

NATIONAL WASTEWATER DRUG MONITORING PROGRAM

REPORT 3, NOVEMBER 2017



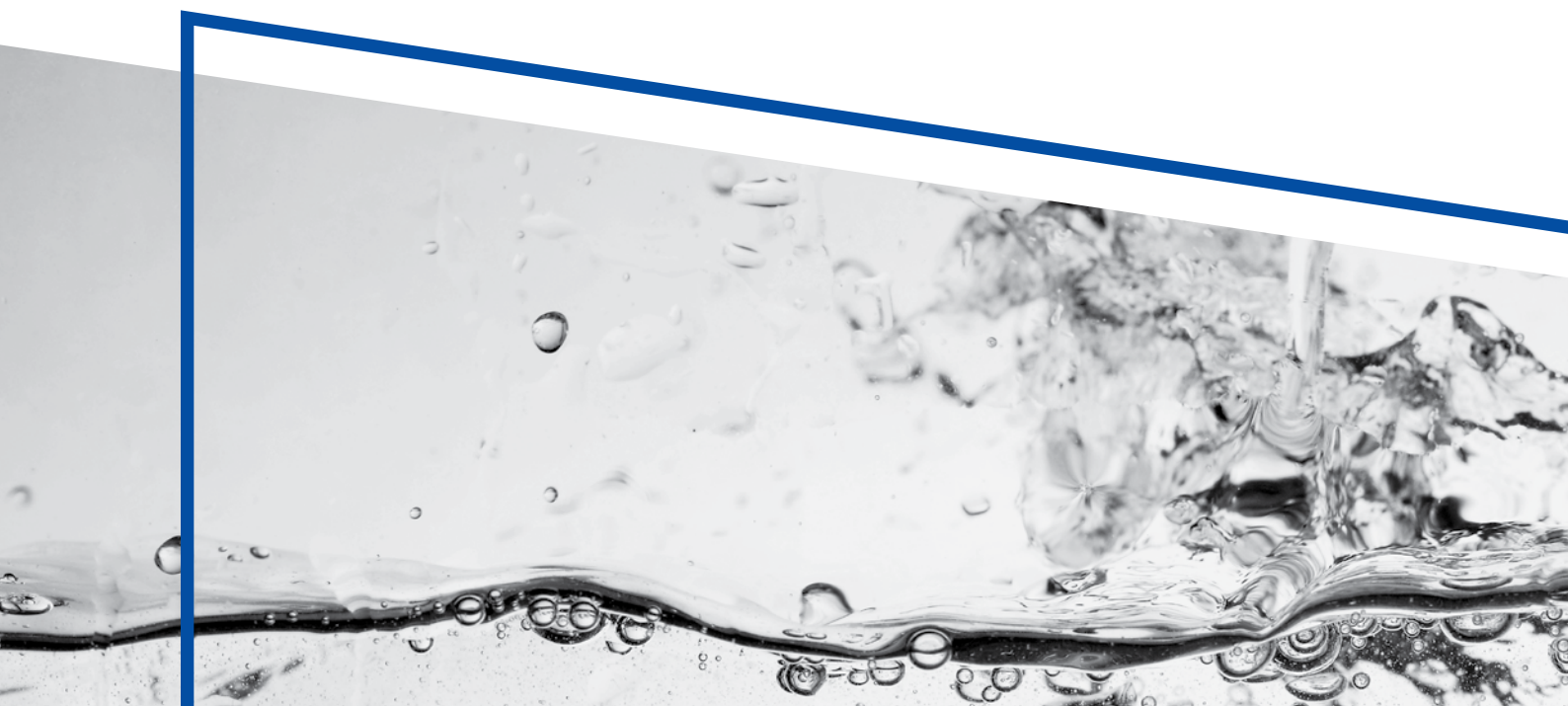
AUSTRALIAN
**CRIMINAL
INTELLIGENCE
COMMISSION**



THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

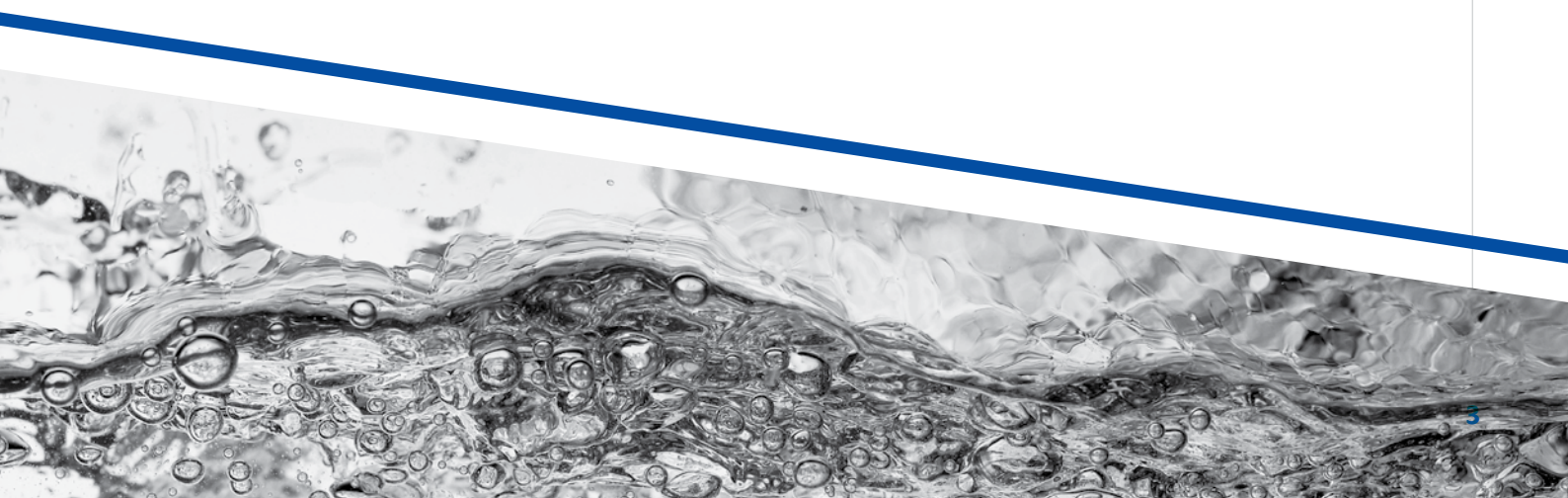


University of
South Australia



CONTENTS

CEO FOREWORD	4
SNAPSHOT	6
INTRODUCTION	8
RESEARCH FINDINGS	13
1: EXECUTIVE SUMMARY	15
2: INTRODUCTION	17
2.1: Preamble	17
3: METHODS	18
3.1: Participating wastewater treatment plants (WWTPs)	19
3.2: Sample collection and preparation	20
3.3: Presentation of data and interpretation	20
4: RESULTS	23
4.1 Individual site comparison of drug use in August 2017	23
4.2 State and territory comparison of drug use	31
4.3 Drug profile for each state and territory	41
5: ACKNOWLEDGEMENTS	46
6: REFERENCES	47
7: APPENDICES	49
Appendix 1: Drug-specific parameters for analytical reporting and usage calculations	49
Appendix 2: Further information on WWTPs	50
Appendix 3: Number of sites assessed in each report	52
CONCLUSIONS	53





CEO FOREWORD

The Australian Criminal Intelligence Commission has a national responsibility to provide information and intelligence on criminal activity. Much of the harm that Australians suffer at the hands of organised crime is due to the trade in illicit substances and abuse of licit substances at the instigation of serious and organised crime groups who profit from importing, trafficking, manufacturing and selling drugs.

This National Wastewater Drug Monitoring Program report is the third in a series of nine public reports which will detail the findings of the national wastewater program until the end of 2019. This report provides statistically valid datasets of drug use and distribution patterns across a large number of sites in capital cities and regional areas.

As noted when the first National Wastewater Drug Monitoring Program report was released, wastewater is widely applied internationally as a tool to measure and interpret drug use within national populations. Wastewater analysis provides a measure of one important aspect of national health—the demand for a range of licit and illicit drugs. An understanding of this behaviour allows governments to effectively direct resources to priority areas, and also to monitor the progress of demand and supply reduction strategies.

EVOLUTION OF THE PROGRAM

Wastewater analysis provides a measure of the demand for a range of licit and illicit drugs, with related analysis offering flexibility to address emerging problems and identify previously unknown drug threats and consumption patterns.

This report includes wastewater data from all states and territories, enabling the National Wastewater Drug Monitoring Program to again provide a national picture of drug use. In August 2017, 54 wastewater sites were monitored nationally. Based on 2016 Census data, these sites cover approximately 61 per cent of the Australian population—around 14.2 million people. This report contributes further data to permit the identification of changes in usage patterns over the 12 month period from August 2016 and to build a comprehensive and increasingly detailed picture of national drug consumption.

The content of this report involves a natural evolution of the existing National Wastewater Drug Monitoring Program. Changes of note include an increase in the number of drug types analysed as part of the program, which now includes heroin, bringing the total number of substances monitored to 14. Additionally, a refinement made to the way in which 3,4-methylenedioxyamphetamine (MDA) is analysed has resulted in MDA data now reflecting use of this drug, rather than its presence in wastewater solely as a metabolite of MDMA use. We are grateful to our partners at the University of Queensland and University of South Australia for extending the existing program in this manner.



TRENDS IDENTIFIED DURING THIS REPORTING PERIOD

For this third report, findings show that nicotine and alcohol remain the most consumed substances tested in all states and territories.

Although the previous report indicated a slight reduction in the use of methylamphetamine nationally, current figures indicate that the national demand for methylamphetamine remains resilient, with no substantial decrease in consumption between August 2016 and August 2017. Of the substances monitored, methylamphetamine continues to be the most prevalent illicit drug consumed in Australia. Its use is well known to cause significant harm, and with widespread use across all jurisdictions methylamphetamine continues to pose significant challenges for the community.

The inclusion of heroin among the substances monitored gives us better insight into the illicit drug market in Australia. Victoria and the Australian Capital Territory capital city sites reported the highest heroin consumption nationally. Heroin consumption is considerably less than that of methylamphetamine.

Nationally cocaine consumption has decreased. While in August 2017 cocaine consumption was higher than it was in August 2016, long-term trends indicate a reduction compared to previous consumption levels reported in December 2016 and April 2017. Since August 2016 MDMA consumption has decreased nationally. For these two substances recent significant seizures and detections appear to have contributed substantially to decreased consumption and to have constrained the growth of the markets.

Through wastewater analysis we have identified MDA consumption as an emerging problem. Consumption in regional areas is of concern. This insight has only been achieved through the evolution of the program and is a pleasing example of the potential offered by wastewater analysis as a means of identifying latent problems. Although consumption of fentanyl and oxycodone has decreased nationally since August 2016, consumption of these substances remains a concern, particularly in regional areas.

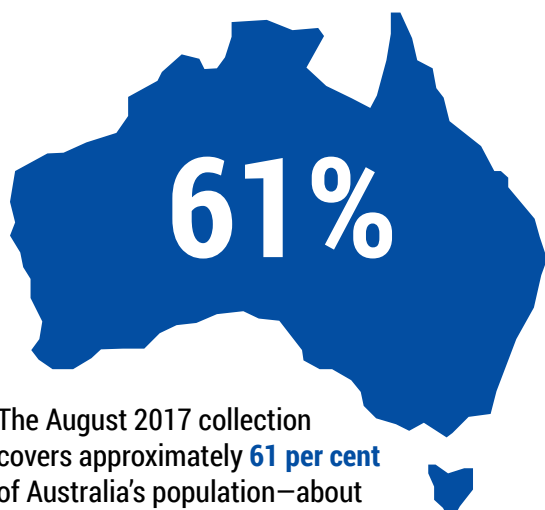
I would like to thank the Minister for Justice for contributing the funding which made this initiative possible, and to acknowledge the Australian Criminal Intelligence Commission officers who contributed to the project. I am grateful for the valuable support and specialist expertise of Jochen Mueller, Wayne Hall, Sharon Grant, Ben Tscharke, Rachel Mackie and Jake O'Brien of the University of Queensland, and Jason White, Cobus Gerber, Richard Bade, Maulik Ghetia and Hetal Aghera from the University of South Australia, who undertook the data collection and analysis which underpins this report.



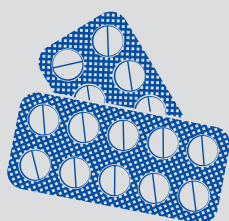
Michael Phelan APM

Chief Executive Officer
Australian Criminal Intelligence Commission

SNAPSHOT



Methylamphetamine continues to be the **most prevalent illicit drug** tested, with similar estimated average consumption in capital city and regional sites.



Consumption of **oxycodone** and **fentanyl** (licit and illicit) **exceeds heroin** consumption.

Consumption levels for tested **new psychoactive substances** confirm this remains a **niche market**.



Alcohol and nicotine remain the **highest consumed substances**.





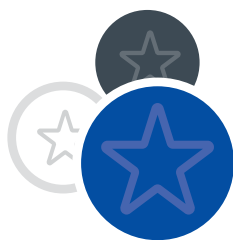
Capital city **alcohol**, **cocaine**, **heroin** and **MDMA** average consumption exceeded regional sites.

Regional **nicotine**, **MDA**, **oxycodone** and **fentanyl** average consumption exceeded capital city sites.



Despite decreases in average **cocaine** consumption in regional and city sites since April 2017, consumption increased from August 2016 to August 2017.

Excluding NPS, **MDMA** was consistently the **lowest consumed drug** nationally.



MDA was identified as a **tangible problem**, particularly in some regional areas.



INTRODUCTION

This is the third in a series of nine National Wastewater Drug Monitoring Program reports to be publicly released by the Australian Criminal Intelligence Commission. The program aims to deliver on the recommendations of the *Final Report of the National Ice Taskforce*. It is the first program to provide leading-edge, coordinated national research and intelligence on illicit and licit drugs, with a specific focus on methylamphetamine and 13 other substances.

In 2016, the Australian Criminal Intelligence Commission received \$3.6 million in funding under the Proceeds of Crime Act to deliver the National Wastewater Drug Monitoring Program over three years. The program provides a measure, rather than an estimate, of the use of a number of illicit drugs, as well as licit drugs including nicotine, alcohol and some pharmaceuticals. It gives us valuable insight into the trends and emerging issues of drug consumption across Australia and can identify new sources of threat.

The findings presented in the nine reports will give law enforcement, policy, regulatory and health agencies additional and more objective data on the use of methylamphetamine and other drugs. This data creates opportunities to shape the response to both the demand and the supply side of the illicit drug market, particularly in high-use areas.

IMPLEMENTATION

The Australian Criminal Intelligence Commission has contracted the University of Queensland, and through it the University of South Australia, to deliver the program. Relationships have been built between the universities and the operators of wastewater facilities across Australia to permit the collection and analysis of samples.

In this report, wastewater analysis from the National Wastewater Drug Monitoring Program measured the presence¹ of the following substances:

- methylamphetamine
- amphetamine
- cocaine
- 3,4-methylenedioxymethylamphetamine (MDMA)
- 3,4-methylenedioxyamphetamine (MDA)
- heroin
- JWH-018
- JWH-073
- mephedrone
- methylone
- oxycodone
- fentanyl
- nicotine²
- alcohol.

1 The contract recognises that threshold levels are substance dependent and will vary accordingly. Refer to the research findings for further information on detection levels, and whether it was possible to measure all substances.

2 For accuracy, estimates have been changed from tobacco in the previous two reports to nicotine in this report due to the inability to distinguish between nicotine intake from tobacco or electric cigarettes and nicotine replacement therapies such as patches and gum.

The first five substances are widely recognised illicit stimulants. Heroin is an illicit depressant. The next four substances are also illicit and are described as new psychoactive substances (NPS). JWH-018 and JWH-073 are synthetic cannabinoids, while mephedrone and methylone are synthetic stimulants. Oxycodone and fentanyl are opioid pharmaceuticals with therapeutic application, but are also diverted to the illicit market. Nicotine and alcohol are licit drugs.

Both contracted universities will monitor wastewater at approximately 50 sites across Australia until the end of 2019. It is the intention of the program that capital city sites cover all state and territory capital cities, with the remaining sites covering regional cities and towns. Capital city sites will be monitored for the duration of the trial, while the remaining sites will be re-assessed periodically during the course of the program.

Sites were selected to permit the Australian Criminal Intelligence Commission to provide data on major population areas, sites of actual or potential concern from a drug use perspective, and sites where the local authorities have established relationships with the two universities. In August 2017, 54 wastewater treatment plants participated nationally.

The breakdown by jurisdiction for August 2017 in the third report is as follows:



The Australian Criminal Intelligence Commission will continue engaging with all states and territories in an attempt to secure their ongoing participation in sampling for future reports. Participation from all states and territories is vital to informing our understanding of the national picture of drug use and demand. In the event that one or more states and territories decide not to participate in the national program in the future, the Australian Criminal Intelligence Commission will identify replacement sites from participating states and territories to ensure that the largest possible segment of the national population is sampled. Accordingly, the location of sites within and between states and territories may change over the three years of the contract.

The third National Wastewater Drug Monitoring Program report reflects a further evolution of the process and for the first time includes heroin among the substances selected for testing. Moreover, while the first two wastewater reports included MDA, the drug was reported solely as a metabolite of MDMA. In this and subsequent reports, the figures for MDA will reflect estimated MDA use. The Australian Criminal Intelligence Commission will continue to review the appropriateness of the monitored substances with its partners, stakeholders and the universities.

REPORTING

National Wastewater Drug Monitoring Program reports will be published as comprehensive public reports three times a year, as per the program contract. In accordance with current wastewater analysis conventions, the terms of the contract, and to protect the integrity of the program, the exact locations of wastewater treatment plants will not be publicly released by the Australian Criminal Intelligence Commission.

To maintain the confidentiality of the participating sites, each site was allocated a unique code so that results could be de-identified. However, trends in particular states and territories are still able to be identified. The public reports will incorporate a discussion of trends in drug use where distinct trends are seen—for example, between regional areas and capital cities, or between states and territories and nationally—and will include comparisons with testing from previous years where that data is available. Similar to the March 2017 report, the March 2018 report will include an assessment of where Australian consumption of some substances sits in comparison with international trends.³

Stakeholders in law enforcement, health and other relevant policy agencies will be given classified reports which identify actual sampling locations in order to inform appropriate responses.

³ The data is only updated annually because, although Australian data is updated every four months, the comparable international data is only collated and updated annually.

EXPLOITATION OF THE NATIONAL WASTEWATER DRUG MONITORING PROGRAM DATA

The Australian Criminal Intelligence Commission intends that the findings of the National Wastewater Drug Monitoring Program analysis will be fundamental to the development of government policy and decision making, as the reports will provide a regular, timely, unambiguous and detailed measure of the level of demand for the listed commodities in the Australian population, complementing other drug datasets published in Australia. The third National Wastewater Drug Monitoring Program report measures drug use by approximately 61 per cent of the Australian population. It is hoped that wastewater data will be used with other available data sources to obtain a more comprehensive and accurate understanding of drug markets nationally and in the respective states and territories.

Findings from the previous two National Wastewater Drug Monitoring Program reports have already been used by agencies to shape local responses and as part of their planning processes—evidence that the program is providing meaningful and actionable intelligence to inform Australia's response to drug supply and demand.

Making the National Wastewater Drug Monitoring Program data available to the public and to public agencies will enrich understanding and inform the national conversation on trends in the demand for drugs. Because the collection and analysis protocols are similar, it will also be possible to compare domestic drug use with levels of use internationally, which may stimulate further discussions on alternative responses to the threat posed by drug use. The National Wastewater Drug Monitoring Program represents world best practice. Reasons for this include:

- the level of sophistication of the University of Queensland and University of South Australia staff who implement the program
- the amount of funding that has been provided to implement the program, which is unique in world terms
- the breadth, depth and geographic scope of the coverage of the population
- the number of substances covered
- the frequency of sampling and reporting
- the ongoing close collaboration between the Australian Criminal Intelligence Commission, the universities and the wastewater treatment plants
- the use of wastewater findings to not only obtain reliable contemporary data, but also to inform and monitor policy and operational responses.

The Australian Criminal Intelligence Commission is also considering methods of using National Wastewater Drug Monitoring Program data as a measure of the effectiveness of supply and demand reduction initiatives in selected locations around the country. The Australian Criminal Intelligence Commission is working to ensure the broadest possible range of stakeholders are engaged throughout the life of the program, consulting with stakeholders through existing drug forums and direct discussions with agencies. Since the release of the first public report in March 2017, the Australian Criminal Intelligence Commission has delivered a series of presentations to forums in Australia and New Zealand concerning the National Wastewater Drug Monitoring Program's capability and the significant potential it offers for enhanced collaboration. In October 2017, representatives from the University of Queensland, University of South Australia and the Australian Criminal Intelligence Commission attended the 3rd International Conference on Wastewater-Based Drug Epidemiology to contextualise the work that is being done in Australia and gain insight into potential means of enhancing the program.

The National Wastewater Drug Monitoring Program is based on a well-established and internationally recognised methodology which has been applied to varying extents by many other nations. In the Australian context, wastewater has been identified as offering an important, unified and consistent guiding tool in developing holistic drug responses. To this end, the scope of the sampling will generate data which will help governments at both a state and national level to formulate appropriate responses.

RESULTS FROM THE INITIAL COLLECTION

Building on the baseline assessment of national drug consumption provided by the first and second public reports, the third report of the National Wastewater Drug Monitoring Program contains data on drug use patterns across states, territories and the nation. It provides data on capital city and regional drug use and, where possible, comparisons with previous levels of use in sites across Australia. This and future reports will contribute further data to identify trends, changes in patterns of use and emerging issues—building a comprehensive and increasingly detailed picture of national drug consumption.

Reported results reflect per capita use in all locations and are expressed in terms of both the number of doses and the weight or volume per capita of the respective substances, to facilitate comparison between substances.



RESEARCH FINDINGS

Prepared for the Australian Criminal Intelligence Commission by:

The University of Queensland

(B Tcharke, R Mackie, J O'Brien, S Grant, J Mueller)

University of South Australia

(M Ghetia, H Aghera, R Bade, C Gerber, J White)



LIST OF ABBREVIATIONS

ABS	Australian Bureau of Statistics
ACIC	Australian Criminal Intelligence Commission
ACT	Australian Capital Territory
DASSA	Drug and Alcohol Services South Australia
LC-MS/MS	Liquid chromatography tandem mass spectrometry
LOD	Limit of detection
LOR	Limit of reporting
MDA	3,4-methylenedioxyamphetamine
MDMA	3,4-methylenedioxymethylamphetamine
NPS	New psychoactive substances
NSW	New South Wales
NT	Northern Territory
NWDMP	National Wastewater Drug Monitoring Program
QLD	Queensland
SA	South Australia
SPE	Solid phase extraction
TAS	Tasmania
VIC	Victoria
WA	Western Australia
WWTP	Wastewater treatment plant

TERMINOLOGY

Methylamphetamine is also commonly known as methamphetamine. In this report, consistent with the preferences of the Australian Criminal Intelligence Commission, methylamphetamine is used.

MDMA is commonly known as ecstasy.

Alcohol consumption in this report refers to ethanol consumption but the more general term ‘alcohol’ is used throughout.

Nicotine consumption has replaced tobacco consumption in this report, as the target metabolites may also be derived from nicotine replacement products such as gums and patches.

1: EXECUTIVE SUMMARY

Wastewater analysis is now a standard method for measuring population-scale use of a range of different chemical compounds. The underlying concepts involved in wastewater analysis were demonstrated in the first national Australian report released in March 2017. Estimates of drug usage in a population were back-calculated from measured concentrations of drug metabolites (excreted into the sewer system after consumption) in wastewater samples. Spatial and temporal trends in drug use have now been included using this approach for several sites across Australia. The National Wastewater Drug Monitoring Program (NWDMP) for the Australian Criminal Intelligence Commission (ACIC) monitors selected substances of concern in most populated regions of Australia. The study now focuses on 14 licit and illicit drugs, including nicotine, alcohol, methylamphetamine, cocaine and MDMA (ecstasy). Heroin and MDA have been included for the first time. Trends in estimated drug consumption will be established over the three-year project. Wastewater treatment plants (WWTPs) located across capital cities and regional Australia, covering all states and territories, have been invited to participate in this program.

For this third report, wastewater samples were collected during weeks of April, June and August 2017. A total of 22 WWTPs in capital cities and a further 32 regional sites participated in the project for the August 2017 period, covering a population of more than 14 million Australians. Data from this report equates to coverage of approximately 57%, 51%, and 61% of Australia's population for April, June and August, respectively. A total of 1 425 individual daily samples have been assessed since the beginning of the program, with results from 690 additional samples added in this current report. The collected samples provide relatively comprehensive, Australia-wide baseline data against which subsequent data can continue to be compared to ascertain both spatial and temporal trends. Twenty-four-hour composite wastewater samples were collected using time-proportional or flow-proportional autosamplers at the influent of each WWTP by plant operators. Samples were collected for up to seven consecutive days. Concentrations of drug metabolites were determined in the wastewater using liquid chromatography-tandem mass spectrometry (LC-MS/MS) analytical methods. Drug consumption estimates for each catchment population were calculated from these measured concentrations using flow volumes and estimates of the catchment population size provided by the treatment plants, together with excretion and dose data derived from the scientific literature. To maintain treatment plant confidentiality, each site was allocated a unique code and site names are not included in this report.

The estimated drug usage across the 54 sites (August 2017) was consistent with previous reports. After normalising the amount of drug measured in wastewater for population size and average dose consumed, alcohol and nicotine were consistently the highest consumed drugs in all states and territories. Estimated consumption of nicotine was generally higher in regional areas compared to capital cities. In the case of alcohol, the difference was less pronounced. The Northern Territory had the highest consumption of nicotine and alcohol, but with only two participating sites, the result may not be representative of the Territory as a whole. In other parts of Australia, alcohol consumption was similar for the most part, except for regional South Australia, where it was relatively low. This may be a consequence of samples provided for week days only, when consumption is typically lower. Nicotine use across the nation was fairly consistent.

Methylamphetamine remains the highest of the illicit drugs included in the report, both in capital cities and regional sites. The highest methylamphetamine levels were seen in South Australia (capital city) and Western Australia (regional). Comparing the latest findings of drug use with previous data for sites in Queensland and Western Australia, current methylamphetamine levels have shown an overall decline since historical highs in October 2016. The South Australian level also showed a decline during the past year, except for the August 2017 collection when levels returned to previous highs. Methylamphetamine levels in Victoria remained steady.

Amphetamine is a metabolite of methylamphetamine and measured amphetamine concentrations across the sites were consistent with the observed levels being primarily related to methylamphetamine metabolism rather than sourced from direct consumption.

Compared to methylamphetamine, estimated usage of other stimulants was generally much lower, although no consistent pattern (profile) of usage for these other drugs could be observed between states and territories. Cocaine consumption in Australia is mostly centred in New South Wales across several capital city and regional sites. Levels in the Australian Capital Territory have increased to become second highest in the nation. At sites elsewhere around the country usage was low in comparison. MDMA usage was similarly low across most sites with a few site-specific exceptions.

Oxycodone and fentanyl, which are both pharmaceutical substances with abuse potential through diversion, had elevated consumption levels at several regional sites. It should be noted that recorded usage is predominantly derived from prescription of the substances. Regional areas had average oxycodone use well above capital city sites in many states. Heroin was included as an illicit opioid for the first time. Consumption of the compound varied widely, with minimal amounts detected in the Northern Territory and high levels recorded in sites in Victoria and the Australian Capital Territory, as well as a few individual sites in other states.

MDA has been included for the first time. After removing the proportion of MDA attributable to MDMA metabolism, use of the drug appeared variable across the nation, with South Australia being the lowest. A feature was a site in regional Queensland where measured levels were extremely high. For the other drugs included in this study, methylone and mephedrone, concentrations were generally at or below detection levels at all participating sites, while JWH-018 and JWH-073 were not detected in any samples.

The collection of wastewater samples at regular intervals allowed for the temporal comparison of consumption data. While small overall changes were evident at both a site and a state or territory level, more data are required to draw longer term conclusions. The recent declines in methylamphetamine use in Queensland and Western Australia, and to a lesser extent South Australia, were clear reversals in longer term trends. A gradual reduction in pharmaceutical opioid use, particularly oxycodone, was also apparent.

2: INTRODUCTION

2.1: PREAMBLE

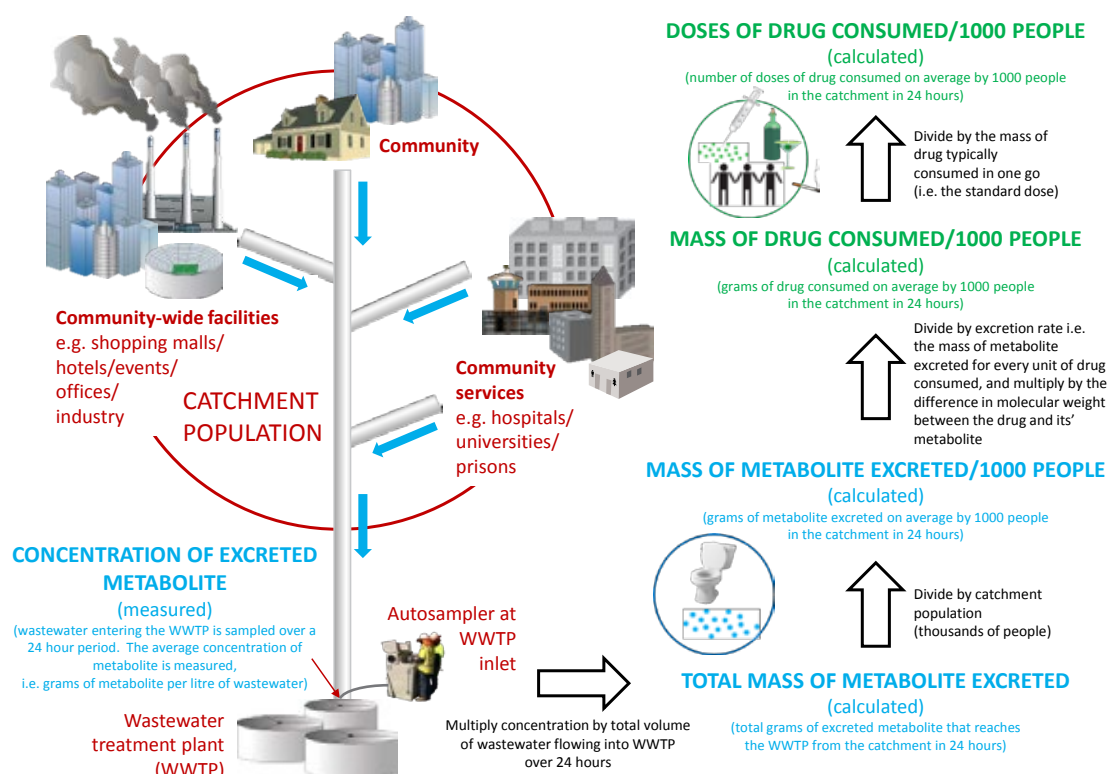
Wastewater analysis is a technique for delivering population-scale consumption of substances. The University of Queensland and University of South Australia have been commissioned to provide drug consumption data to the ACIC for a period of three years, beginning in August 2016. A total of approximately 50 wastewater treatment sites have been assessed, bimonthly in the case of capital city sites and every four months for regional sites. The aim is to acquire data on the population-scale use of substances that cause potential harm, either through addiction, health risks, or criminal and anti-social behaviour. The intention is to establish baseline data of substance use across Australia. This third National Wastewater Drug Monitoring Program report compares consumption data from the first two reports with results obtained subsequently from April, June and August 2017.

Compounds of concern include nicotine from tobacco, ethanol from alcohol intake, pharmaceutical opioids with abuse potential, illicit substances such as methylamphetamine, MDMA and cocaine, as well as a number of new psychoactive substances (NPS) including synthetic cannabinoids. The compounds amphetamine and MDA were measured but not included in the initial reports. Amphetamine is a by-product of methylamphetamine pyrolysis and also one of its metabolites. MDA is a metabolite of MDMA, but since the proportion of MDA derived from MDMA is known, the difference between measured MDA and MDMA metabolite has now been included in the current report. The amount of MDA was calculated by subtracting 1.65 mg of MDA for every 100 mg of MDMA consumed (Khan 2011). The report presents patterns of substance use across Australia, showing differences in levels between capital cities and regional centres within states and territories, and nationally.

3: METHODS

The method underlying wastewater based monitoring of drug use in a given population is based on the principle that any given compound that is consumed (irrespective of whether it is swallowed, inhaled/smoked or injected) will subsequently be excreted (either in the chemical form it is consumed and/or in a chemically modified form that is referred to as a metabolite). The excreted compound or metabolite will eventually arrive in the sewer system. The drugs and their metabolites of interest in this study are given in the first National Wastewater Drug Monitoring Program report (available at www.acic.gov.au). Collectively, waste products in the sewer system arrive at a wastewater treatment plant (WWTP) where wastewater samples are collected over a defined sampling period. Measuring the amount of target compound in the wastewater stream allows for a back-calculation factor to be applied to determine the amount of drug that was used over the collection period (Figure 1). The method is non-invasive and is done on a population-scale level, so individuals are not targeted and privacy is respected.

Figure 1: Schematic of the population catchment area and methodology employed to convert measured concentration of substances in wastewater to mass loads or doses consumed per day per normalised population.



To obtain an estimate of drug use, representative samples are collected over a given period (typically 24 hours) using autosamplers that collect time or flow proportional samples. Wastewater treatment plant operators provide assistance with collecting the samples from the influent autosampler (where the wastewater enters the treatment plants). Details of the calculation methods are given in the first National Wastewater Drug Monitoring Program report.

Collected wastewater samples were analysed at the University of South Australia and the University of Queensland laboratories. The steps routinely performed in our laboratories are based on filtration of the samples followed by an enrichment/concentration step where the concentrated sample is injected, or (for chemicals with sufficiently high concentrations) direct injection of samples into the analytical instruments. The instrumental analysis consists of chromatographic separation and subsequent compound specific detection. A summary of the extraction and analytical methods is given in the first National Wastewater Drug Monitoring Program report. An updated excretion and dose table including the heroin metabolite, 6-monoacetylmorphine, can be found in Appendix 1.

3.1: PARTICIPATING WASTEWATER TREATMENT PLANTS (WWTPs)

Fifty-four WWTPs across Australia participated in this study for the August 2017 collection (Figure 2). Of these, 22 sites were located in capital cities and a further 32 were regional sites covering a wide range of catchment population sizes. Sites were selected by the ACIC. The number of participating sites for April, June and August 2017 is listed Table 1. A complete list of participating sites, number of samples and relative catchment sizes is listed in Appendix 2. To maintain the confidentiality of the participating sites, all sites were allocated a unique code to de-identify their results. Only site codes are presented in the results sections.

Figure 2: Participating WWTPs in August 2017, showing the split between capital city and regional plants by state and territory. The colours in this figure are used in the remainder of the report to identify results relating to individual states and territories.

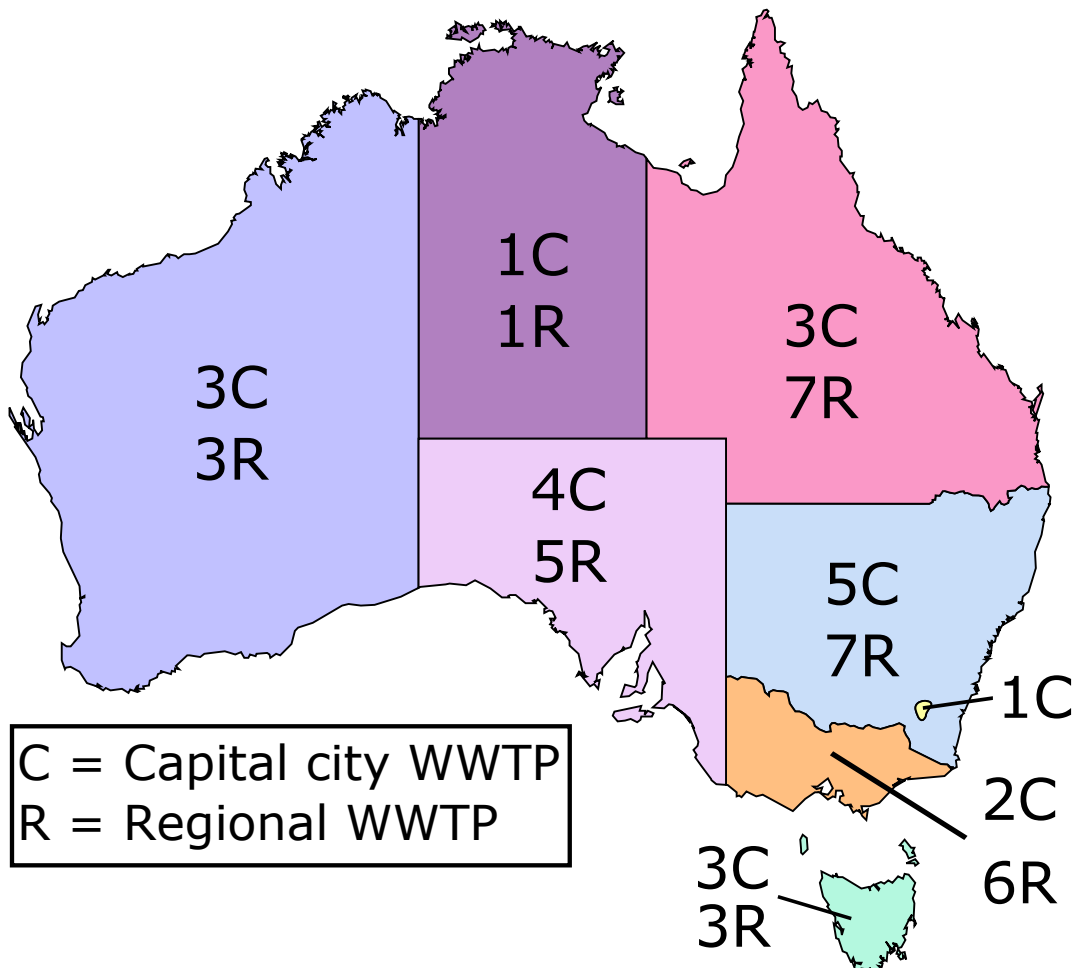


Table 1: Number of participating WWTPs for the periods covered in this report. Every second collection period aims to collect data from both regional (R) and city (C) sites (Apr and Aug), while the in-between collection periods (Jun) aim to collect data from city sites only.

	Apr-17		*Jun-17		Aug-17	
State/territory	C	R	C	R	C	R
ACT	1	-	1	-	1	-
NSW	3	2	3	-	5	7
NT	-	-	-	-	1	1
QLD	3	8	3	-	3	7
SA	4	5	4	-	4	5
TAS	-	-	-	-	3	3
VIC	2	2	2	-	2	6
WA	3	3	3	-	3	3
Population (millions) C & R	11.9	1.2	11.9	-	12.4	1.8
Total Population (millions)	13.1		11.9		14.2	
% of Australian population	57%		51%		61%	

* Every second time point aims to sample from only capital city sites.

Census 2016 population used (23 401 892) for population percentage estimates.

Estimates have been rounded to the nearest 0.1 million. For a complete site list for all reports, see Appendix 3.

3.2: SAMPLE COLLECTION AND PREPARATION

Composite samples were collected by treatment plant staff daily on seven consecutive days from Monday to Sunday, or where seven days was not feasible, across as many consecutive days as possible. Samples were stored at 4°C or were frozen prior to transport to Adelaide or Brisbane. Further details of the sampling protocol and relevant quality controls are included in Irvine et al. (2011), Lai et al. (2011), Lai et al. (2015), Tschärke et al. (2016). All other descriptions of calculations, extractions and analytical methods are outlined in the first National Wastewater Drug Monitoring report.

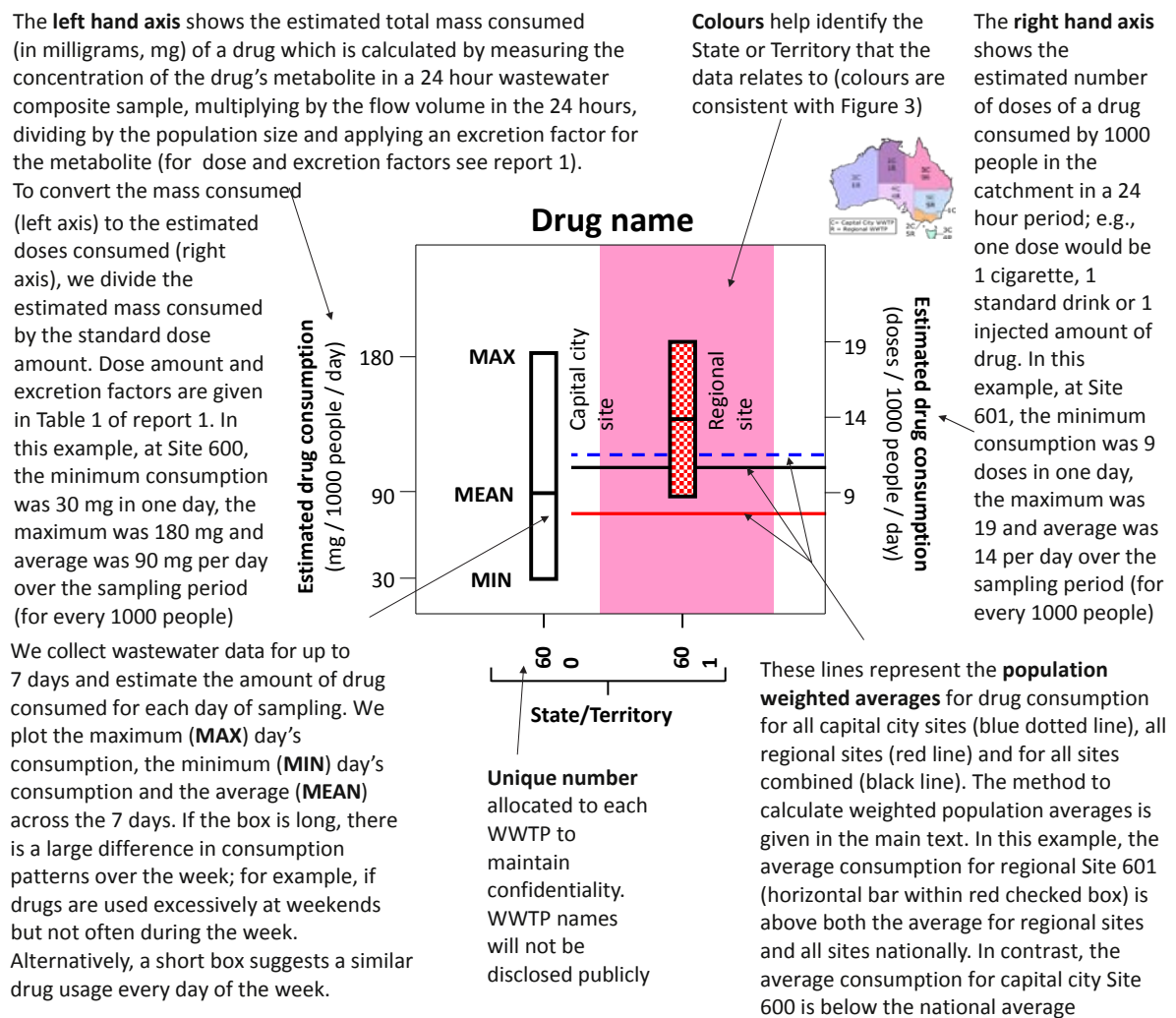
3.3: PRESENTATION OF DATA AND INTERPRETATION OF GRAPHS

Reported averages: All averages for state/territory or Australia-wide drug consumption data are presented throughout this report as population weighted averages. The number of people in the catchment population is used as the weighting for the respective drug consumption data for that population. For example, to calculate the population weighted average of capital city methylamphetamine consumption, the methylamphetamine consumption data for each WWTP was multiplied by the respective population number, all data were then summed and divided by the total population across all capital city sites. Reported average values are therefore not skewed towards usage data from small, non-representative populations.

Per capita consumption: The per capita consumption estimates presented in this report are calculated using the total estimated catchment population (which includes children). For example, per capita alcohol consumption has previously been reported by the Australian Bureau of Statistics (ABS) based on population numbers for people aged 15 and over. The consumption values presented in the current report will be under-estimated compared to those determined for an adult-only population. For consistency, data from other studies included in this report were recalculated where necessary using estimated total population.

Graphical presentation of data: An overview of how the data is presented in the graphs for the individual sites is given in Figure 3. This includes information on interpreting the consumption data presented on the vertical axes in all graphs in this report; in some graphs, the values plotted in the graph can be read as either mass of drug consumed (left axis) or doses of drug consumed (right axis). For the specific case of MDA, the amount of MDA excreted following MDA consumption is not known, and therefore for this drug we can only express the results as how much drug was excreted into the sewer network, e.g. the mg excreted per 1 000 people per day.

Figure 3: Explanation of the graphical representation of data for individual sites. General concepts relevant to all graphs in the report are also outlined (unique site codes, explanation of vertical axes, colour coding).



Instrumental method limits of detection and limits of reporting: Since the wastewater samples contain very low quantities of particular drugs, the limit of detection (LOD) was determined analytically as the lowest concentration of that drug that could be distinguished in the sample (using the methods described in Report 1). A drug may be present at a concentration below the LOD. However, trace quantities may actually be present at undetectable levels. The limit of reporting (LOR) is a concentration (higher than the LOD), above which we have high confidence that the concentration measured on the analytical instrument is accurate. Above the LOD but below the LOR there may be some uncertainty as to the actual concentration. To be conservative (a drug may be present but there is uncertainty as to its concentration) and in line with current practise, for back calculations to estimate per capita consumption, a concentration below the LOD is included at a value of LOD. A concentration above the LOD but below LOR, is included at the midpoint between the LOD and LOR (i.e. $(\text{LOD} + \text{LOR})/2$).

Weekly pattern of drug use: The pattern of drug use over the sampling week for the sites in this report cannot be elucidated from the data included in the current report. We present only maximum, minimum and average (for the individual sites) (Figure 3) and only average (or population weighted average, see above) values for all other graphs. Consistent patterns of drug use in Australia from previous wastewater-based epidemiology studies indicate that some illicit drugs such as cocaine, MDMA, mephedrone and methylone, have high variation in weekly consumption rates, with higher consumption on weekends. Other drugs such as methylamphetamine, oxycodone and fentanyl appear to have a lower daily variation, suggesting that their consumption is consistent throughout the week (Lai et al., 2015, Tscharke et al., 2016).

4: RESULTS

Estimated drug consumption data are presented in several different ways in the following sections to allow comparisons of drug use at the individual site level (Section 4.1), between states and territories (Section 4.2) and within each state and territory (Section 4.3). We recommend exercising caution when comparing results between sites. Although every effort has been made to ensure accuracy, population size and estimated consumption may be affected by inaccuracies in population figures provided by plants or managing agencies. Revisions to population estimates for each WWTP based on the 2016 Census results will be incorporated from Report 4 and will result in a greater level of accuracy. The uncertainties in individual population estimates have less impact when data are averaged, for example when broader comparisons at the state/territory or international level are undertaken. The uncertainties in population numbers are particularly evident in smaller regional communities or sites where short term population changes occur due to employment opportunities, tourism or festival events.

4.1: INDIVIDUAL SITE COMPARISON OF DRUG USE IN AUGUST 2017

4.1.1 NICOTINE AND ALCOHOL

Tobacco consumption was estimated by measuring two nicotine metabolites. The method does not distinguish between nicotine intake from tobacco or electronic cigarettes and nicotine replacement therapies such as patches and gums. Therefore, for the sake of accuracy, the estimate has been changed from tobacco in previous reports to nicotine in this report. Estimated nicotine consumption varied significantly between sites and regions (Figure 4). Sites in regional areas across all states and territories showed noticeably higher per capita consumption levels during August 2017 than capital city precincts. This was evident from the regional vs capital city averages for the August sampling period (red horizontal and dotted blue lines, Figure 4). The Northern Territory and Tasmania were the only regions where consumption in capital city sites matched rural levels. However, since only a single capital city and rural site were included in the Northern Territory, this may not be indicative of the general population in the region.

Alcohol was measured using a specific metabolite of ethanol. Differences between the average capital city and regional centre alcohol consumption were less pronounced than for nicotine (Figure 5). Many sites showed a wide range over the collection week. Alcohol consumption in some regional areas of Victoria, South Australia and parts of Queensland was well below the national average. However, many regional sites did not sample on weekends, when consumption of alcohol is typically higher. The Northern Territory and many Western Australian sites were above the national capital city and regional averages.

Figure 4: Estimated nicotine consumption for August 2017 in mass of nicotine consumed per day (left axis) and number of cigarettes per day (right axis) per thousand people. The number of collection days varied from 4-7.

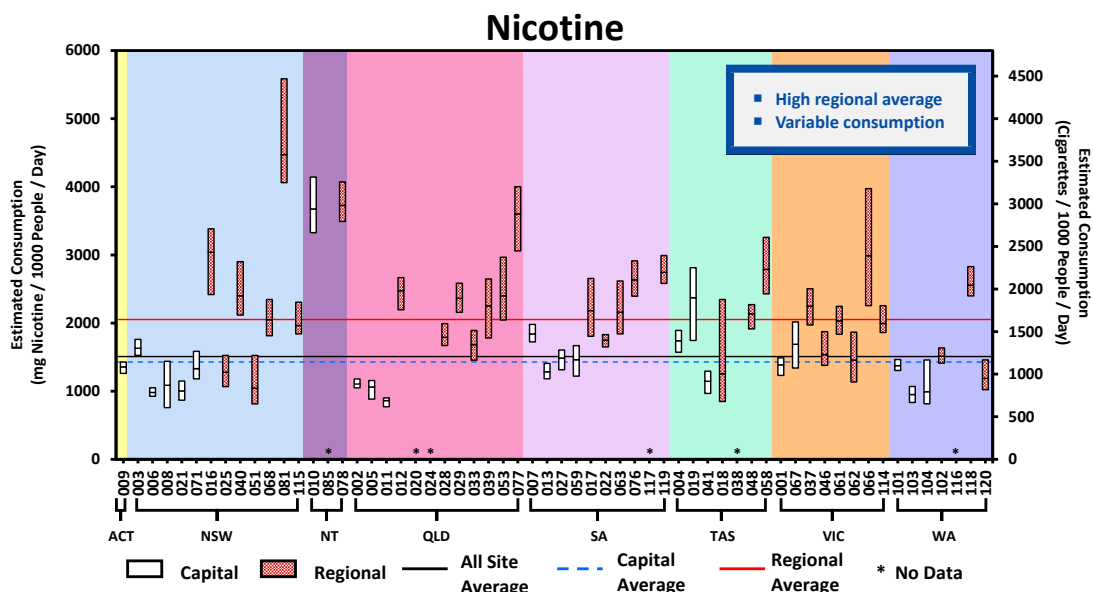
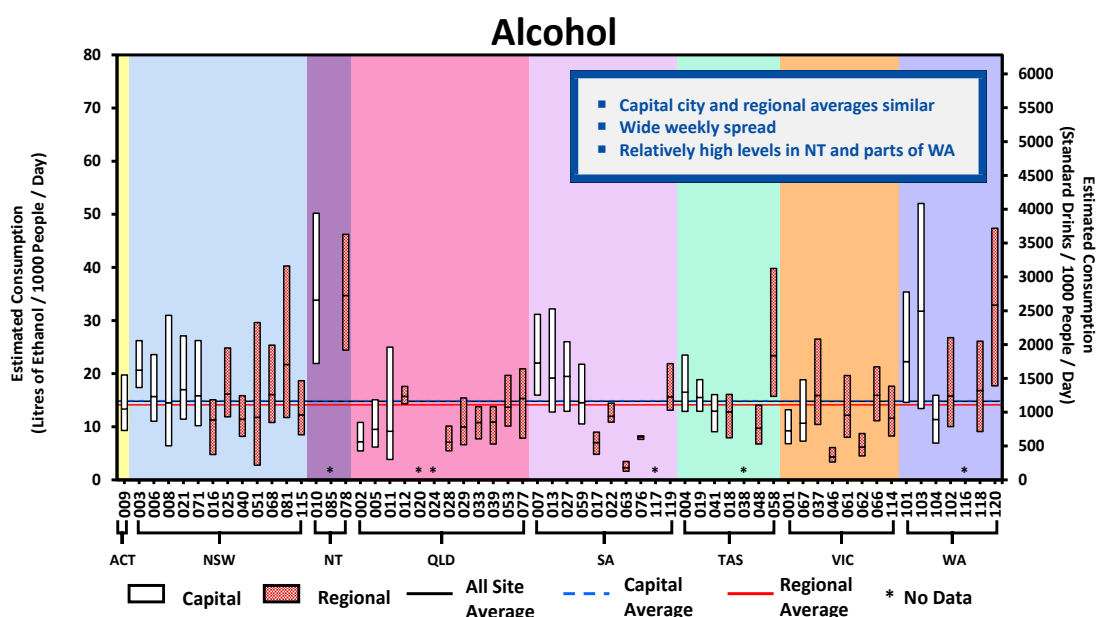


Figure 5: Estimated alcohol consumption for August 2017 in volume consumed per day (left axis) and standard drinks per day (right axis) per thousand people. The number of collection days varied from 4-7.



4.1.2 STIMULANTS

The relative estimated consumption levels across the participating sites for four stimulants, methylamphetamine, cocaine, MDMA and MDA, are described in more detail below.

4.1.2.1 METHYLAMPHETAMINE

Estimated mass loads of methylamphetamine were high compared to other illicit substances. The average regional and capital city consumption was at similar levels. However, large site differences were evident. The high variability in consumption was observed across all states. Mass loads in capital city South Australia were the highest in the nation in August 2017 (Figure 6).

4.1.2.2 AMPHETAMINE

The concentration of amphetamine observed in the August 2016 and August 2017 samples strongly correlated with the methylamphetamine concentrations, with approximately seven times higher methylamphetamine measured than amphetamine for both years (see Appendix 4 of Report 1) which is consistent with the reported amphetamine excretion range following methylamphetamine consumption (Gracia-Lor et al., 2016). Therefore, we assumed that the levels of amphetamine measured were predominantly metabolites of methylamphetamine. It is possible that some of the amphetamine measured could be a result of amphetamine ingestion. But, due to the much higher methylamphetamine consumption and excretion profile, this cannot be confirmed by our present data.

4.1.2.3 COCAINE

Cocaine was measured using its specific metabolite, benzoylecgonine. Unlike methylamphetamine, capital city areas on average had higher cocaine use than regional centres (Figure 7). However, it has to be recognised that many regional sites did not provide weekend samples, unlike capital cities, when consumption of cocaine is known to peak (Lai et al., 2016 and Tschärke et al., 2016). Western Australia had relatively low consumption in both regional and capital city areas. In contrast, capital city New South Wales showed the highest levels nationwide, while consumption in regional parts of the state were also higher than the national average. Nevertheless, the scale of cocaine use in Australia remained noticeably lower than methylamphetamine levels.

4.1.2.4 MDMA (3,4-METHYLENEDIOXYMETHYLAMPHETAMINE)

In comparison with other illicit substances, estimated consumption of MDMA was low across the country (Figure 8). Site 10 in capital city Northern Territory had relatively high levels on some days of the week, but in general, levels were comparable across the nation. The regional average was slightly lower than capital city sites. A direct comparison of regional and capital city sites in some states (e.g. South Australia) may be inappropriate as many regional sites did not sample on weekends when MDMA consumption is typically higher.

4.1.2.5 MDA (3,4-METHYLENEDIOXYAMPHETAMINE)

MDA previously had low overall detection frequency using a direct injection method. In this latest report, the compound was detected after concentrating the sample using solid phase extraction (SPE) prior to analysis to improve the sensitivity of the method. Data is not available in the scientific literature for the proportion of MDA that is eliminated after MDA consumption. However, data is available detailing the proportion of MDA eliminated after MDMA consumption. Therefore, the proportion of MDA attributable from MDMA metabolism was subtracted from the total measured amount of MDA for each site. Data for MDA is expressed as mg excreted per 1 000 people per day and cannot be expressed as consumption due to the lack of metabolic information of MDA elimination following MDA consumption. Although the dosage of MDA is not known, it is likely to be similar to that of MDMA, of 100 mg. The daily mass loads for regional sites were on average higher than capital cities (Figure 9). Site 12 in Queensland had very high levels compared to other sites in the state and elsewhere and may have distorted the average value for regional centres. Since the parent drug is measured in wastewater, disposal of unused drug into the sewer system may result in unusually high values being recorded. South Australia generally had the lowest levels of MDA, both in regional and capital city centres.

Figure 6: Estimated methylamphetamine consumption for August 2017 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 4-7.

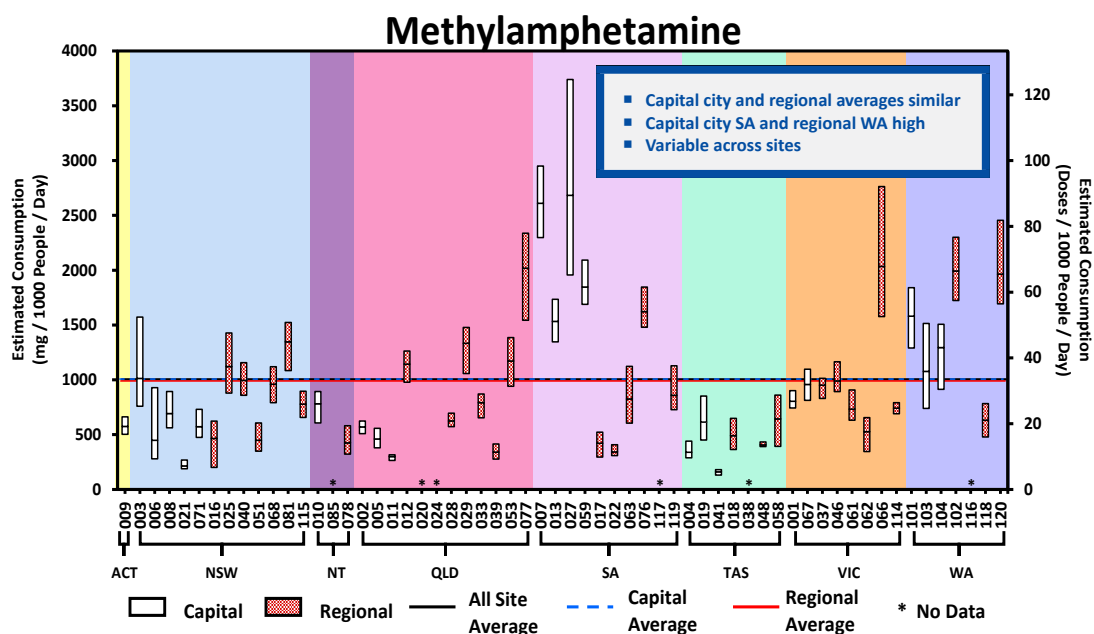


Figure 7: Estimated cocaine consumption for August 2017 in mass consumed per day per thousand people (left axis) and doses per day (right axis). The number of collection days varied from 4-7.

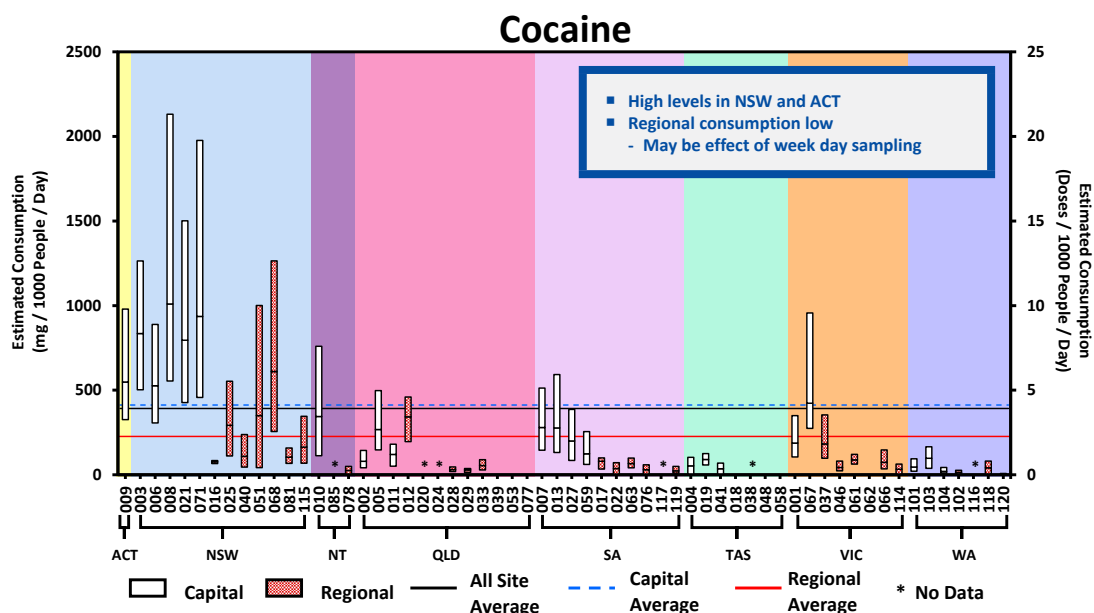


Figure 8: Estimated MDMA consumption for August 2017 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 4-7.

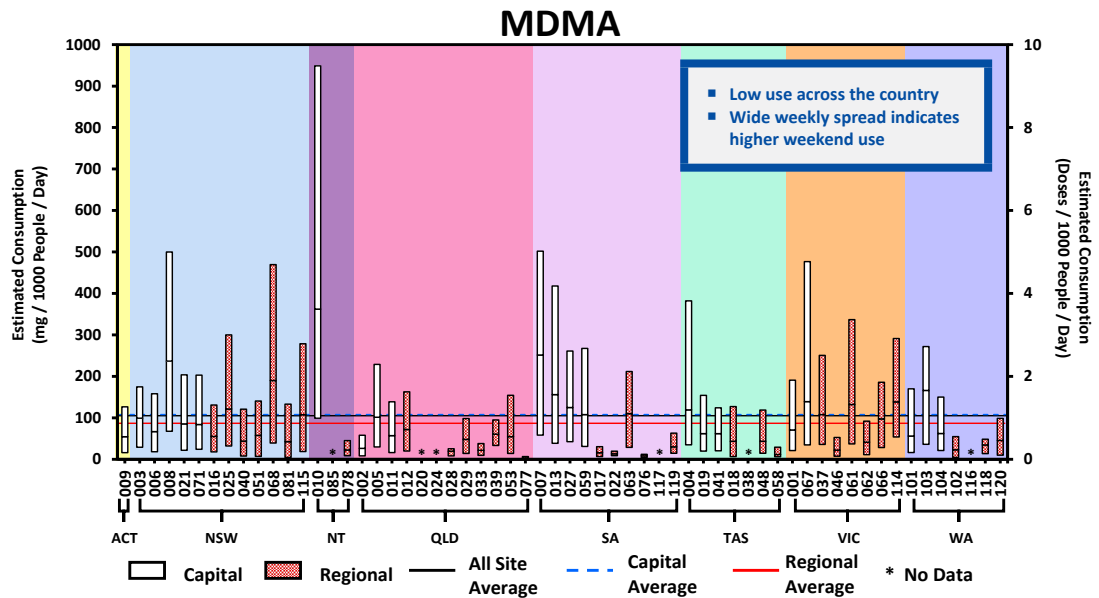
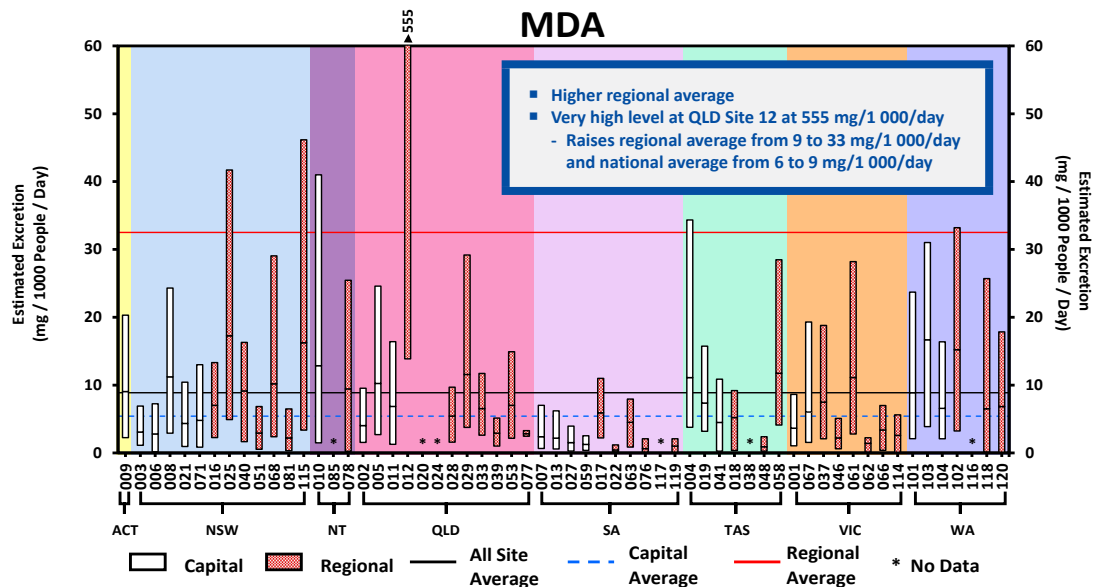


Figure 9: Estimated MDA consumption for August 2017 in mass consumed per day per thousand people. The number of collection days varied from 4-7.



4.1.3 OPIOIDS

Two pharmaceutical opioids were measured, as well as heroin, an illicit drug.

4.1.3.1 PHARMACEUTICAL OPIOIDS

Although oxycodone and fentanyl are legally prescribed pharmaceuticals, they are substances with abuse potential. The metabolism and excretion of both compounds are well characterised. The major metabolite of each compound was measured to estimate drug consumption.

Consumption of oxycodone in regional sites was well above capital city levels, with the regional national average being almost double that of the capital cities (Figure 10). Regional Queensland and parts of Tasmania and Victoria were amongst the highest overall users of oxycodone, while South Australia and Tasmania were highest of the capital city sites.

The extent of fentanyl use was very variable across the nation. Some regional centres in almost every state had values well above the national average (Figure 11). One location in particular, Site 81 in New South Wales, gave a value that was almost three times the next highest measurement. Factors such as the relatively low population at this site, the above-average age and high number of per capita hospital beds may all play a role to account for the high fentanyl use. As this was the first data collected from Site 81, future results from this site will place the current value in context and confirm whether it was indicative of usual consumption for the area. Except for a few sites, regional consumption was substantially higher than capital city areas. Rates of fentanyl use in capital cities across Australia were at comparable levels, with relatively small differences in per capita consumption per day between sites.

4.1.3.2 HEROIN

Heroin has been included in the project for the first time. The compound is metabolised by users and excreted in low amounts as the unique metabolite, 6-monoacetylmorphine (6-MAM). A method to detect heroin by 6-MAM was described in a paper by Tschärke et al., 2016. Since 6-MAM is characteristic of heroin use, it can be used to distinguish heroin from other opioids such as morphine and codeine. Heroin consumption in Australia in August 2017 was relatively low (Figure 12). Site 67 in Victoria had the highest consumption of capital cities. Levels in regional areas were generally lower than capital cities. However, some regional areas of Victoria and New South Wales recorded the highest levels of all measured locations. The large daily differences observed at Victorian Site 46 is atypical of heroin use and may be indicative of a changing population during the week, or other reasons. New South Wales Site 40 recorded high heroin levels on two days of the week, but nothing on the remaining 5 days. Disposal of unconsumed heroin may cause such a result since the illicit drug contains small quantities of the metabolite, 6-MAM, as an impurity.

Figure 10: Estimated oxycodone consumption for August 2017 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 4-7.

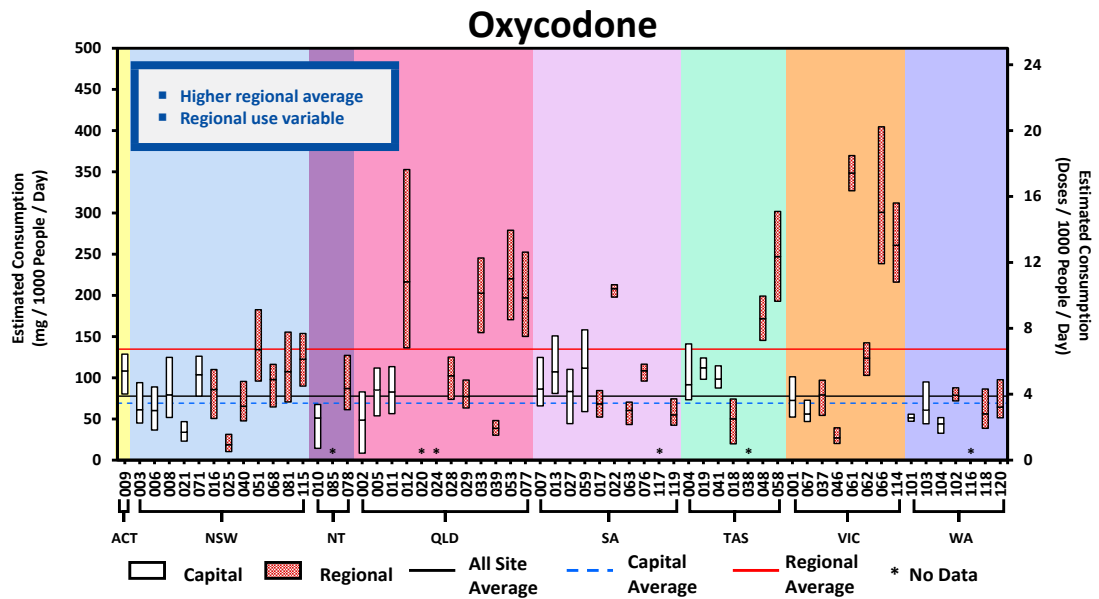
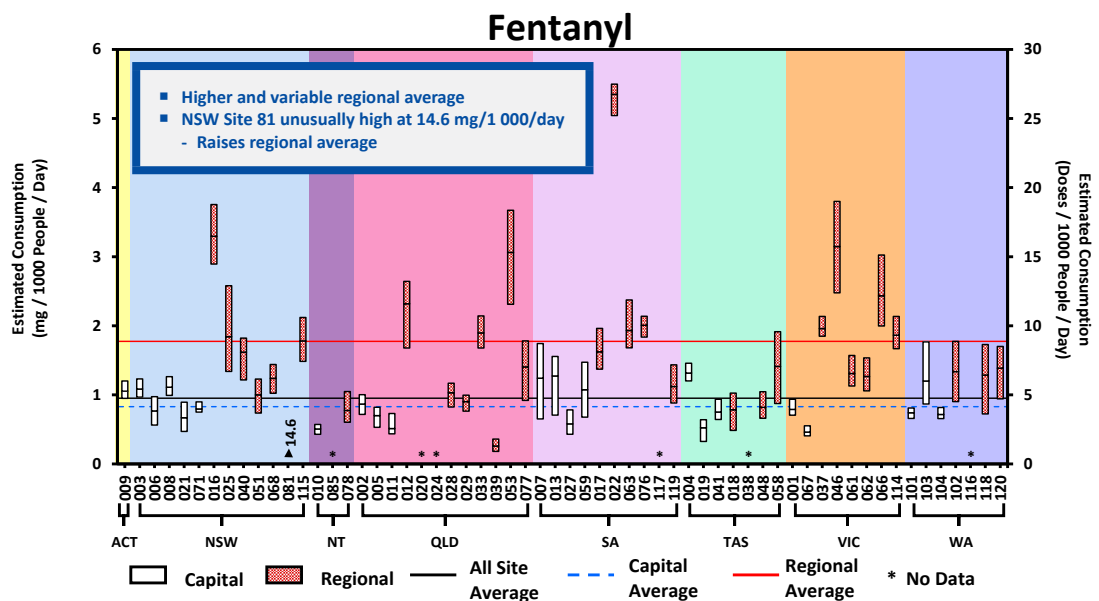
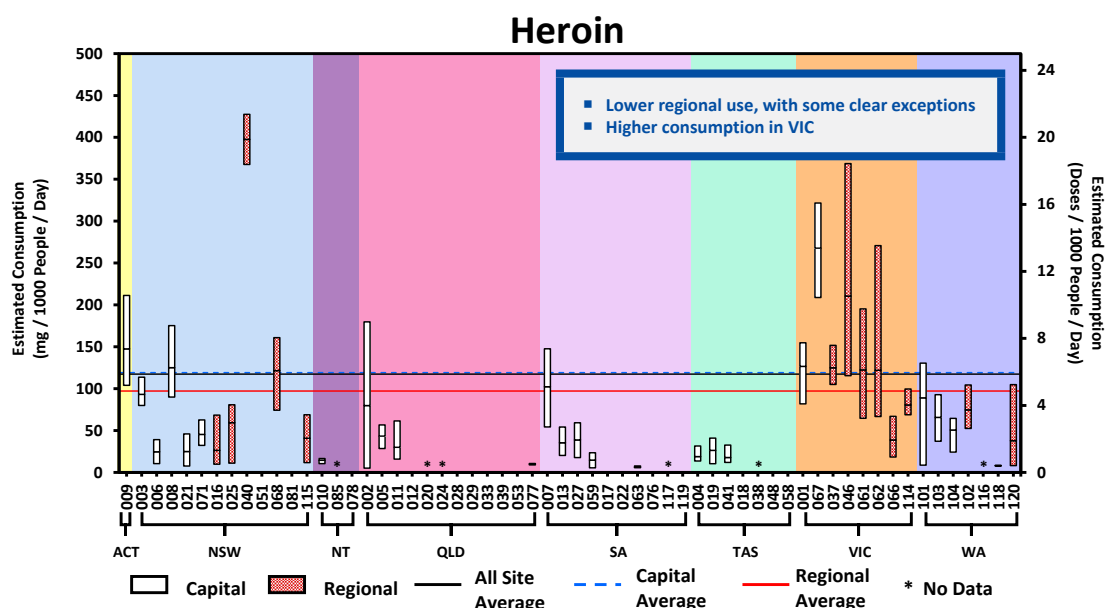


Figure 11: Estimated fentanyl consumption for August 2017 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 4-7.



Site NSW:081 was above the scale, with a mean consumption value (mg/1 000/day) indicated by the arrow.

Figure 12: Estimated heroin consumption for August 2017 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 4-7.



4.1.4 NEW PSYCHOACTIVE SUBSTANCES

Methylone, mephedrone and two synthetic cannabinoids, JWH-073 and JWH-018, were included in the study. Limited information is available on the human metabolism and excretion of these drugs. Therefore, the parent compound was measured. It is probable that a significant proportion of the ingested drug is converted into different metabolites. Apart from sporadic instances of methylone detections in Queensland, only a few sites showed evidence of methylone and mephedrone use. The measured levels were mostly below the limits of reporting. Sites that showed the presence of the two compounds are qualitatively listed in Table 2 for the August 2017 period. No JWH-073 or JWH-018 was detected in any of the samples.

Table 2: The number and code of sites per state and territory where mephedrone and methylone were detected in August 2017. The total number of daily samples that were assessed in August was 342.

State/territory	Number of detections Aug 2017		Sites detected Aug 2017	
	Mephedrone	Methylone	Mephedrone	Methylone
NT	0	3		010
ACT	0	0		
NSW	0	2		006, 115,
				002, 005, 011,
				012, 028, 029,
QLD	1	60	005	033, 039, 053
SA	0	0		
				004, 019, 041,
TAS	0	15		018, 058
VIC	3	7	001, 067, 037	001, 067, 066
WA	7	3	102, 118, 120	103, 104,
Total	11	90		

4.2. STATE AND TERRITORY COMPARISON OF DRUG USE

The total level of each drug outlined in the preceding reports per state or territory was compared with subsequent collection periods included in the current report. Every effort was made to assess the same sites for each period. However, as the individual sites and the number of sites used to generate the population-weighted averages may have changed between periods, comparing between time points should be done with caution. This would be most evident for the regional averages, which had more variation in participation between each period (see Appendix 2 for a comprehensive list of participating sites and number of days assessed per sampling campaign). The lines on each graph representing averages are the cumulative average across all sampling batches.

4.2.1 NICOTINE AND ALCOHOL

Average nicotine consumption in samples collected from regional sites were generally higher when compared to the capital cities (Figure 13). In some states and territories, nicotine consumption showed steady levels over the total collection periods. The Australian Capital Territory, New South Wales and Queensland were regions where nicotine consumption increased, while Western Australia showed an overall decrease for both capital city and regional areas. In the case of alcohol, the difference between overall capital city and regional centre consumption within each state or territory was less pronounced (Figure 14). For the most part, consumption levels remained steady with no apparent trend in terms of changes in use over time within each region.

Figure 13: Estimated average consumption of nicotine by state/territory, where 1 cigarette contains 1.25 mg of nicotine.

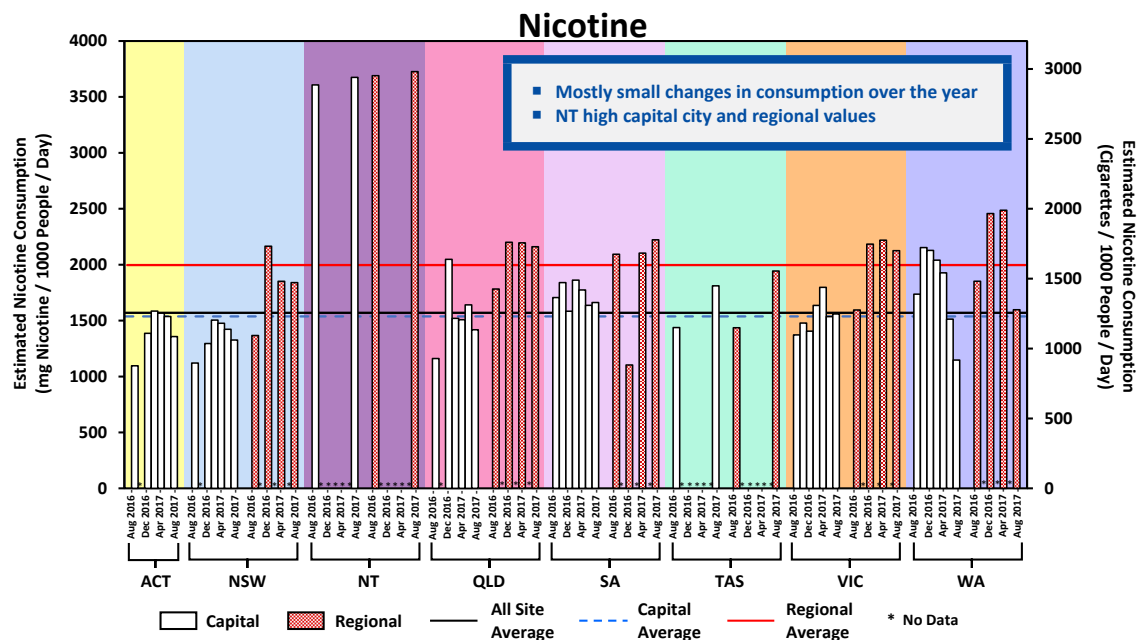
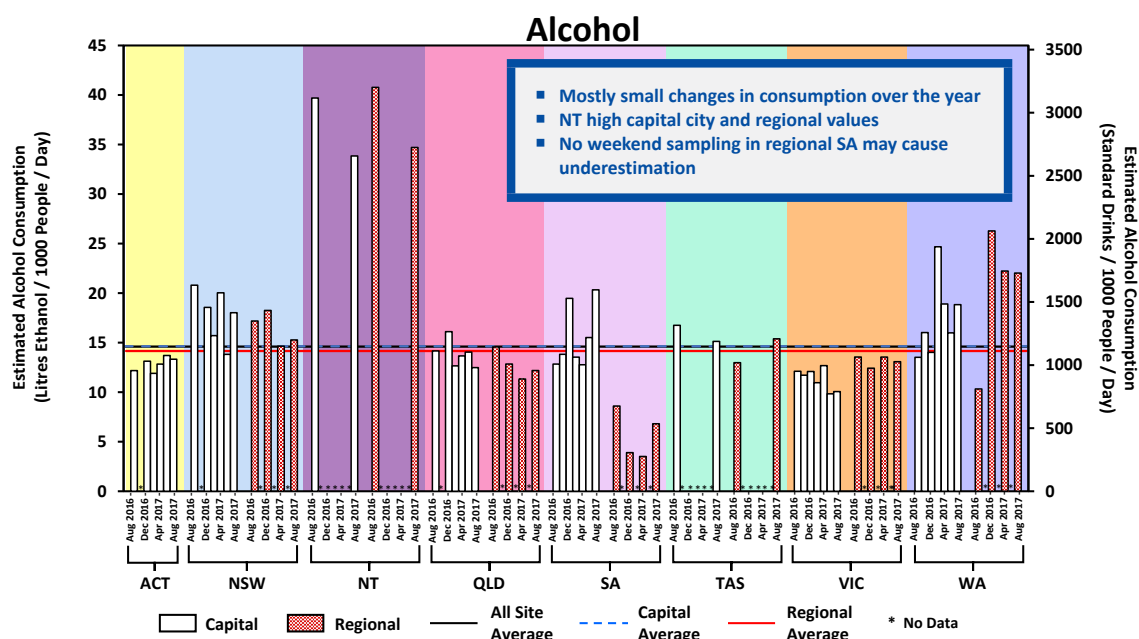


Figure 14: Estimated average consumption of alcohol by state/territory. A standard drink is 10.0 g or 12.5 mL.



4.2.2 ILLICIT DRUGS

The trend in methylamphetamine use was variable in many parts of the country (Figure 15). The Australian Capital Territory and New South Wales showed small overall increases, while levels were down in the Northern Territory, Queensland, Victoria and Western Australia. South Australia had the highest capital city consumption, but no clear trend was apparent. Western Australia had the highest regional levels of methylamphetamine consumption.

When plotted against historical levels recorded in the three regions, the previously described decline or levelling off in use in South Australia, Western Australia and Queensland were largely maintained. Levels in Victoria showed marginal declines (Site 67) or remained steady (Site 1) over the current and historical periods (Figure 16). It is not yet clear whether these are part of longer term trends.

The consumption of cocaine in capital city sites in New South Wales remained high for the duration of the monitoring period compared to other Australian regions (Figure 17). The upward trend in consumption observed in the previous report for the Australian Capital Territory and Victoria slowed or started to decrease after April 2017. Small increases were evident in other states, but these are from a very low base. Regional consumption was noticeably lower than in capital cities in every state and territory, except Queensland. Western Australia and Tasmania remained well below the national average.

MDMA use in Australia appeared to be on the decline in all states and territories, except the South Australian capital city region (Figure 18). The Northern Territory remained high compared to other parts of the country, but the August 2017 figure was well down on the initial value recorded a year ago. Regional centres showed levels slightly below the capital city locations. However, this may be attributable to some regional sites not providing weekend samples, when consumption is typically higher. The actual trend would not be affected by sampling day and is a reasonable measure of changes in consumption over the study period.

MDA use, corrected for the proportion derived from MDMA (Khan, 2011), showed that regional Queensland had the highest levels, while most other states and territories were very similar (Figure 19). South Australia and capital city New South Wales were at levels below average. The regional and overall national averages were skewed somewhat by the high MDA levels detected at site QLD: 012 in South-East Queensland.

Figure 15: Estimated average consumption of methylamphetamine by state/territory.

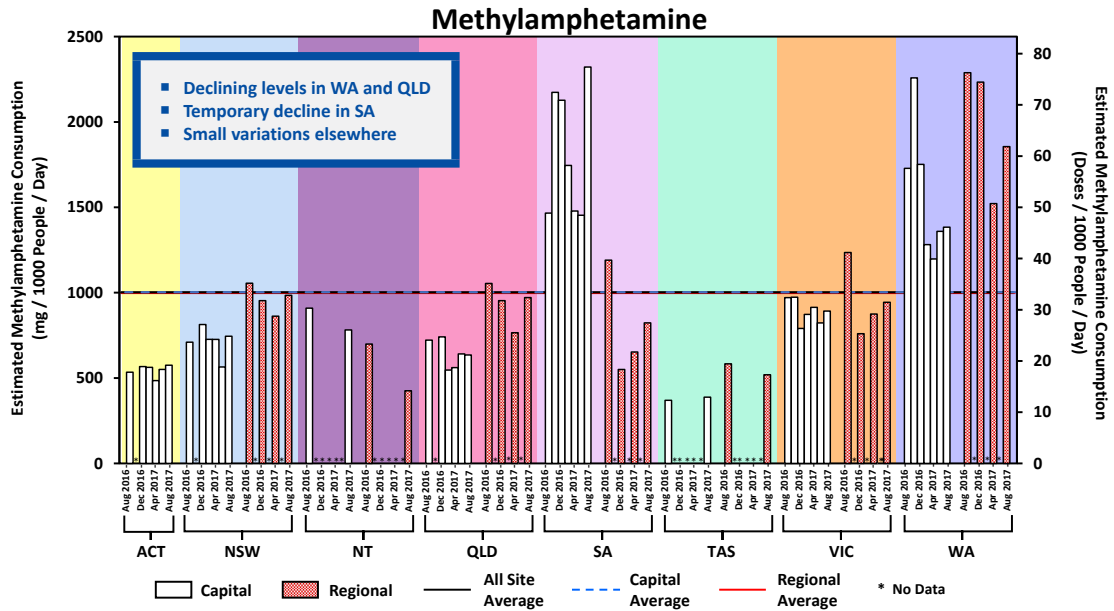


Figure 16: Change in methylamphetamine consumption for sites with historical data.

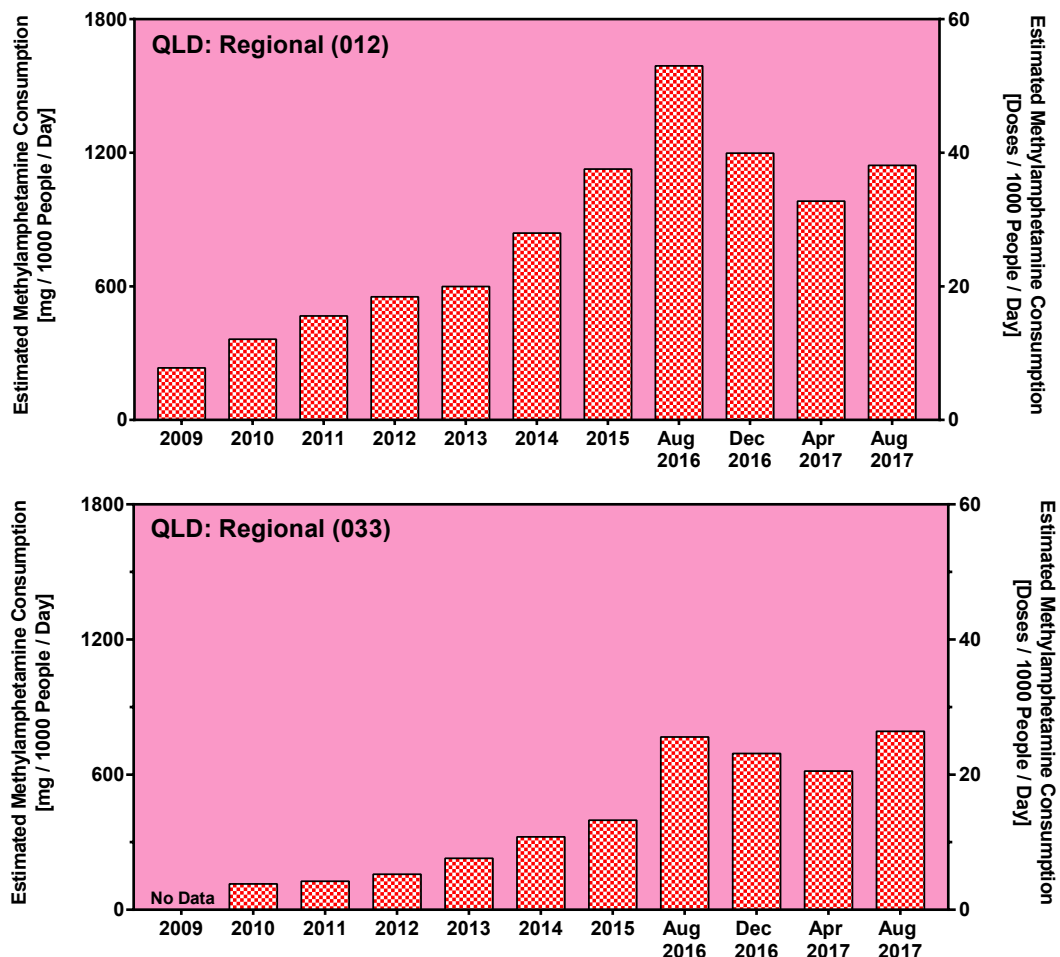


Figure 16 (continued): Change in methylamphetamine consumption for sites with historical data.

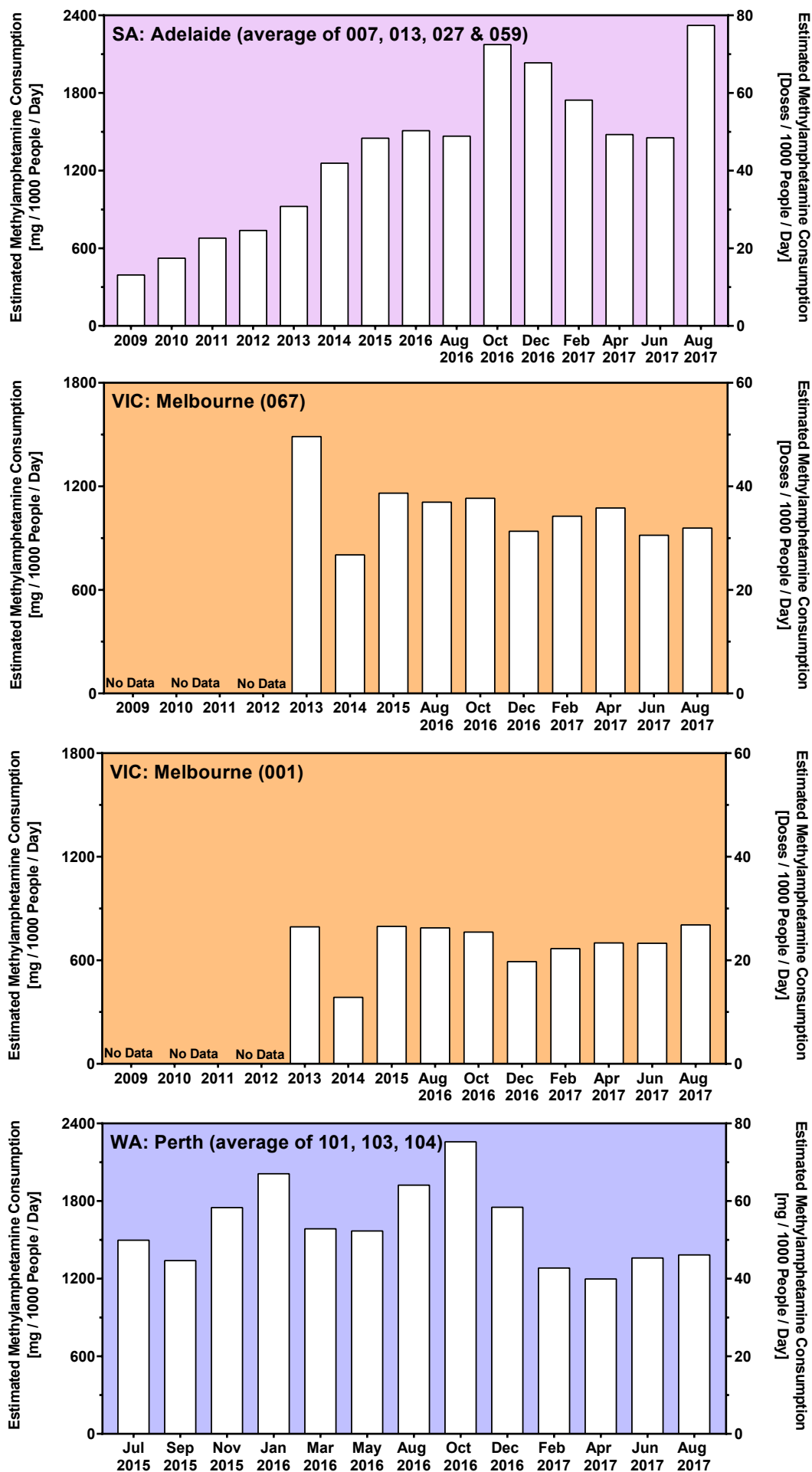


Figure 17: Estimated average consumption of cocaine by state/territory.

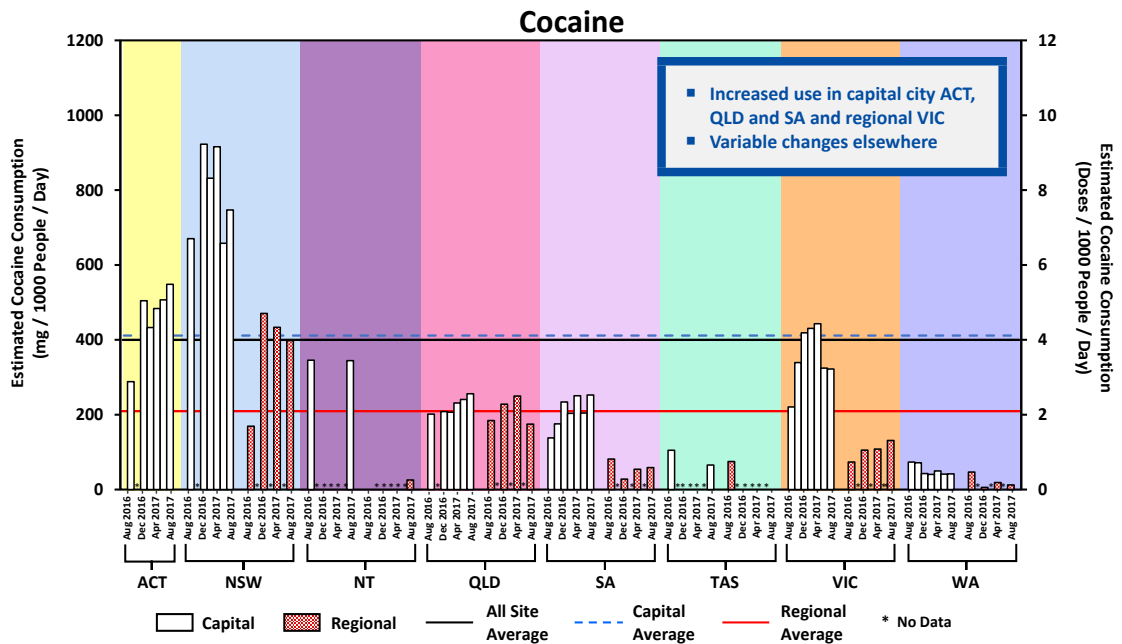


Figure 18: Estimated average consumption of MDMA by state/territory.

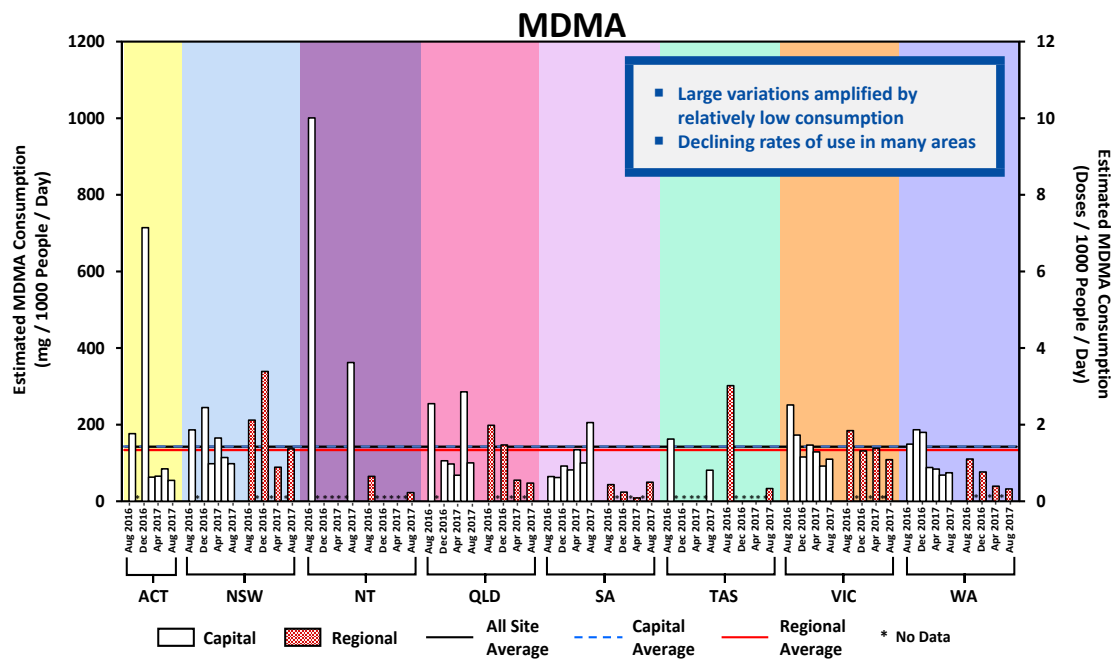
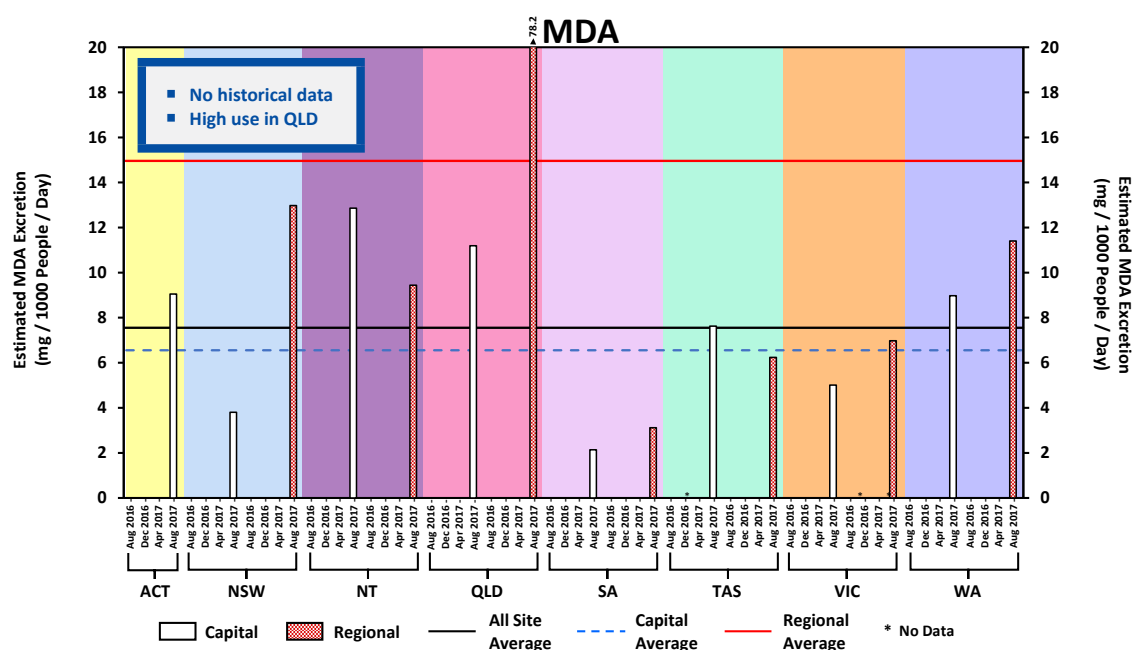


Figure 19: Estimated average consumption of MDA by state/territory.



Site QLD:012 had high levels of MDA and increased the QLD regional average considerably, with the weighted average MDA excretion of all QLD regional sites indicated by the arrow. If site QLD:012 is considered an outlier and is omitted from the results, the QLD regional average reduces to 6.95 mg/1 000 people/day, with the all site regional average (red line) reducing to 8 mg/1 000 people/day.

4.2.3 OPIOIDS

The average levels of oxycodone and fentanyl use were higher in regional areas of a number of states (Figure 20 and Figure 21). Since the first report in March 2017, which contained analysis of samples collected in August 2016, consumption of the pharmaceutical opioids declined in some regions. For example the Australian Capital Territory, regional New South Wales, South Australia and Western Australia. No state or territory showed year on year increases, but some fluctuations in use were evident for the most part. The variation in participating rural sites (and hence the sampled populations) may also have an effect on the observed trend of the population-weighted averages.

Although heroin was included for the first time and historical data are lacking for most sites, a state and territory comparison of the use of the substance showed that consumption was highest in Victoria (Figure 22). In general, regional areas of each state had lower levels of heroin, with New South Wales the only exception.

The extent of heroin consumption has been measured in capital city South Australia since 2013. Together with the current reporting period, levels of heroin consumption for the region have been slightly declining (Figure 23).

Figure 20: Estimated average consumption of oxycodone by state/territory.

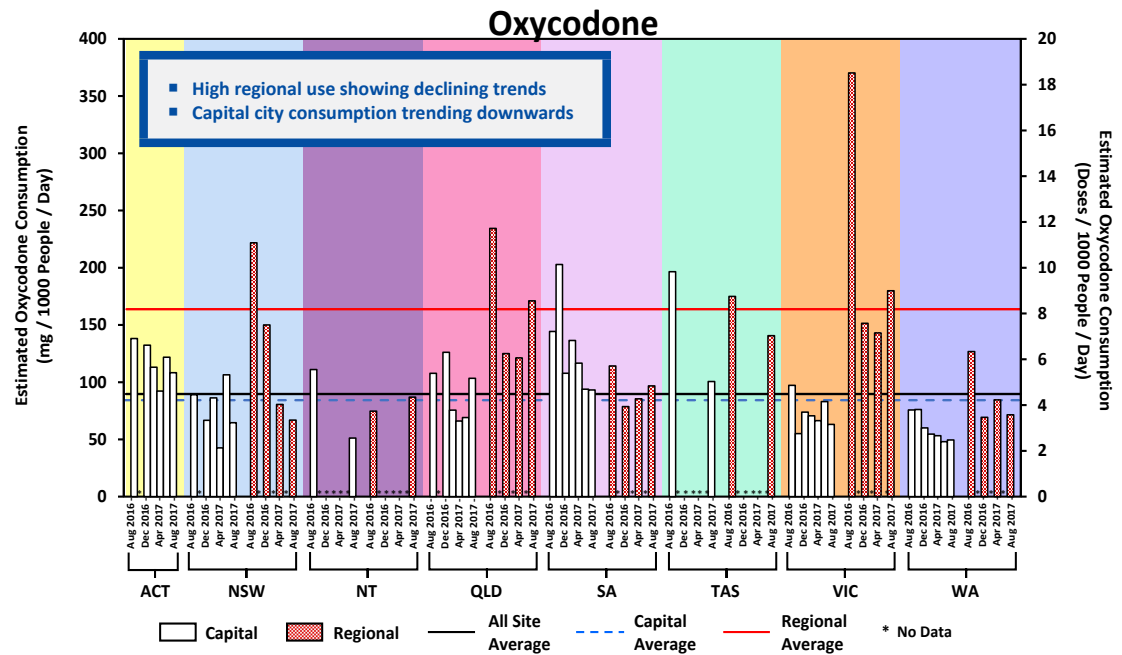


Figure 21: Estimated average consumption of fentanyl by state/territory.

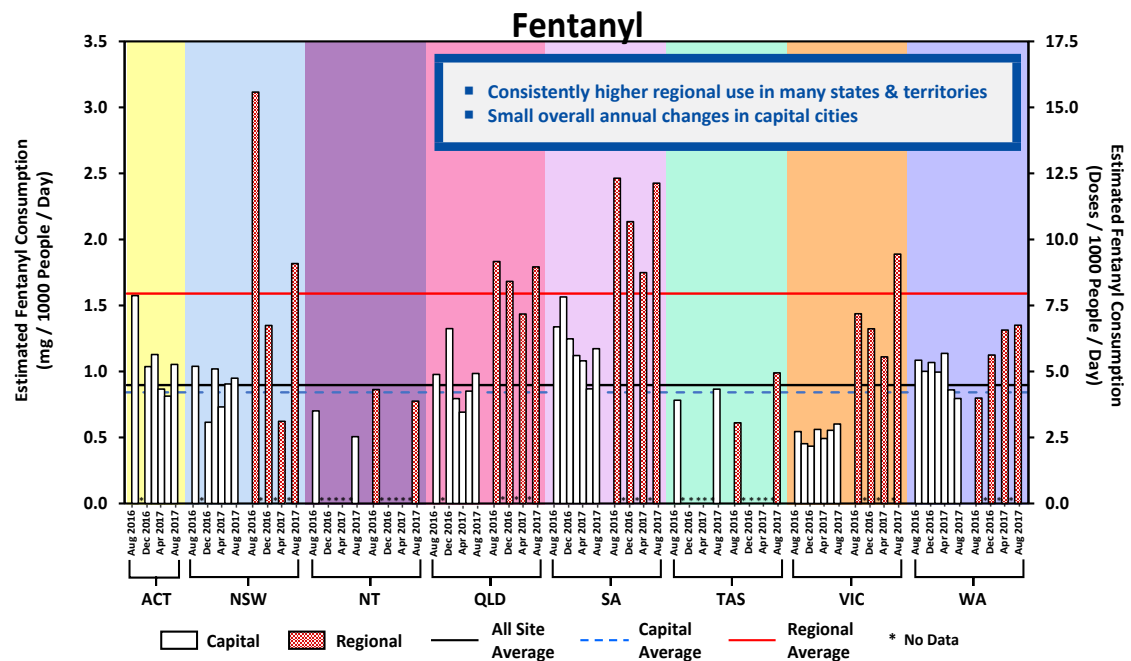


Figure 22: Estimated average consumption of heroin by state/territory.

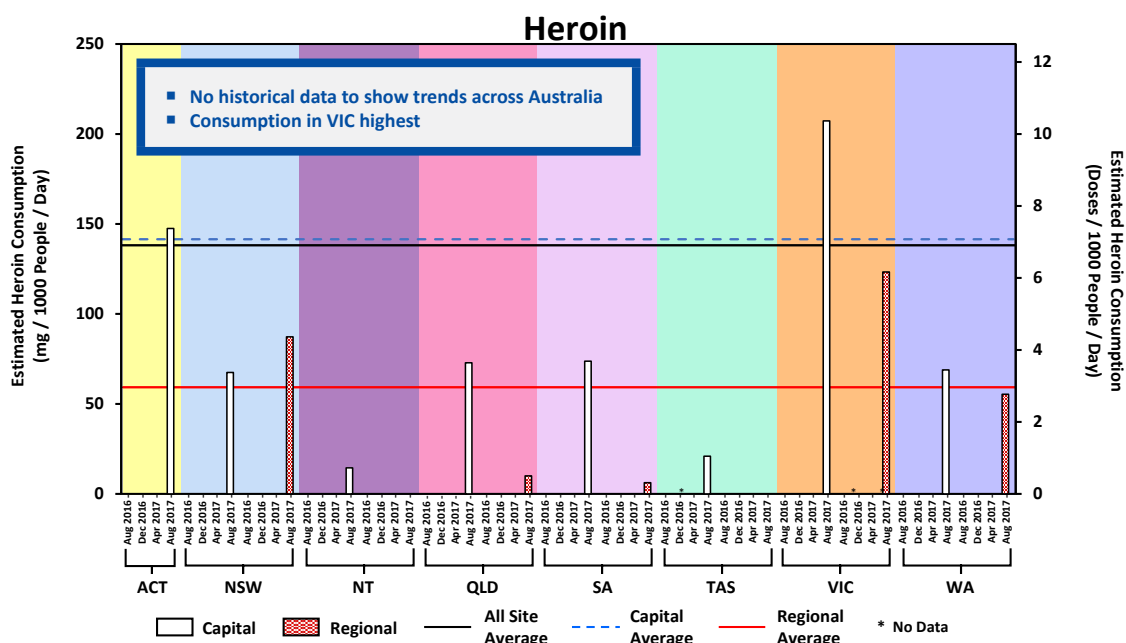
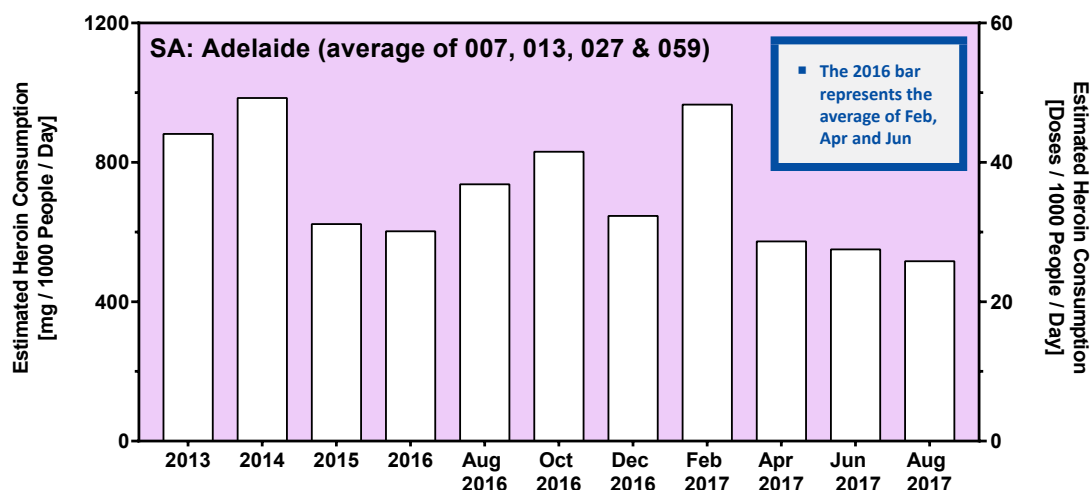


Figure 23: Change in heroin consumption for South Australia.



4.2.4 NPS

The cannabinoid NPS drugs were not detected at all. Methylone and mephedrone were only detected sporadically and at very low levels compared to other substances included in the report (August mephedrone and methylone results are shown in Table 2).

4.2.5 CAPITAL CITY AVERAGES

For the purposes of determining representative population trends for the collective catchments included in the report over the total sampling period, the averaged capital city site populations were expressed as the total capital average consumption of illicit stimulants (Figure 24). A complication with this type of analysis was that fewer sites were sampled in between August 2016 and August 2017, so the contributing population was smaller between these dates. Some approximations had to be made to account for the absence of some densely populated regions (e.g. October 2016 for capital city New South Wales, and

Queensland). For the total population included in the report, methylamphetamine appeared to show a steady decline from October 2016 to June 2017, with an increase in August 2017. With additional data from future collections, the significance of any trend will become more apparent. MDMA levels declined overall over the year on year reporting period, but since detected levels are very low, the result may not be significant. Cocaine consumption showed some short-term increases, but has steadied since December 2016. In terms of legal substances with abuse potential, nicotine consumption remained largely unchanged over the reporting period (Figure 25). In contrast, the two pharmaceutical opioids included in the study showed an overall decline in capital city areas since August 2016. In regional areas, fentanyl remained steady for the year on year period, but showed a decline from August 2016 to April 2017. In the case of alcohol, marginal changes were evident.

Figure 24: The population-weighted average of all sites for methylamphetamine, MDMA and cocaine.

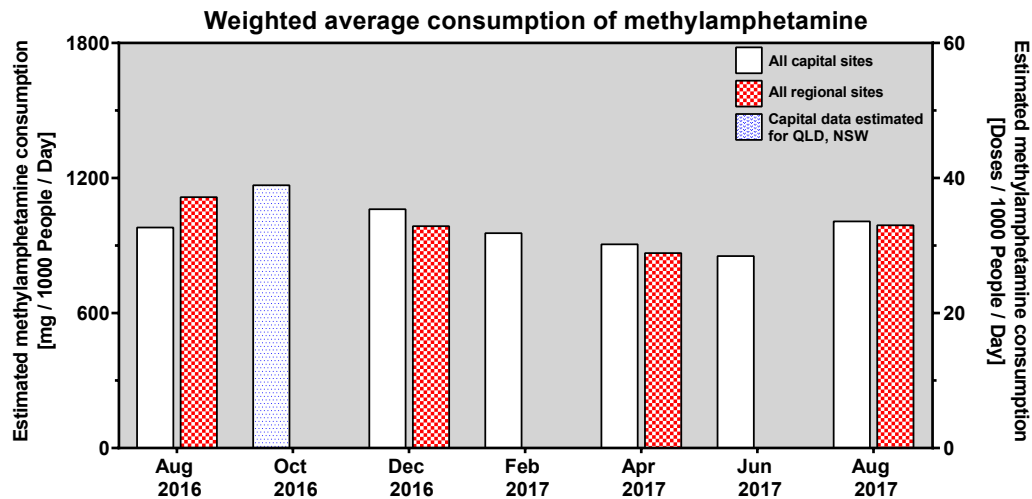
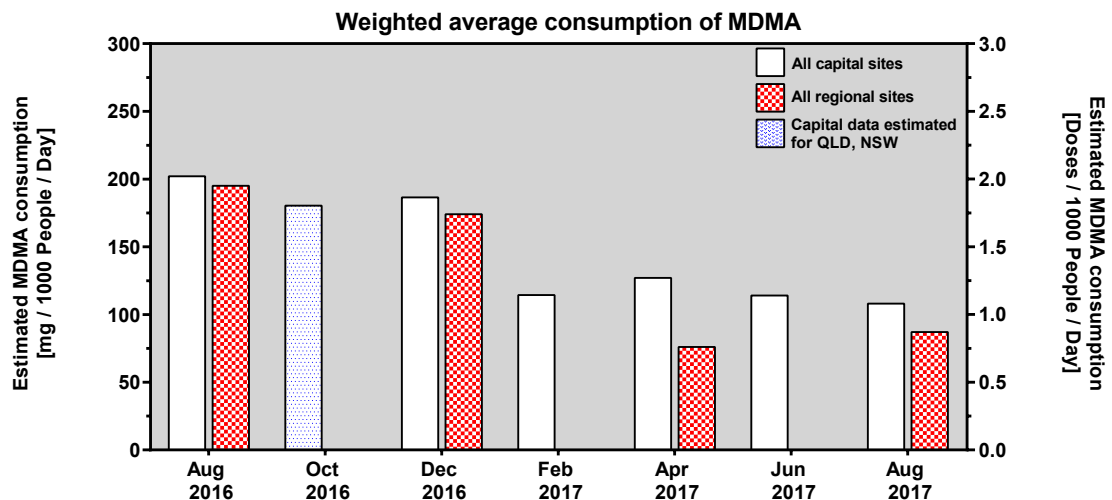
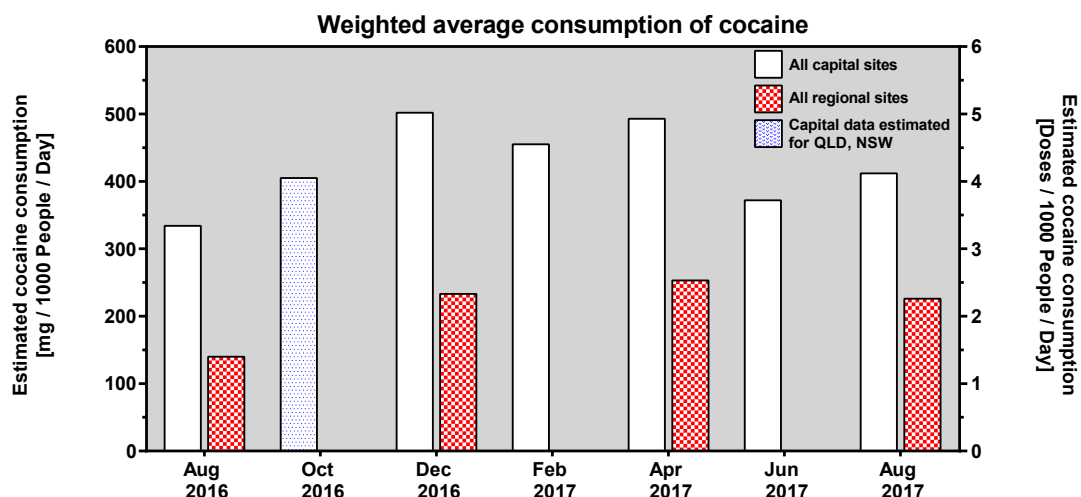


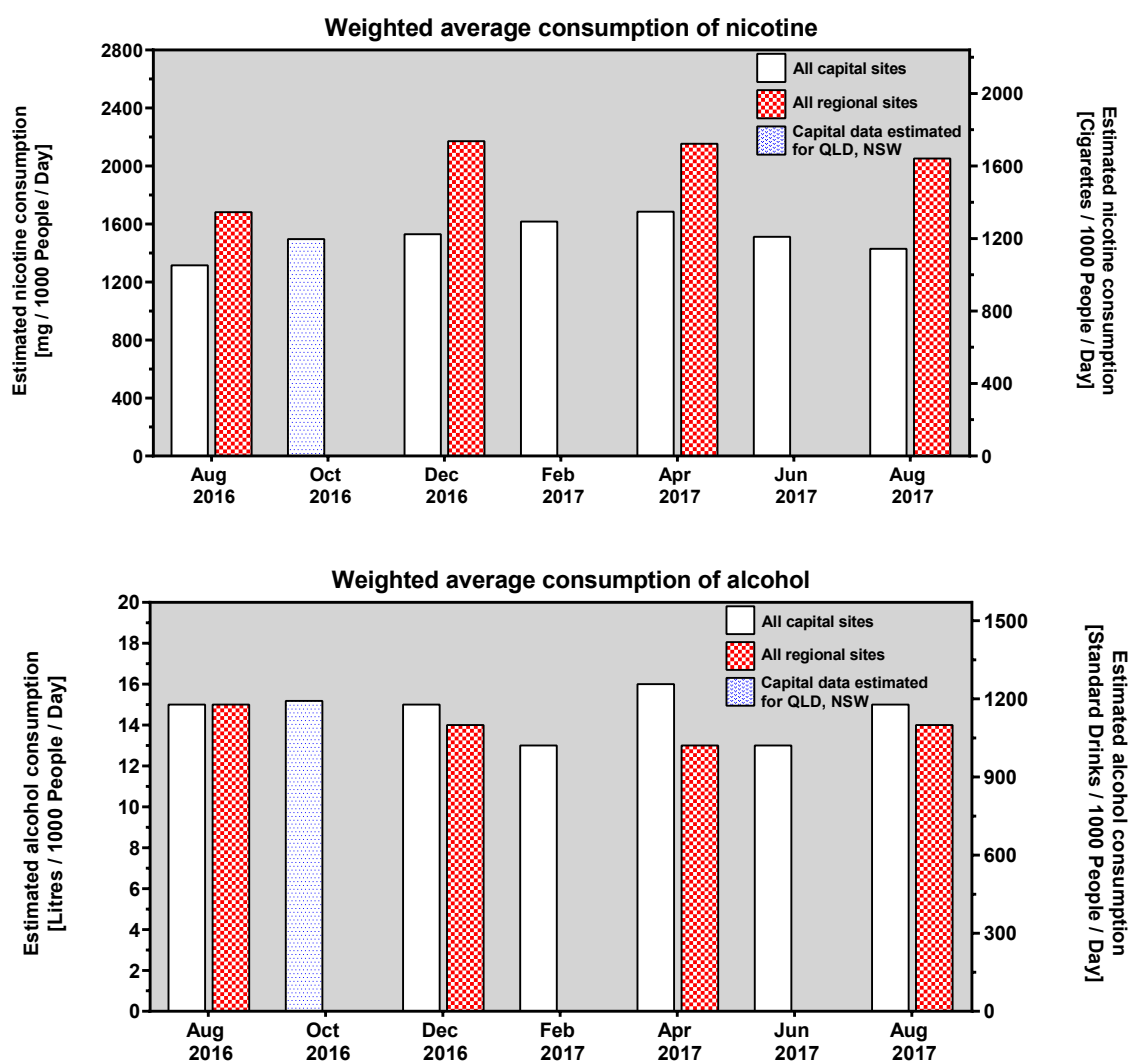
Figure 24 (continued): The population-weighted average of all sites for methylamphetamine, MDMA and cocaine.

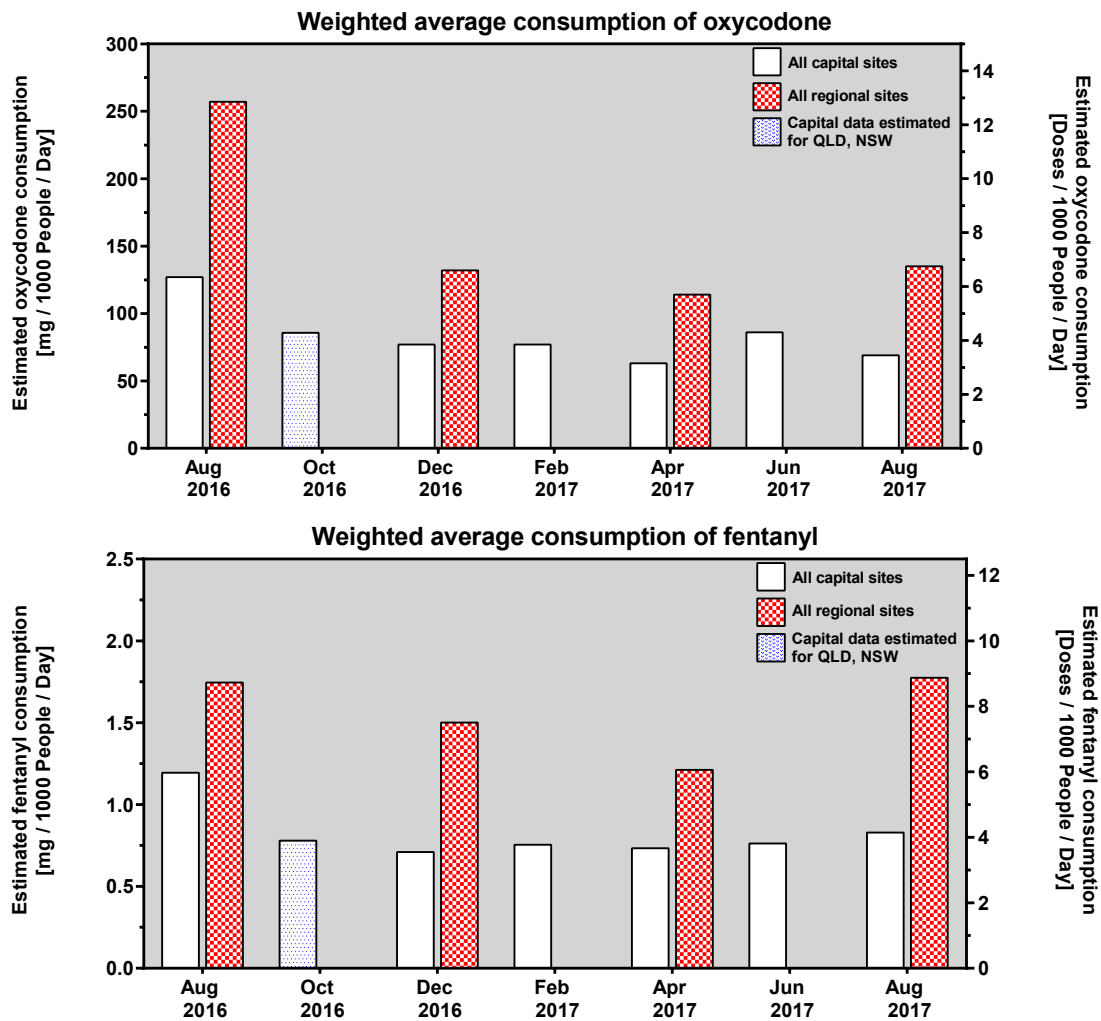




As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and December 2016 was used to provide the overall October estimate. Regional areas were only sampled every second collection period.

Figure 25: The population-weighted average of all sites for nicotine, alcohol, oxycodone and fentanyl.





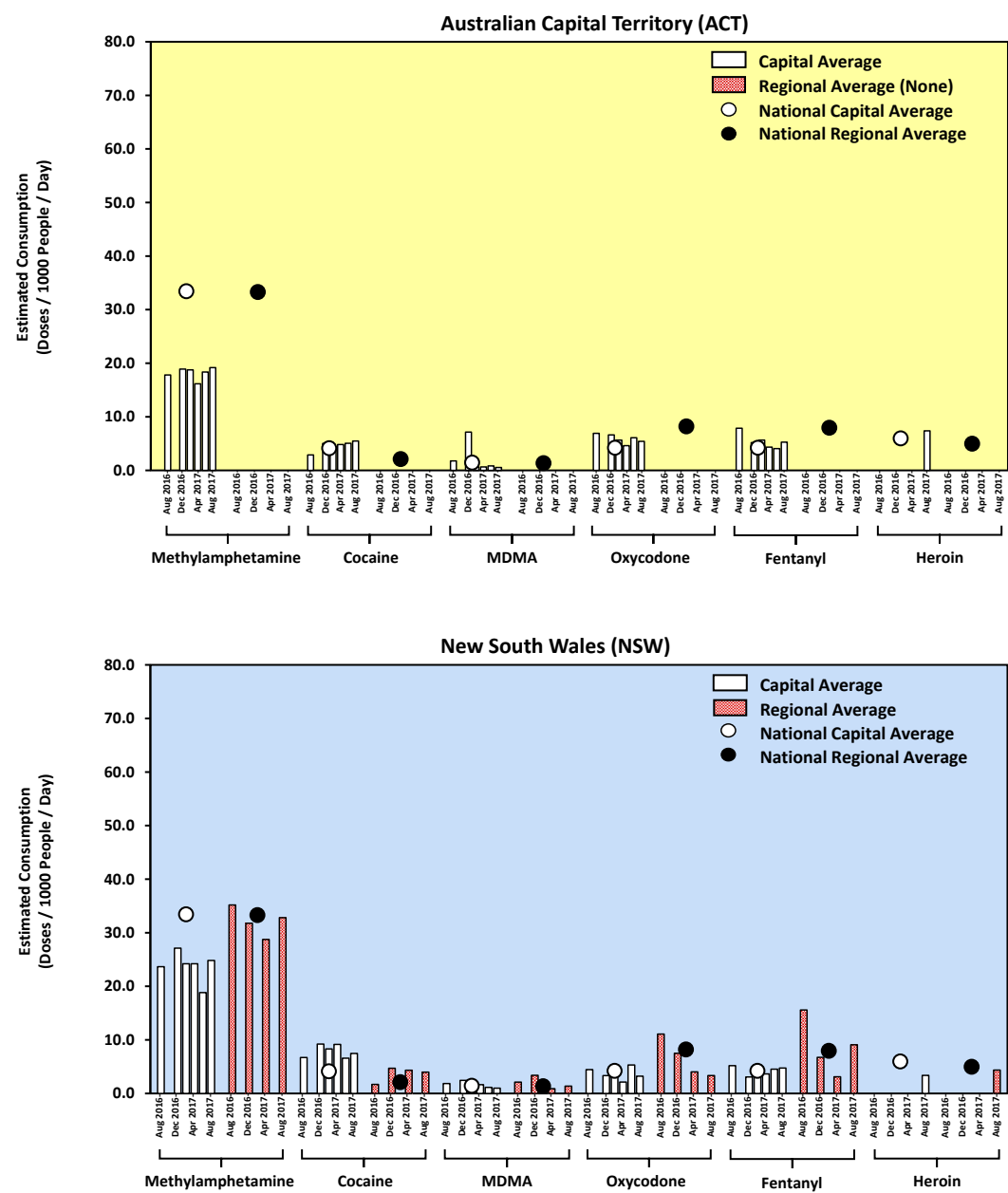
As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and December 2016 was used to provide the overall October estimate. Regional areas were only sampled every second collection period.

4.3. DRUG PROFILE FOR EACH STATE AND TERRITORY

In order to compare the scale of use of different types of drugs within the same region (for example, within a state or territory), drug consumption was reported as the number of doses consumed. When the amount of drug measured in wastewater was normalised for population size and average dose consumed (conversion factors listed in the first National Wastewater Drug Monitoring Program report), alcohol and nicotine remained consistently the highest consumed drugs in all states and territories (for example, the national average consumption of alcohol and nicotine per 1 000 people per day was 1 300 cigarettes per 1 000 people (Figure 4) or 1 200 standard drinks per day (Figure 5), whereas for methylamphetamine, the national average consumption was closer to 33 doses per 1 000 people per day (Figure 6).

Consistent with previous reports, methylamphetamine consumption remained the highest amongst the illicit drugs and opioids, across all regions of Australia (Figure 26 and Figure 27). This trend was consistent for both capital cities and regional sites. Based on the consumption profiles of other drugs detected in this study (cocaine, MDMA, oxycodone and fentanyl), no other consistent patterns of usage within the different states and territories were observed. Oxycodone and fentanyl use was very similar within almost all states and territories, with small differences between the proportions in capital cities vs regional areas.

Figure 26: Profile of average drug consumption by state or territory, for ACT, NSW, NT and QLD. Consumption is shown as the number of doses per 1 000 people per day to allow comparison of drugs of different types within the same region (state or territory).



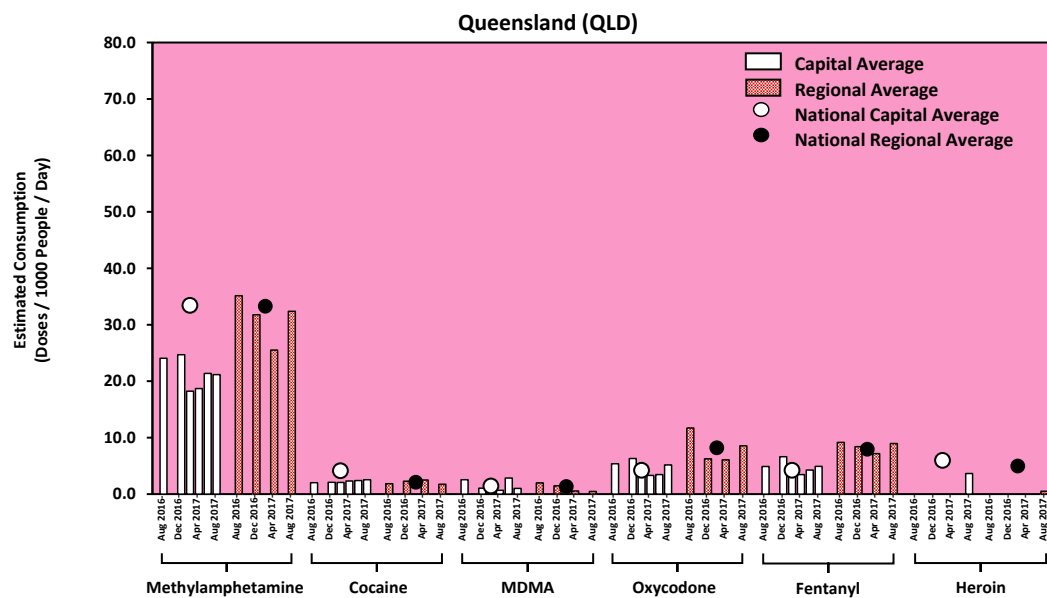
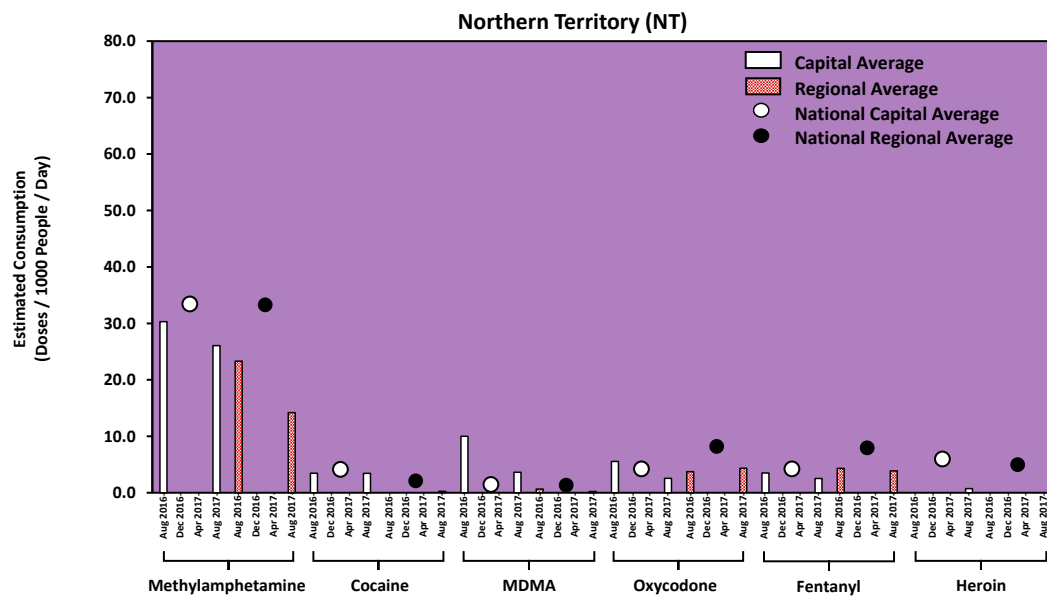
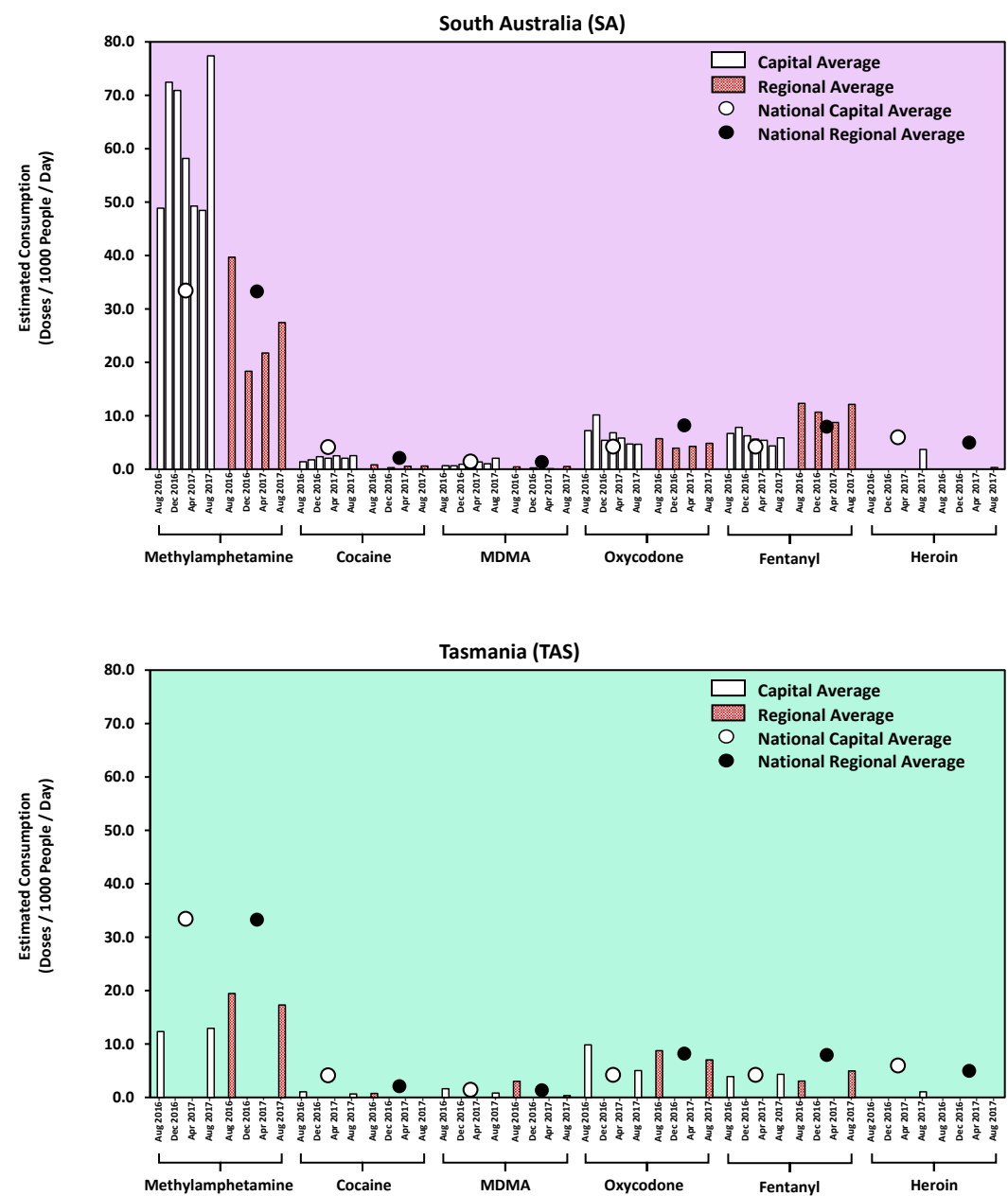
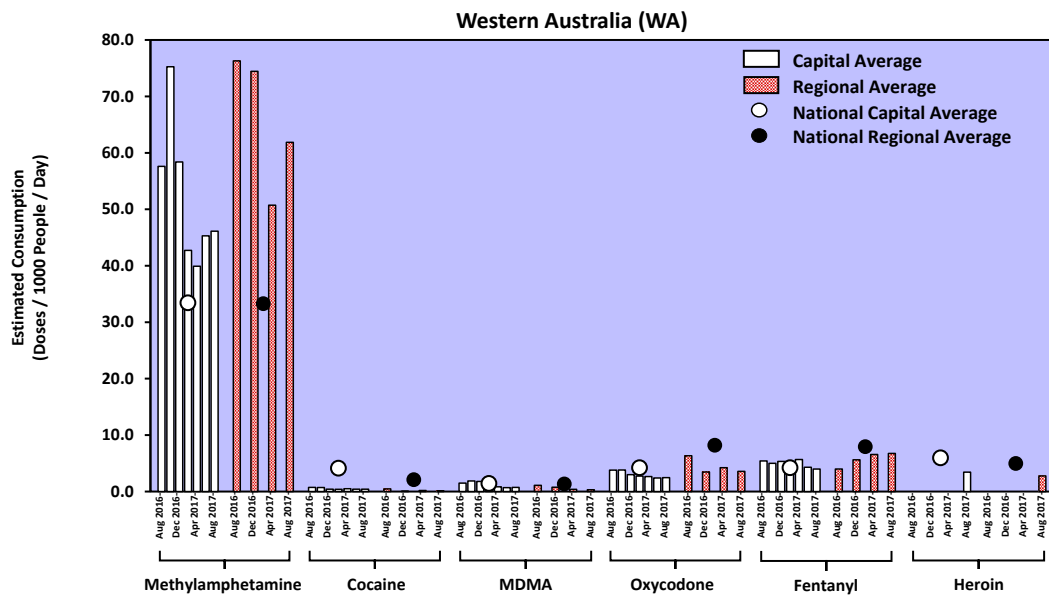
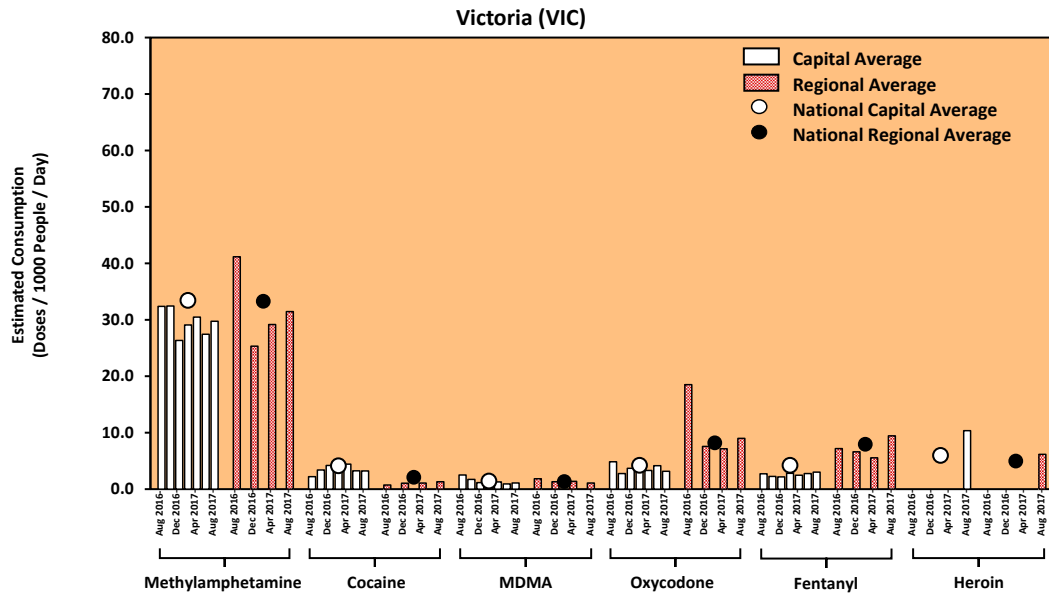


Figure 27: Profile of average drug consumption by state or territory, for SA, TAS, VIC and WA. Consumption is shown as the number of doses per 1 000 people per day to allow comparison of drugs of different types within the same region (state or territory).





5: ACKNOWLEDGMENTS

The project team sincerely thanks the numerous WWTP operators involved in sample collection and WWTP management agencies for providing flow volumes and other site information. The cooperation of the plants and management agencies is critical to the ongoing success of this project.

The University of South Australia would like to thank our funding partners, the Drug and Alcohol Services South Australia (DASSA), for their permission to use historical and current data from South Australia as well as the Western Australia Police Force for permission to use data from Western Australia. We would also like to acknowledge the efforts of other team members at the University of South Australia, including Lynn Nguyen, for assistance with logistics and analytical methods.

The University of Queensland thanks Geoff Eaglesham for his contributions to the analytical work for this study. We also thank the members of the Emerging Environmental Health Risks research group at Queensland Alliance for Environmental Health Services (incorporating the former Entox) for assistance with preparing and shipping over 1 000 sampling bottles to the various plants, and those members, past and present, who helped establish this field at the university.

We also would like to acknowledge the wider wastewater-based epidemiology field which includes addiction specialists, analytical chemists, environmental engineers, forensic scientists, pharmacologists, policy advisors and sewer engineers for their ongoing contributions to knowledge, willingness to share both methodology and data, critical review and for advancing wastewater analysis research.

The symbols/images used in Figure 1 in the report were provided courtesy of the Integration and Application Network, University of Maryland, Center for Environmental Science (ian.umces.edu/symbols/).

6: REFERENCES

- Boerner, U., et al. (1975). "The metabolism of morphine and heroin in man." *Drug metabolism reviews* 4(1): 39-73.
- Castiglioni, S., I. Senta, A. Borsotti, E. Davoli and E. Zuccato (2015). A novel approach for monitoring tobacco use in local communities by wastewater analysis. *Tob Control* 24(1): 38-42. DOI: 10.1136/tobaccocontrol-2014-051553
- Gracia-Lor, E., E. Zuccato and S. Castiglioni (2016). Refining correction factors for back-calculation of illicit drug use. *Sci Total Environ* 573: 1648-1659. DOI: 10.1016/j.scitotenv.2016.09.179
- Irvine, R.J., C. Kostakis, P.D. Felgate, E.J. Jaehne, C. Chen and J.M. White (2011). Population drug use in Australia: a wastewater analysis. *Forensic Sci Int* 210(1-3): 69-73. DOI: 10.1016/j.forsciint.2011.01.037
- Khan, U. and Nicell, J.A. (2011). Refined sewer epidemiology mass balances and their application to heroin, cocaine and ecstasy. *Environment International* 37: 1236-1252.
- Khan, U. and J.A. Nicell (2012). Sewer epidemiology mass balances for assessing the illicit use of methamphetamine, amphetamine and tetrahydrocannabinol. *Sci Total Environ* 421-422: 144-162. DOI: 10.1016/j.scitotenv.2012.01.020
- Lai, F.Y., S. Anuj, R. Bruno, S. Carter, C. Gartner, W. Hall, K.P. Kirkbride, J.F. Mueller, J.W. O'Brien, J. Prichard, P.K. Thai and C. Ort (2015). Systematic and Day-to-Day Effects of Chemical-Derived Population Estimates on Wastewater-Based Drug Epidemiology. *Environ Sci Technol* 49(2): 999-1008. DOI: 10.1021/es503474d
- Lai, F.Y., J. O'Brien, R. Bruno, W. Hall, J. Prichard, P. Kirkbride, C. Gartner, P. Thai, S. Carter, B. Lloyd, L. Burns and J. Mueller (2016). Spatial variations in the consumption of illicit stimulant drugs across Australia: A nationwide application of wastewater-based epidemiology. *Sci Total Environ* 568: 810-818. DOI: 10.1016/j.scitotenv.2016.05.207
- Lai, F.Y., C. Ort, C. Gartner, S. Carter, J. Prichard, P. Kirkbride, R. Bruno, W. Hall, G. Eaglesham and J.F. Mueller (2011). Refining the estimation of illicit drug consumptions from wastewater analysis: Co-analysis of prescription pharmaceuticals and uncertainty assessment. *Water Research* 45(15): 4437-4448. DOI: 10.1016/j.watres.2011.05.042
- Lalovic, B., E. Kharasch, C. Hoffer, L. Risler, L.Y. Liu-Chen and D.D. Shen (2006). Pharmacokinetics and pharmacodynamics of oral oxycodone in healthy human subjects: role of circulating active metabolites. *Clin Pharmacol Ther* 79(5): 461-479. DOI: 10.1016/j.clpt.2006.01.009

Rossi, S. (2016). Australian Medicines Handbook, (internet). Adelaide, Australia, Australian Medicines Handbook, Pty. Ltd.

Ryu, Y., D. Barcelo, L.P. Barron, L. Bijlsma, S. Castiglioni, P. de Voogt, E. Emke, F. Hernandez, F.Y. Lai, A. Lopes, M.L. de Alda, N. Mastroianni, K. Munro, J. O'Brien, C. Ort, B.G. Plosz, M.J. Reid, V. Yargeau and K.V. Thomas (2016). Comparative measurement and quantitative risk assessment of alcohol consumption through wastewater-based epidemiology: An international study in 20 cities. *Sci Total Environ* 565: 977-983.
DOI: 10.1016/j.scitotenv.2016.04.138

Sullivan, M. A., et al. (2006). "Depot naltrexone: antagonism of the reinforcing, subjective, and physiological effects of heroin." *Psychopharmacology* 189(1): 37-46.

Tscharke, B.J., C. Chen, J.P. Gerber and J.M. White (2016). Temporal trends in drug use in Adelaide, South Australia by wastewater analysis. *Sci Total Environ* 565: 384-391.
DOI: 10.1016/j.scitotenv.2016.04.183

Zuccato, E., C. Chiabrando, S. Castiglioni, R. Bagnati and R. Fanelli (2008). Estimating community drug abuse by wastewater analysis. *Environ Health Perspect* 116(8): 1027-1032.
DOI: 10.1289/ehp.11022

7: APPENDICES

APPENDIX 1: DRUG-SPECIFIC PARAMETERS FOR ANALYTICAL REPORTING AND USAGE CALCULATIONS

Analyte levels of detection, levels of reporting, highest detection, excretion factors and standard doses from the literature.

Analyte	Level of detection (LOD) [ng/L]	Level of reporting (LOR) [ng/L]	Excretion factor	Standard dose pure drug (mg)
Amphetamine	50	150	0.394 ^a	30 ^b
Cocaine	17	50	0.075 ^b	100 ^b
Cotinine	33	100	0.3 ^c	1.25 ^c
Norfentanyl	0.1	0.1	0.3 ^d	0.2 ^d
JWH-018	1	14	n.a.	n.a.
JWH-073	10	20	n.a.	n.a.
MDA*	67	200	n.a.	n.a. [#]
MDMA	33	100	0.225 ^b	100 ^b
Mephedrone	0.4	0.8	n.a.	n.a.
Methylamphetamine	33	100	0.39 ^g	30 ^b
Methylone	0.01	0.1	n.a.	n.a.
Hydroxycotinine	17	50	0.44 ^c	1.25 ^c
Noroxycodone	0.1	1	0.22 ^f	20 ^d
Ethyl sulfate	167	500	0.00012 ^e	10g ^e
Benzoyllecgonine	33	100	0.35 ^g	100 ^b
6-monoacetylmorphine			0.013 ^h	20 ⁱ

n.a. = data not available; a = (Khan and Nicell 2012); b = (Zuccato, Chiabrando et al. 2008); c = (Castiglioni, Senta et al. 2015); d = (Rossi 2016), e = (Ryu, Barcelo et al. 2016); f = (Lalovic, Kharasch et al. 2006); g = (Lai et al., 2011); h = (Boerner et al., 1975); i = (Sullivan et al. 2006)

* Data is not available in the scientific literature for the proportion of MDA that is eliminated after MDA consumption. However, data is available detailing the proportion of MDA eliminated after MDMA consumption. Therefore, our MDA estimate of mg excreted per day per 1 000 people is the amount of MDA excreted from the population after considering the metabolic fraction excreted from MDMA.

[#] It is likely that the dose for MDA is similar to that of MDMA, of 100 mg.

APPENDIX 2: FURTHER INFORMATION ON WWTPS

Sampling details of each wastewater treatment plant.

Site Code	Capital/Regional	# Samples Aug 16	# Samples Oct 16	# Samples Dec 16	# Samples Feb 17	# Samples Apr 17	# Samples Jun 17	# Samples Aug 17	Population Category
ACT: 009	Capital	7	-	7	7	7	7	7	>150,000
NSW: 003	Capital	7	-	7	4	7	7	7	>150,000
NSW: 006	Capital	7	-	7	7	7	7	7	>150,000
NSW: 008	Capital	6	-	7	7	7	7	7	>150,000
NSW: 021	Capital	7	-	-	-	-	-	7	30,000 to 150,000
NSW: 071	Capital	7	-	-	-	-	-	7	>150,000
NSW: 016	Regional	5	-	7	-	-	-	5	30,000 to 150,000
NSW: 025	Regional	7	-	-	-	-	-	7	>150,000
NSW: 040	Regional	7	-	-	-	-	-	7	<30,000
NSW: 051	Regional	7	-	-	-	-	-	7	<30,000
NSW: 068	Regional	1	-	4	-	7	-	7	>150,000
NSW: 081	Regional	-	-	-	-	-	-	7	<30,000
NSW: 115	Regional	-	-	7	-	7	-	7	30,000 to 150,000
NT: 010	Capital	7	-	-	-	-	-	7	30,000 to 150,000
NT: 078	Regional	7	-	-	-	-	-	7	<30,000
QLD: 002	Capital	7	-	6	6	7	7	7	>150,000
QLD: 005	Capital	7	-	-	7	7	7	6	>150,000
QLD: 011	Capital	7	-	7	6	7	7	6	>150,000
QLD: 012	Regional	5	-	7	-	7	-	7	>150,000
QLD: 020	Regional	7	-	-	-	-	-	-	<30,000
QLD: 024	Regional	7	-	7	-	7	-	-	30,000 to 150,000
QLD: 028	Regional	7	-	7	-	7	-	7	30,000 to 150,000
QLD: 029	Regional	7	-	7	-	7	-	7	30,000 to 150,000
QLD: 033	Regional	7	-	7	-	7	-	7	30,000 to 150,000
QLD: 039	Regional	7	-	7	-	7	-	7	<30,000
QLD: 053	Regional	7	-	3	-	5	-	7	<30,000
QLD: 077	Regional	7	-	7	-	7	-	7	<30,000

Sampling details of each wastewater treatment plant (continued).

Site Code	Capital/Regional	# Samples Aug 16	# Samples Oct 16	# Samples Dec 16	# Samples Feb 17	# Samples Apr 17	# Samples Jun 17	# Samples Aug 17	Population Category
SA: 007	Capital	5	7	7	7	7	7	7	>150,000
SA: 013	Capital	5	7	7	7	7	7	7	>150,000
SA: 027	Capital	5	7	7	7	7	7	7	30,000 to 150,000
SA: 059	Capital	5	7	7	7	7	7	7	30,000 to 150,000
SA: 017	Regional	5	-	4	-	4	-	4	<30,000
SA: 022	Regional	5	-	4	-	4	-	4	<30,000
SA: 063	Regional	5	-	4	-	5	-	4	<30,000
SA: 076	Regional	5	-	4	-	4	-	4	<30,000
SA: 119	Regional	-	-	4	-	4	-	4	<30,000
TAS: 004	Capital	7	-	-	-	-	-	5	30,000 to 150,000
TAS: 019	Capital	7	-	-	-	-	-	5	30,000 to 150,000
TAS: 041	Capital	7	-	-	-	-	-	4	30,000 to 150,000
TAS: 018	Regional	7	-	-	-	-	-	5	30,000 to 150,000
TAS: 038	Regional	7	-	-	-	-	-	-	<30,000
TAS: 048	Regional	7	-	-	-	-	-	5	<30,000
TAS: 058	Regional	7	-	-	-	-	-	5	<30,000
VIC: 001	Capital	7	7	7	7	7	7	7	>150,000
VIC: 067	Capital	7	7	7	7	7	7	7	>150,000
VIC: 037	Regional	7	-	7	-	-	-	7	>150,000
VIC: 046	Regional	7	-	-	-	-	-	7	30,000 to 150,000
VIC: 061	Regional	7	-	7	-	7	-	7	30,000 to 150,000
VIC: 062	Regional	7	-	-	-	-	-	5	30,000 to 150,000
VIC: 066	Regional	6	-	7	-	7	-	7	30,000 to 150,000
VIC: 114	Regional	-	-	-	-	-	-	5	30,000 to 150,000
WA: 101	Capital	7	7	7	7	7	7	7	>150,000
WA: 103	Capital	7	7	7	7	7	7	7	>150,000
WA: 104	Capital	7	7	7	7	7	7	7	>150,000
WA: 102	Regional	7	-	7	-	7	-	7	30,000 to 150,000
WA: 118	Regional	0	-	7	-	7	-	7	<30,000
WA: 120	Regional	-	-	7	-	7	-	7	30,000 to 150,000
Total Days		329	63	236	107	236	112	342	
Total Sites		51	9	37	16	36	16	54	
Total Capital		22	9	15	16	16	16	22	Grand total number of samples analysed for Report 1, 2 & 3:
Total Regional		30	0	22	0	20	0	32	
Total samples in Report 1; August 2016: 329		Total samples in Report 2; Oct & Dec 2016 & Feb 2017: 406				Total samples in Report 3; Apr, Jun & Aug 2017: 690			1 425

APPENDIX 3: NUMBER OF SITES ASSESSED IN EACH REPORT

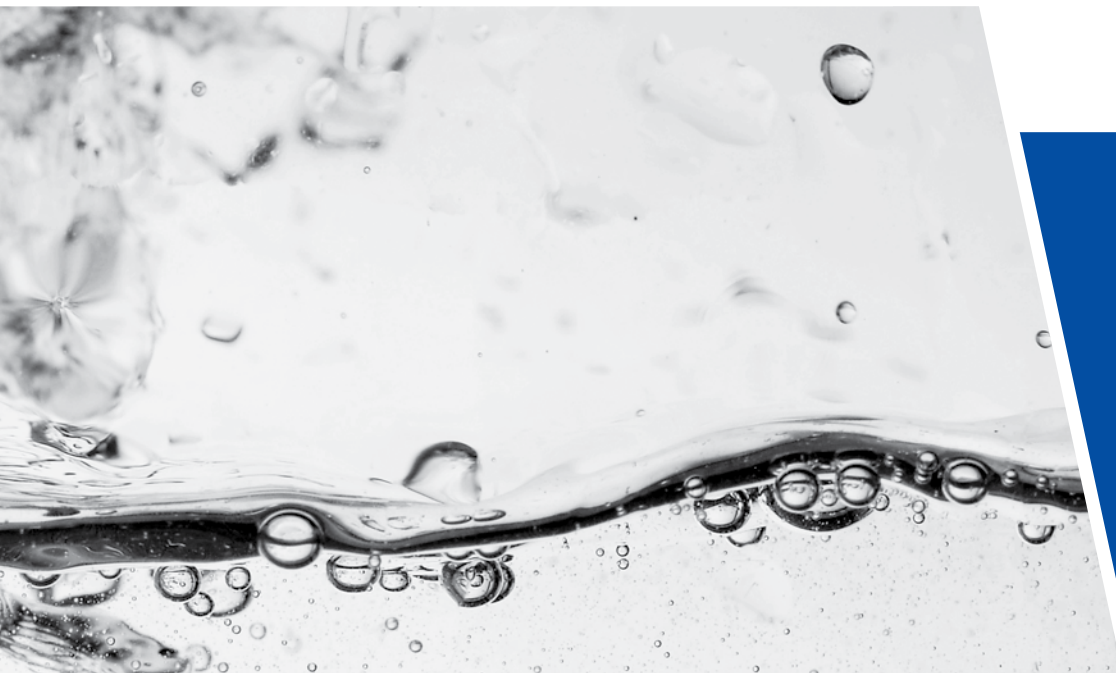
Number of sites assessed in each state for each report and total populations assessed. C = capital city wastewater treatment plant, R = regional wastewater treatment plant.

Report 1			Report 2												Report 3											
Aug-16			*Oct-16				Dec-16				*Feb-17				Apr-17				*Jun-17				Aug-17			
State/Territory	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R				
ACT	1	-	-	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-				
NSW	5	5	-	-	3	3	3	-	3	2	3	2	3	-	3	-	3	-	5	5	7	7				
NT	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1				
QLD	3	9	-	-	2	8	3	-	3	8	3	8	3	-	3	-	3	-	3	3	7	7				
SA	4	4	4	-	4	5	4	-	4	5	4	5	4	-	4	-	4	-	4	4	5	5				
TAS	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3	3				
VIC	2	5	2	-	2	3	2	-	2	2	2	2	2	-	2	-	2	-	2	2	6	6				
WA	3	1	3	-	3	3	3	-	3	3	3	3	3	-	3	-	3	-	3	3	3	3				
Population (millions) C & R	12.1	2.0	6.8	-	11.2	1.4	11.9	-	11.9	1.2	11.9	1.2	11.9	-	11.9	-	12.4	1.8								
Total Population (millions)	14.1		6.8		12.6		11.9		13.1		11.9		14.2													
% of Australian population	61%		29%		54%		51%		57%		51%		61%													

* Every second time point aims to sample from only capital city sites.

Census 2016 population used (23 401 892) for population percentage estimates.

Estimates have been rounded to the nearest 0.1 million.



CONCLUSIONS



CONCLUSIONS¹

For the third report of the National Wastewater Drug Monitoring Program, wastewater analysis was conducted between April 2017 and August 2017. Findings show that alcohol and nicotine consumption remained the highest of the substances tested in all states and territories. Methamphetamine consumption was the next highest of the substances tested, indicating that demand for the drug remains strong.

Although there is some variation in consumption across states and territories, overall, the estimated average consumption of fentanyl and oxycodone in capital city and regional sites is higher than that reported for the remaining substances tested. Estimated consumption of heroin and cocaine varied across states and territories but was overall less than the pharmaceutical opioids. Excluding NPS, MDMA was consistently the least consumed drug nationally. Results for methylone, mephedrone and the synthetic cannabinoids again support the assessment that this is a niche market which remains small in comparison with traditional illicit drug markets.

METHYLAMPHETAMINE

When comparing data from August 2016 and August 2017, population-weighted averages for methamphetamine consumption in capital city and regional sites remained relatively stable. In August 2016 regional sites reported higher consumption levels compared to city sites, with similar average consumption reported for both capital city and regional sites in August 2017.

While consumption levels have fluctuated, both within and between states and territories and reporting periods, Western Australia, Queensland, Victoria and the Northern Territory showed decreased methamphetamine consumption between August 2016 and August 2017, with decreases also reported in regional New South Wales, South Australia and Tasmania.

With the exception of the Northern Territory and South Australia, estimated average consumption of methamphetamine in regional sites exceeded the levels reported for capital city sites in August 2017. South Australia capital city and regional Western Australia sites reported the highest methamphetamine consumption nationally.

Historical wastewater analysis data for estimated methamphetamine consumption since 2009 is available for two sites in regional Queensland, four sites in capital city South Australia and two sites in capital city Victoria. The data shows that the sites in Queensland had increased year-on-year methamphetamine consumption to 2016, with a small decrease noted in 2017. Similar to Queensland, the average consumption in South Australia shows that methamphetamine consumption increased year-on-year to 2016. Average methamphetamine consumption at these sites varied over the period August 2016 to August 2017, with the highest consumption reported in August 2017. Methamphetamine consumption has been relatively stable in the two capital city sites in Victoria since 2015.

The overall picture for methamphetamine is one of ongoing and strong demand. While the National Wastewater Drug Monitoring Program showed fluctuations in consumption over the first 12 months of sampling, consumption remains relatively stable at a high level.

¹ Throughout this report, with the exception of MDA, all comparisons on the consumption of different drugs are based on doses consumed rather than the mass of the drug consumed.

AMPHETAMINE

Amphetamine is a metabolite of methylamphetamine consumption. Although it is recognised that some forms of amphetamine (such as amphetamine and dexamphetamine) are used for both licit and illicit purposes, amphetamine results have not been reported separately in this report as amphetamine concentrations across the sites were consistent with the observed levels being primarily related to methylamphetamine metabolism rather than direct amphetamine consumption.

COCAINE

When comparing data from August 2016 and August 2017, population-weighted averages for cocaine consumption in capital city and regional sites increased. Following earlier increases in consumption, capital city and regional average consumption decreased from April 2017. Nationally, average cocaine consumption in capital city locations remains almost double that in regional locations. Cocaine use remained highest in New South Wales, mainly in the capital city locations, with the Australian Capital Territory reporting the second highest capital city average consumption nationally.

3,4-METHYLENEDIOXYMETHYLAMPHETAMINE (MDMA)

When comparing data from August 2016 and August 2017, population-weighted averages for MDMA consumption decreased for both capital city and regional sites, with figures reported in August 2017 almost half that reported in August 2016. Although nationally there has been an overall decline in MDMA consumption, South Australia reported increased estimated average consumption in both capital city and regional sites.

The overall picture for MDMA is one of declining consumption, with population-weighted average consumption in capital city sites consistently exceeding that in regional sites.

3,4-METHYLENEDIOXYAMPHETAMINE (MDA)

MDA is a metabolite of MDMA. As the proportion of MDA derived from MDMA is known, it has been possible in this report to estimate MDA consumption rather than its presence solely as a metabolite of MDMA use. Consequently, MDA consumption has been identified as an emerging problem in Australia, especially in regional sites. Site 12 in Queensland is of particular concern given the very high consumption levels reported in August 2017. Ongoing monitoring of MDA consumption in subsequent reports will provide further insight into this market.

HEROIN

Heroin consumption was measured for the first time in August 2017 and is included in this third National Wastewater Drug Monitoring Program report. While heroin consumption was detected in all capital city sites, this was not the case for all regional sites. Of the capital city sites, Victoria, followed by the Australian Capital Territory, reported the highest estimated average consumption of heroin. Of the regional sites, Victoria, followed by New South Wales, reported the highest estimated average consumption. For those states and territories where heroin consumption was reported for both regional and capital city sites, with the exception of New South Wales, estimated average consumption was higher in capital city sites.

Historical data for heroin is available for four capital city sites in South Australia since 2013. This data shows an overall declining trend in estimated heroin consumption. Following an increase in reported heroin consumption between 2013 and 2014, consumption decreased by almost a third in 2015, with consumption in 2016 remaining relatively stable.

The continued monitoring of heroin consumption in subsequent reports will provide further insight into this market.

JWH-018 AND JWH-073

Methods for measuring the synthetic cannabinoids JWH-018 and JWH-073 were included in the National Wastewater Drug Monitoring Program but failed to detect the compounds in sites across Australia.

MEPHEDRONE

Mephedrone was detected 11 times at a total of seven sites across Queensland, Victoria and Western Australia in August 2017, but the quantity of the substance was mostly below the level at which it could reliably be quantified.

METHYLONE

Methylone was detected 90 times at a total of 22 sites in all states and territories except the Australian Capital Territory and South Australia in August 2017, but the quantity of the substance was mostly below the level at which it could reliably be quantified.

OXYCODONE

Oxycodone, which may be licit or illicit, was detected in all states and territories. When comparing data from August 2016 and August 2017, population-weighted averages for oxycodone consumption decreased in both capital city and regional sites. Regional sites consistently reported higher average consumption than capital city sites. Similar to previous collection periods, regional site averages were around double that of capital city sites.

With the exception of regional Northern Territory sites, estimated average consumption of oxycodone in regional and capital city sites decreased between August 2016 and August 2017. Victoria reported the highest average regional oxycodone consumption in August 2017, with the Australian Capital Territory reporting the highest capital city average consumption.

FENTANYL

Fentanyl, which may be licit or illicit, was detected in all states and territories. When comparing data from August 2016 and August 2017, population-weighted averages for fentanyl consumption in capital city sites decreased, while regional averages remained relatively stable for the period. Increased fentanyl consumption was detected in August 2017 following decreases in consumption between August 2016 and April 2017 for regional sites. Following decreased consumption between August 2016 and December 2016, fentanyl consumption remained relatively stable in capital city sites.

Fentanyl consumption was high in many regional centres, particularly in South Australia. Fentanyl consumption at Site 81 in New South Wales was almost three times the next highest measurement.² This is the first time data has been collected from Site 81, with future results to be monitored to understand the site characteristics. Elevated consumption levels were observed at several regional sites, with weighted average consumption in regional sites more than double that of capital city sites.

NICOTINE³

When comparing data from August 2016 and August 2017, population-weighted averages for nicotine consumption in capital city and regional sites increased.

With the exception of South Australia capital city sites and Western Australia capital city and regional sites, nicotine consumption increased from August 2016 to August 2017. With the exception of the Northern Territory,⁴ which reported the highest nicotine consumption, consumption was fairly consistent across the country.

The overall picture for nicotine is that it remains one of the most consumed drugs in Australia, with population-weighted average consumption in regional sites consistently exceeding that in city sites.

ALCOHOL

When comparing data from August 2016 and August 2017, population-weighted averages for alcohol consumption remained relatively stable in capital city sites and decreased in regional sites. In August 2016, similar averages for alcohol consumption were reported in capital city and regional sites; however, consumption in capital city sites has exceeded regional site averages since December 2016.⁵

In August 2017 alcohol consumption in both capital city and regional locations in the Northern Territory far exceeded the national average. Average national alcohol consumption was slightly higher in capital city locations than regional locations, with alcohol consumption in regional South Australia well below the national average.⁶ Victoria, Queensland and the Australian Capital Territory reported below-average alcohol consumption.

Alcohol remains one of the most consumed drugs in Australia, with notable variations in consumption, both within and between states and territories, between capital city and regional sites, and across time.

NEXT REPORT

The fourth report of the National Wastewater Drug Monitoring Program is scheduled to be publicly released in March 2018.

² Figures of fentanyl consumption at Site 81 may be influenced by a number of factors including the relatively low population at this site and age demographics, although there are other possible scenarios.

³ For accuracy, estimates have been changed from tobacco in the previous two reports to nicotine in this report due to the inability to distinguish between nicotine intake from tobacco or electric cigarettes and nicotine replacement therapies such as patches and gum.

⁴ As there are only two participating sites in the Northern Territory, results may not be representative of the Territory as a whole.

⁵ Many regional sites did not sample on weekends, when consumption of alcohol is typically higher.

⁶ No weekend sampling was undertaken in regional South Australia.

