-adjusted price of heroin and steady price and potency of cannabis); and
- the responsiveness of drug use to changes in heroin price could not be assessed because purity-adjusted heroin prices were stable.

Implications for policy and practice:

- changing market conditions for methamphetamine seem to have had relatively small impacts in relation to heroin use; and
- further work is needed to determine how injecting drug use evolves over time and whether a decline in injecting leads to change in overall drug preferences and general use.

Appendix A

Data source: The Melbourne Injecting Drug User Cohort Study (MIX)

This report uses data on drug purchasing, use and preferences obtained from the Melbourne Injecting Drug User Cohort Study (MIX) (Horyniak et al. 2013). Relevant characteristics of the cohort and the process for scheduling interviews are outlined in this chapter, as well as specific details on the questions and types of responses used for this analysis and subtleties in their interpretations.

Recruitment

MIX is a prospective cohort study of 694 young (≤30 years of age) PWID who were recruited into the study between April 2008 and January 2010.[10] Individuals were eligible for the study if they—1) reported being aged between 18 and 30 years old; 2) had injected either heroin or methamphetamine at least six times in the previous six months; 3) were currently residing in Melbourne; 4) were willing to provide detailed contact information including their full name, residential address and telephone number; and 5) were able and willing to provide a valid Medicare card number, to be used, along with other personal details, for data linkage. Between August 2011 and January 2013, an additional 63 participants, known as SuperMIX participants, were entered into the study.

Respondent-driven sampling, street outreach and snowball sampling were used to recruit participants from Footscray, the CBD, Fitzroy, St Kilda, Richmond, Collingwood, Dandenong and Frankston. These suburbs were then classified into one of three recruitment sites:

- Inner West (Footscray);
- Central (CBD, Fitzroy, St Kilda, Richmond, Collingwood); and
- Outer-Urban (Dandenong, Frankston).

Interview scheduling

Experienced fieldworkers conduct face-to-face interviews with participants approximately annually. Attempts to contact participants and schedule interviews commence two months before their due date (annually from baseline date) and, where contact is difficult (eg no phone, new address, incarceration), participants are prioritised as they become overdue. Following overdue interviews, further follow-up interviews may be conducted after a minimum of six months to catch up to original due dates. The total number of interviews and central 90 percentiles of each follow-up have so far occurred between:

MIX:

- November 2008 – January 2010 (baseline), N=694;
- February 2010 – February 2012 (follow-up one), N=523;
- November 2010 – February 2013 (follow-up two), N=455;

10 Horyniak et al. (2013) detail only 688 original MIX cohort members, as a technical error meant that data on six were lost. These interviews have since been recovered and are included in this report as part of the original cohort.

- September 2011 – October 2013 (follow-up three), N=383; and
- July 2012 – ongoing (follow-up four), N=273.

SuperMIX:

- August 2011 – November 2012 (baseline), N=63;
- June 2012 – November 2013 (follow-up one), N=52; and
- July 2013 – February 2014 (follow-up two), N=33.

These dates containing 90 percentiles of interviews may change in the future as further interviews are conducted.

Baseline characteristics

A brief snapshot of the socio-demographic details and drug use history of the whole cohort at baseline is shown in Table 9. Further details of the MIX cohort can be found in Horyniak et al. (2013), and, unless mentioned otherwise, the MIX cohort will henceforward refer to both MIX and SuperMIX participants.

There were significant differences in the demographics of participants across recruitment sites: participants from the Inner West and Central were more likely than those from Outer-Urban regions to be born in Australia, be better educated and live in owner-occupied homes and were less likely to have been in prison.

In terms of drug use, participants from Outer-Urban regions were more likely than participants from the Inner West or Central to start injecting at a younger age, have methamphetamine as their first injected drug and use heroin less frequently and methamphetamine more frequently. Respondents from Outer-Urban regions were also more likely than those from anywhere else to be on opioid substitution therapy (OST).

Table 9 Socio-demographics and drug use of the MIX and SuperMIX cohorts at baseline

	Inner West				Central				Outer-Urban				χ^2 p-value
	MIX N=365		SMIX N=42		MIX N=177		SMIX N=6		MIX N=152		SMIX N=15		Comparing locations (combined MIX/SMIX)
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
Sex													
Female	122	(33)	15	(36)	58	(33)	2	(33)	53	(35)	5	(33)	0.929
Male	243	(67)	27	(64)	119	(67)	4	(67)	99	(65)	10	(67)	
Age (median, IQR)	27.3	(24.4,29.3)	37.3	(34.0,43.1)	28.0	(24.3,29.8)	34.7	(33.4,44.6)	27.7	(23.8,29.6)	31.9	(28.5,35.2)	0.145
Country of birth													
Australia	278	(76)	26	(62)	136	(77)	4	(67)	140	(93)	12	(80)	<0.001
Other	86	(24)	16	(38)	41	(23)	2	(33)	11	(7)	3	(20)	
Main income source													
Wage or salary	29	(8)	7	(17)	15	(9)	2	(33)	15	(10)	2	(13)	
Government pension or benefits	310	(85)	32	(76)	150	(85)	3	(50)	132	(89)	13	(87)	0.345
Other[a]	25	(7)	3	(7)	11	(6)	1	(17)	2	(1)	0	(0)	
Employment status													
Not employed	314	(86)	29	(69)	154	(88)	4	(67)	126	(83)	13	(87)	0.688
Employed	50	(14)	13	(31)	22	(13)	2	(33)	25	(17)	2	(13)	
Education													
Did not complete year 10	118	(32)	10	(24)	49	(28)	2	(33)	65	(43)	7	(47)	
Completed year 10–11	171	(47)	15	(36)	85	(48)	2	(33)	63	(42)	8	(53)	<0.01
Completed high school or higher	75	(21)	17	(41)	43	(24)	2	(33)	23	(15)	0	(0)	

Table 9 Socio-demographics and drug use of the MIX and SuperMIX cohorts at baseline cont.

	Inner West				Central				Outer-Urban				χ^2 *p*-value
	MIX N=365		SMIX N=42		MIX N=177		SMIX N=6		MIX N=152		SMIX N=15		Comparing locations (combined MIX/SMIX)
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
Current accommodation type													
Owner-occupied	97	(27)	7	(17)	27	(15)	0	(0)	31	(21)	1	(7)	
Private rental	112	(31)	19	(45)	43	(24)	3	(50)	60	(40)	5	(33)	<0.001
Public housing	98	(27)	9	(21)	52	(29)	2	(33)	38	(26)	6	(40)	
No stable accommodation	55	(15)	7	(17)	55	(31)	1	(17)	20	(13)	3	(20)	
Incarceration history													
None	148	(27)	14	(33)	76	(43)	0	(0)	55	(37)	3	(20)	
Once	123	(31)	13	(31)	46	(26)	2	(33)	42	(28)	2	(13)	<0.05
Twice	40	(27)	9	(21)	31	(18)	1	(17)	20	(14)	3	(20)	
Three or more times	52	(15)	6	(14)	23	(13)	3	(50)	31	(21)	7	(47)	
Recent arrest (past 12 months)													
Yes	201	(55)	13	(31)	86	(49)	1	(17)	82	(55)	7	(47)	0.172
No	162	(45)	29	(69)	89	(51)	5	(83)	64	(43)	8	(53)	
Age first injected (median, IQR)	17	(15, 20)	19	(17, 23)	17	(15,19)	17	(13,22)	16	(14, 18)	15	(13, 17)	<0.001
Length of injecting career (median, IQR)	9.7	(6.2, 12.3)	16.7	(12.9,24.1)	10.2	(5.6, 13.1)	20.2	(20.0,22.6)	11.2	(7.6, 13.8)	17.0	(13.8,18.3)	0.101

Table 9 Socio-demographics and drug use of the MIX and SuperMIX cohorts at baseline cont.

	Inner West				Central				Outer-Urban				χ^2 p-value
	MIX N=365		SMIX N=42		MIX N=177		SMIX N=6		MIX N=152		SMIX N=15		Comparing locations (combined MIX/SMIX)
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
First drug injected													
Heroin	262	(72)	22	(52)	106	(60)	3	(50)	78	(52)	7	(47)	
Amphetamines	93	(26)	19	(45)	63	(36)	3	(50)	60	(40)	7	(47)	<0.001
Other stimulate	4	(1)	1	(2)	5	(3)	0	(0)	1	(1)	0	(0)	
Other opiate	3	(1)	0	(0)	2	(1)	0	(0)	10	(7)	1	(7)	
Other	1	(0)	0	(0)	0	(0)	0	(0)	2	(1)	0	(0)	
Frequency of heroin injection past week (median, IQR)	5	(2,10)	5	(3,15)	4	(2,9)	4.5	(3,6)	2.5	(1,5)	2	(1,2)	<0.001
Frequency of meth. injection past week (median, IQR)	1	(0,2)	1	(0,3)	1	(0,3)	3	(3,3)	1	(0,3)	1.5	(0,3)	<0.001
Ever been on OST													
Yes	284	(78)	42	(100)	133	(76)	6	(100)	121	(81)	15	(100)	0.287
No	78	(22)	0	(0)	43	(24)	0	(0)	28	(19)	0	(0)	
Currently on OST													
Yes	121	(33)	31	(74)	50	(28)	3	(50)	71	(47)	9	(60)	<0.01
No	244	(67)	11	(26)	127	(72)	3	(50)	81	(53)	6	(40)	

a Includes criminal activity, sex work, being supported by spouse or family member and no current income

Questions of relevance

This section presents a subset of questions from the MIX relevant to this report, including details on how the questions were recorded and any data manipulation that has taken place. The following questions are asked in the order they are presented.

Use and injection of specific drugs

Participants are asked the following about each of the drugs heroin, methadone, buprenorphine, Suboxone, morphine, oxycodone, other opiates, powder methamphetamine, base methamphetamine, crystal methamphetamine, prescription stimulants, cocaine, hallucinogens, ecstasy, benzodiazepines, antipsychotics, antidepressants and 'other':

- have you used *drug* in the past 12 months (since we saw you last);
- did you use *drug* in the past month;
- how many times have you used *drug* in the past week (tastes + injections);
- have you injected *drug* in the past 12 months (since we saw you last);
- did you inject *drug* in the past month; and
- how many times have you injected *drug* in the past week?

Questions about use are answered as yes/no variables and the number of times used/injected is given as an integer.

Drug preference and overall drug use

Participants are asked the following questions about drug preference, and overall drug use:

- what drug did you use most during the past month;
- what drug did you inject most during the past month;
- what is your main illicit drug of choice (ie preferred or favourite drug) (include illicit use of licit drugs); and
- thinking about it overall, about how many times did you inject in the past week?

Interviewers record participant responses (any allowed) to drug used/injected most as: heroin, speed, methamphetamine base, crystal methamphetamine/ice, ecstasy, pharmaceutical stimulants, cocaine, LSD, ketamine, GHB-type substances, methadone, morphine, buprenorphine, suboxone, benzodiazepines, cannabis, inhalants, alcohol, other, don't know, refuse to answer or not applicable; and participant responses (any allowed) to illicit drug of choice as: heroin, methadone, buprenorphine, other opiates (eg codeine, morphine, opium), methamphetamine, cocaine, hallucinogens (including LSD, peyote, mescalin, mushrooms), ecstasy, benzodiazepines (including Rohypnol, Megaron, temazepam, Valium, Serepax), cannabis, inhalants, other, don't know, refuse to answer and not applicable.

Both drug used most and drug of choice responses were collapsed into six categories: heroin, methamphetamine, cannabis, benzodiazepines, other opioids, and other.

Specific drug purchases

For the drugs heroin, methamphetamine, benzodiazepines and other opioids, participants are asked the following questions about each of their three most recent purchases (if applicable):

- how long ago did you purchase the drug;
- what form was the drug in (heroin/methamphetamine only) or
- what type of benzodiazepine/opioid was this (benzodiazepines and other opioids);

- how much did you purchase;
- how much did you pay;
- from where did you score the drug;
- from which suburb did you score the drug;
- how much of the purchase did you use yourself (estimate percentage);
- how much of the purchase did you share with others (estimate percentage);
- how much of the purchase did you sell to others (estimate percentage);
- how long did it take you to score the drug;
- how soon after you purchased the drug did you first use it;
- where did you use the drug;
- with whom did you use the drug; and
- what time of day did you use the drug?

The question 'how long ago did you purchase the drug' is answered categorically, and categories today, yesterday, within the past week, within the past month, more than a month ago or not purchased in the past month *have been converted to dates by assigning them 0, 1, 4, 19, 45 and 45 days prior to the interview date respectively.*

Forms of heroin were recorded as powder, rock/compressed powder, brown heroin or don't know, and forms of methamphetamine as powder (speed), crystal (ice/shabu), base/point/wax or don't know. Types of benzodiazepine were recorded as temazepam (including Normison), diazepam (including Valium), oxazepam (including Serepax, Murelax), alprazolam (including Xanax), nitrazepam (including Mogadon), clonazepam (including Rivotril) or other; and type of opioid as buprenorphine (Subutex), buprenorphine-naloxone (Suboxone), methadone, morphine (eg Anamorph, MS Contin), oxycodone (eg OxyContin, OxyNorm), prescription codeine (eg Panadeine Forte) or other.

Responses to 'how much did you purchase' are in user-nominated units (eg rock, gram, point, dollar value, tablet), and *heroin and methamphetamine purchases have been converted to grams by assigning weights of 0.1 gram to 'points' or 'caps'* (where it is assumed that caps, regarded as a single dose, are equivalent to 0.1 g) (Cogger, Dietze & Lloyd 2013), and excluding entries with size recorded in dollars or ambiguous units such as 'line' or 'rock'. *Benzodiazepine and other opioid purchases with units of tables have been assigned the most common tablet size listed in the 2010 PBS data* (Kirwan, Dietze & Lloyd 2012), *and scaled to diazepam equivalent* (Burns et al. 2009) *(benzodiazepines) or morphine equivalent* (Turner et al. 2011) *(other opioid) grams* based on their relative strengths listed in Table 10.

Table 10 Conversion of benzodiazepine and other opioid tablet purchases to grams		
Drug	Most common tablet size [a]	Relative strength to diazepam[b] (benzodiazepines) or morphine[c] (opioids)
Benzodiazepines		
Diazepam	5 mg	1.0
Temazepam	10 mg	0.5
Oxazepam	30 mg	0.5
Alprazolam	1 mg	20.0
Clonazepam	0.5 mg	20.0
Other opioids		
Morphine	30 mg	1.0
Buprenorphine	2 mg	40.0
Methadone	10 mg	7.5
Oxycodone	5 mg	1.5
Prescription codeine	30 mg	0.1

a Kirwan, Dietze & Lloyd (2012)

b Burns et al. (2009)

c Turner et al. (2011)

Categorical responses describing the *location types where drugs were purchased and used have been classified as shown in* Table 11. 'With whom did you use the drug' was answered only if some of the purchase was shared, and the categorical responses allowed were: partner, friend, acquaintance, dealer, housemate or other.

All times and monetary values were recorded in minutes and Australian dollars, and time of day was recorded rounded to the hour.

Table 11 Allocation of purchase and use location types from interview responses	
Grouped responses	Responses
Deal location types	
Street	Street
Mobile dealer	Mobile dealer, car
House	Home deal, friend's house, other person's home
Other	Other
Use location types	
Street	Street, park
Car	Car
Public toilet	Public toilet
House	House, friend's house, other person's home
Other	Disused building, stairwell, other

Limitations and ambiguities

After consultation with fieldworkers and study designers, the following interpretations have been used for this report:

- *recruitment site is an approximation for three different markets*—although it is common for participants to buy or use drugs away from their suburb of residence, it is much rarer (though not uncommon) for them to do so in a region different to the one in which they live;
- *recruitment site is treated as a fixed geographical location for each participant*—updating the site at each interview is unlikely to improve any accuracy, as participants are more likely to buy drugs from a suburb outside their recruitment region than they are to move residence between them;
- *percentage shared may be ambiguous, as it can reflect either gifting or pooling money for a purchase*—consider two examples: 1) two people contribute $50 each to buy 0.2 grams of heroin; and 2) one person spends $100 on 0.2 grams of heroin and gives away half. Both purchases would be recorded as paying $100 for 0.2g, with the percentage shared 50 percent;
- *with whom used is with whom shared and does not provide information on the company with whom a participant uses*—if a purchase has 0 percent shared, this question is automatically filled in as not applicable.

Attrition

Table 12 shows the retention of participants at 1 March 2014 for each geographical location over the first four interview waves. This is important as there are significant socio-demographic differences between participants from each area (Horyniak et al. 2013), suggesting there is a need to control for locality when running regressions and estimating statistics.

Table 12 Retention of participants from each geographic location

Interview wave	Inner West N (%)	Central N (%)	Outer-Urban N (%)
Baseline	407 (54%)	183 (24%)	167 (22%)
Follow-up 1	295 (51%)	135 (23%)	145 (25%)
Follow-up 2	240 (49%)	114 (23%)	134 (27%)
Follow-up 3	182 (48%)	92 (24%)	109 (28%)

Appendix B

Analysis of the methods used in the Melbourne Injecting Drug User Cohort Study: Is asking about the most recent purchase a biased way of studying drug markets?

Summary

Objectives

Various surveys now ask respondents to describe their most recent purchase of illicit drugs as one mechanism through which market characteristics—in particular, size—can be estimated. This relies on an untested assumption that the most recent purchase is representative of other purchases, and that bias associated with the timing of survey administration does not affect data. This chapter tests this assumption by comparing the amount spent and type of deal of the most recent purchase with details of three or more recent purchases reported by MIX participants.

Findings

Findings in this chapter have been reported as part of a wider paper by Bond et al. (2014). For heroin and methamphetamine, no differences were found between the amount spent by participants on their most recent purchase and the average amount spent on three or more recent purchases, and there were no differences between the type of deals of participants' most recent purchases and those of larger subsets of purchases.

This suggests that asking about the most recent purchase is an economical way to learn about purchases more generally, with little evidence of substantial variation between the most recent purchase and other recent purchases reported by participants.

This analysis was also undertaken using the Washington Cannabis Consumption Survey (WCCS) (Lenton et al. 2015) with similar outcomes. Further details can be found in Bond et al. (2014).

Background

The harms associated with illicit drugs include those created by their distribution and sale (Zeuzem et al. 2011), so understanding the size and character of illegal markets is important (Sumnall et al. 2004). In particular, estimating the market's size is of particular interest since users' spending drives economic-

compulsive crime, systemic crime, impoverishment of some users and incentives for corruption.

Consequently, typical patterns of drug purchase and consumption are a crucial component of surveys of people who use drugs. They are often used to generate estimates of annual drug consumption. For example, if respondents could faithfully report the average weekly consumption, one would merely need to multiply by 52 for annual consumption. However, there are reasons to be sceptical about respondents' ability to answer such questions. For example, reports of the frequency of recent drug use tend to be multi-modal, reflecting the characteristics of survey question responses (eg weekly, monthly, annually) rather than a true consumption pattern. This and other types of recall bias are inevitably part of most drug use surveys.

One way to minimise recall bias is to focus on specific instances of drug purchase or use (*Drugs Poisons and Controlled Substances Act* 1981: Schedule 11, parts 1–3, column 3; Hughes et al. 2014). The practice is common in relation to studies of drug purchases such as the IDRS, but its validity depends entirely on a tacit and experimentally un-validated assumption that the most recent purchase is representative of other purchases. There are many reasons why that assumption could be violated. For example, IDRS interviews inevitably occur during normal working hours, and it is unknown whether this adequately captures the range of drug purchases made in the course of 24 hours.

A deeper concern, though, is the possibility of random incidence bias. If drug consumers purchased like clockwork, always buying exactly the same amount at regular intervals, the most recent purchase would be like all the others, but that need not be the case. Even regular patterns can be problematic if survey times are not random. For example, someone who regularly buys twice a day may purchase only a small 'wake-up dose' ($25) in the morning, and a larger dose at the end of the day with whatever money was obtained during the day ($100). Now suppose surveys are administered during the day, because that is when survey staff work. The most recent purchase would always be one of the small, wake-up doses. Even if the respondent reported accurately the total number of purchases (14 per week), the inferred weekly spending (25×$10=$250) would be less than one-third of the correct amount (7×$25+7×$100=$875).

A still more pernicious problem is the possibility that larger purchases are followed by longer gaps before the next purchase, and smaller purchases are soon followed by another purchase, creating systematic bias due to random incidence (Dore 2012). Consider cannabis purchasing, because the arithmetic is simple. Imagine there are users who consume exactly one gram every day, and buy whenever they run out. Furthermore, suppose that half of the marijuana is purchased one gram at a time and half in quarter ounces (7 g), so that each user makes 14 purchases of one gram and two purchases of 7 grams over the course of a (28-day) month, for a total of 16 purchases. Now, on exactly half of the days of the month, the most recent purchase was 7 grams, and on half the most recent purchase was 1 gram. A survey that asked only about the most recent purchases would conclude that these individuals bought and consumed (50%×1+50%×7)×16=65 grams per month, or more than double the actual 28 grams per month.

These numerical examples illustrate that the bias from asking only about the most recent purchases can be large and can go in either direction. This fundamentally limits the accuracy of demand-side estimates of total quantities consumed. Given the well-known limits of supply-side estimates (Dore 2012), this means that our basic understanding of perhaps the most fundamental market aggregate related to substance use hangs by a strong and entirely untested assumption about the regularity of purchase behaviour—a rather awkward situation given that the lives of those who account for the majority of drug consumption are generally not regimented. One way of addressing this issue is to examine a number of specific recent purchases rather than just one.

The MIX data offer a unique opportunity to investigate this issue as participants are asked about their three most recent purchases, not just their most recent, and follow-up interview waves enable this comparison to be made within each individual several times. This paper tests this assumption by comparing the most recent purchases reported in MIX with those of a larger set with respect to price paid and location type. If biases of the sort just described are commonplace, we would expect to observe significant differences.

Methods

The characteristics of purchases to be compared are the amount spent and purchase location type (street, mobile, house). To enable a fair longitudinal comparison only data from the 383 respondents with four interviews were used (see Appendix A). Due to low reporting of consecutive benzodiazepine and pharmaceutical opioid purchases, only heroin and methamphetamine purchases were considered.

Purchase sizes

The mean and standard error of the mean for the size of the most recent heroin and methamphetamine purchases were compared with those of the average sizes of several recent purchases by the same individuals as follows.

The average amount participants spent on each heroin and methamphetamine purchase over the three most recent (all observations, follow-up interview three), six most recent (all observations in follow-up three and follow-up two) and 12 most recent (all observations) reported purchases were calculated, and values excluded for participants if one of their purchases being considered was zero or missing. As no participants reported 12 consecutive methamphetamine purchases, this category was not considered. The distribution of the amount spent on the most recent purchase was then compared with the distributions of the average amount spent on each purchase in the past three, six and 12 purchases. To account for differences among the participants who report all purchases and those with one or more missing entries, this was repeated only for participants who reported all 12 purchases (or six recent for methamphetamine).

Statistical comparisons of the distributions were not undertaken as they were not independent. The means of the distributions being compared (eg most recent versus average of three most recent) were chosen, as for practical purposes they represent the values of interest.

Purchase location type

The percentages of street, mobile and house heroin and methamphetamine deals in the most recent purchase were compared with the percentages reported by pooling a series of recent purchases.

For heroin and methamphetamine, the three, six and 12 most recent purchases were pooled, and the percentages occurring in each location type calculated only considering purchases made by participants for whom the most recent three, six and 12 respective purchases were valid. As with the purchase size analysis, this was repeated using only data from participants who reported all 12 (heroin) or all six (methamphetamine) purchases.

Statistical analysis was not undertaken as distributions were not independent of one another.

Results

Comparison of purchase sizes

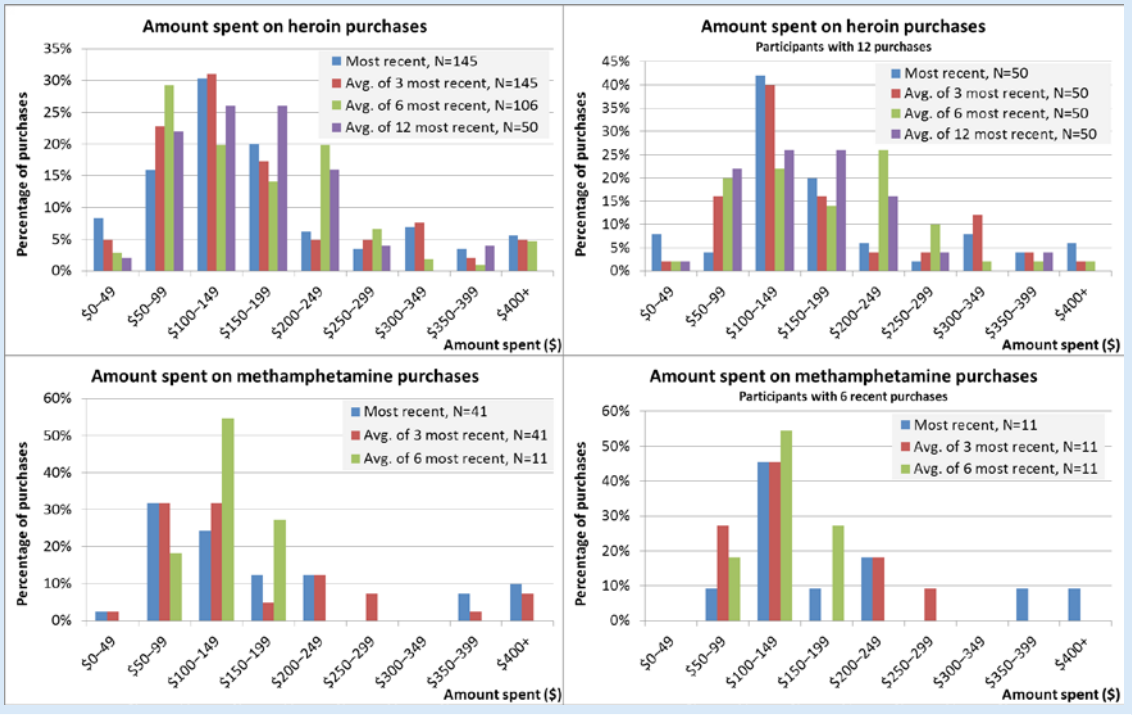
Table 13 presents the mean and standard error of the mean of the size of the most recent purchase and the average of the three, six and 12 most recent purchases, omitting respondents who described one of the purchase sizes as zero or left that item missing, and Figure 28 shows the corresponding distributions of purchase sizes. The size of the most recent purchase approximates well the average of the three most recent purchases for all substances.

When comparing the most recent purchase with the six or 12 reports of recent purchases—notably, the most recent methamphetamine purchase versus the average of the past six—the averages of amount spent do differ. This stems primarily from differences between respondents who answered all questions versus those who answered the questions only in the most recent interview: the average of the most recent methamphetamine purchase was $241 among 41 respondents, versus an average of the past six of only $128 among 11 respondents describing all six purchases. However, the average of the most recent purchase for those 11 was $168—much closer and not significantly different (ie no more than two standard errors) to the $128 figure.

Table 13 Comparison of most recent purchases with larger set of purchases

Drug		Most recent	Sum of three most recent divided by three	Sum of six most recent divided by six	Sum of 12 most recent divided by 12
Unit of analysis is the interview					
Heroin	Average	$158	$162		
	Std error	$8	$7		
	# of obs.	541	541		
Unit of analysis is respondent					
Heroin	Average	$192	$194	$192	$157
	Std. error	$32	$32	$30	$10
	# of obs.	145	145	106	50
Meth.	Average	$241	$235	$128	
	Std. error	$85	$85	$11	
	# of obs.	41	41	11	0
Heroin	Average	$165	$168	$172	$157
Participants reporting all 12 purchases	Std. error	$16	$13	$12	$10
	# of obs.	50	50	50	50
Meth.	Average	$168	$129	$128	
Participants reporting 6 recent purchases	Std. error	$34	$20	$11	
	# of obs.	11	11	11	0

Figure 28 Comparison of the amount spent on the most recent purchase with the average of the past three, six and 12 reported purchases: participants reporting the minimum number of recent purchases (left) and participants with all 12 (heroin) and six (methamphetamine) recent purchases (right)



Comparisons of location types

Table 14 summarises the results for the location type of drug purchases. It suggests that asking only about the most recent purchase may provide results indicative of users' current regular behaviours. As with purchase size, the (modest) differences between the latest purchase and the 12 most recent purchases can be explained by differences between respondents who answered all questions versus those who answered the questions only in the most recent interview.

Table 14 Reported location type of most recent purchases versus larger set of purchases					
Drug	Source	Most recent purchase N (%)	Three most recent purchases N (%)	Six most recent purchases N (%)	Twelve most recent purchases N (%)
Unit of analysis is the interview					
Heroin	Street	108 (18%)	306 (17%)		
	Mobile dealer	197 (32%)	602 (33%)		
	House	300 (49%)	905 (50%)		
Unit of analysis is the respondent					
Heroin	Street	20 (14%)	64 (15%)	110 (17%)	103 (17%)
	Mobile dealer	47 (32%)	132 (30%)	189 (30%)	234 (39%)
	House	78 (54%)	239 (55%)	337 (53%)	262 (44%)
Meth.	Street	0 (0%)	2 (2%)	0 (0%)	–
	Mobile dealer	5 (12%)	15 (12%)	4 (6%)	–
	House	36 (88%)	106 (86%)	62 (94%)	–
Heroin	Street	8 (16%)	23 (15%)	47 (16%)	103 (17%)
Participants reporting all 12 purchases	Mobile dealer	20 (40%)	58 (39%)	119 (40%)	234 (39%)
	House	22 (44%)	69 (46%)	134 (45%)	262 (44%)
Meth.	Street	0 (0%)	2 (4%)	0 (0%)	–
Participants reporting 6 recent purchases	Mobile dealer	1 (6%)	1 (2%)	4 (6%)	–
	House	17 (94%)	45 (94%)	62 (94%)	–

– Not applicable

Note: Totals may not add up to 100 percent because of rounding

Discussion

Survey designers struggle with constraining the length of the instrument and interview (Inverson & Maher 2012), so it is important to understand whether one can assess characteristics of drug buyers' behaviour, including amount spent, by asking only about the most recent purchase or whether surveys should ask a larger battery of questions, for example, asking about each of the past three purchases or about all purchases made within a certain time window.

Before undertaking this work, we thought it would be dangerous to presume that the most recent purchase is representative. It seemed plausible, if not likely, that random incidence or other idiosyncrasies related to the timing of survey administration might make the most recent purchase unrepresentative of current purchasing more generally. We investigated this question by comparing characteristics of the most recent purchase with those of a larger set of purchases.

The average size of the most recent by-interview heroin purchase was $158, whereas the average for interviews of the average-across-purchases for the three most recent heroin purchases was $162. That $4 difference is small in percentage terms, is very small relative to other sources of error when estimating spending on illegal drugs, and is less than half of one standard error of the mean—all of which suggest that asking only about the most recent heroin purchase yields almost the same estimate of average purchase size as asking about the three most recent purchases. Similarly, the differences between the most recent and three most recent purchases of $6 ($241 versus $235) for methamphetamine indicate that, by and large, the most recent purchases are representative of other purchases.

Nevertheless, it is prudent to remember that an assumption is being made when extrapolating from data on only the most recent purchase—and to make that assumption explicit when describing any such analysis.

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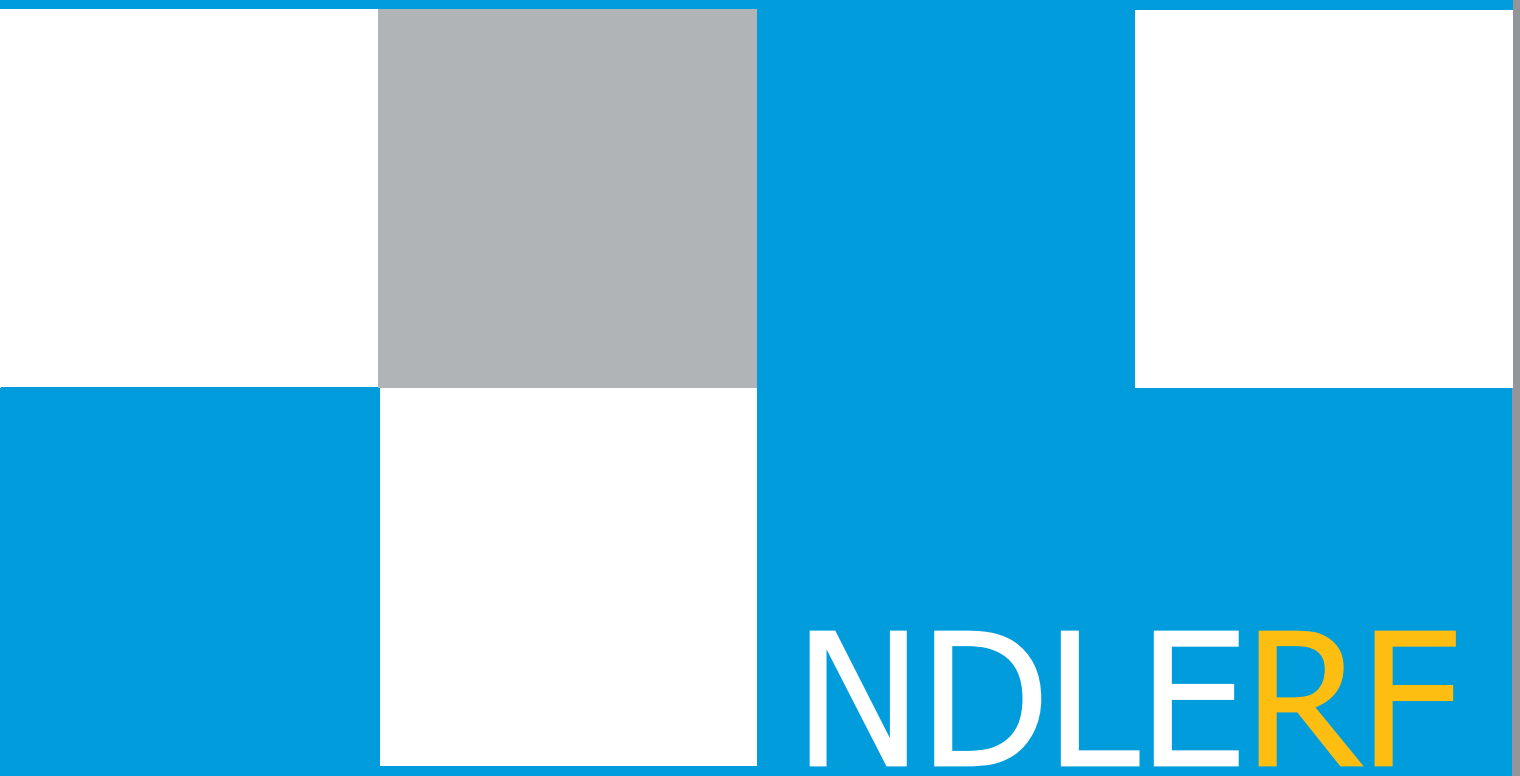
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