NATIONAL WASTEWATER DRUG MONITORING PROGRAM

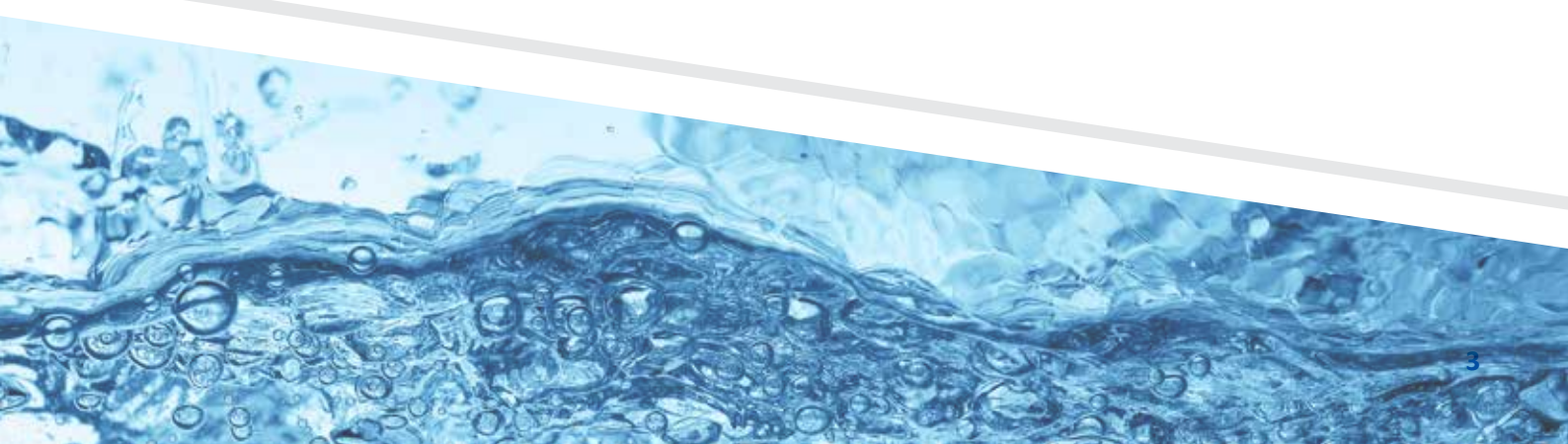
REPORT 5, AUGUST 2018

AUSTRALIAN CRIMINAL INTELLIGENCE COMMISSION

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

University of South Australia

CONTENTS



CEO FOREWORD

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

This National Wastewater Drug Monitoring Program report is the fifth in a series of nine public reports that will detail the findings of the 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.

Wastewater analysis is widely applied internationally as a tool to measure and interpret drug use within national populations, with the current national program in Australia representing world best practice. 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 monitor the progress of demand and supply reduction strategies.

EVOLUTION OF THE PROGRAM

This report includes wastewater data from all states and territories and covers both capital city and regional sites, enabling the program to provide a national picture of drug use. In April 2018, 47 wastewater sites were monitored nationally. Based on 2016 Census data, these sites cover 54.8 per cent of the Australian population—around 12.8 million people. This report contributes further data to permit the identification of changes in usage patterns and to build a comprehensive and increasingly detailed picture of national drug consumption.

In future reports the Australian Criminal Intelligence Commission will test for cannabis consumption, one of the most used illicit drugs, both domestically and internationally. This exemplifies the continuing evolution of the program and we are grateful to our partners at the University of Queensland and the University of South Australia for extending the existing program in this manner.

TRENDS IDENTIFIED DURING THIS REPORTING PERIOD

Of the drugs monitored by the program, consistent with previous reports, alcohol and nicotine continue to be the most consumed drugs in Australia. Although the population-weighted average consumption of methylamphetamine decreased in both capital city and regional sites from December 2017 to April 2018, it remains the most consumed illicit drug of those tested. The consumption of other drugs monitored by the program remains considerably lower.

While there is variation in consumption levels both within and across states and territories, there has been an overall decrease in the population-weighted average consumption of many of the drugs measured by the program from December 2017 to April 2018. Of note and concern this reporting period is the increase in fentanyl consumption, particularly in regional sites, with

the population-weighted average consumption of fentanyl in April 2018 in both capital city and regional sites the highest recorded since the program began. While fentanyl consumption measured by the program reflects both licit and illicit use, increased consumption is of concern as the high potency of fentanyl greatly increases the risk of overdose.

This report also includes updated SCORE data, which provide international consumption comparisons for a number of drugs monitored by the program. Of the 23 countries with comparable reported data, Australia ranks second highest after the United States of America —where only one site was tested—for total estimated stimulant consumption. When comparing individual drugs, Australia ranks highly for methylamphetamine consumption, with medium MDMA consumption and relatively low cocaine consumption.

In addition to placing Australian drug use in context with other countries, for the first time this report includes 'bubble maps', which provide a visual representation of average consumption in capital city and regional sites. These maps enable users to readily see and compare national consumption averages, and European consumption averages where available, for individual drug types.

ADDITIONAL INSIGHTS GAINED FROM WASTEWATER ANALYSIS

Wastewater analysis provides a measure of the demand for a range of licit and illicit drugs. Analysis of wastewater data offers opportunities to address emerging problems, identify previously unknown drug threats and consumption patterns, and assists to measure the effectiveness of harm reduction initiatives and supply disruption strategies.

Following on from the national consumption estimates for methylamphetamine, cocaine, MDMA and heroin derived from the program and included in Report 4, this report includes a further breakdown of these figures to the state and territory level. This again reinforces that population size is not the sole influencing factor on drug consumption and highlights the variation in drug use that exists between the individual states and territories. Understanding these differences is important in the development and delivery of tailored responses to suit the specific needs of individual jurisdictions. In the future we will also look to calculate annual consumption estimates for the second and third year of the program. This longitudinal data will provide valuable insights, enabling the ready comparison of data across reporting periods and assist in identifying changes in drug consumption across the life of the program.

I would like to thank the Australian Government for contributing the funding which made this initiative possible and to acknowledge the Australian Criminal Intelligence Commission officers who contributed to the project. I also acknowledge the valuable support and specialist expertise of the University of Queensland and 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

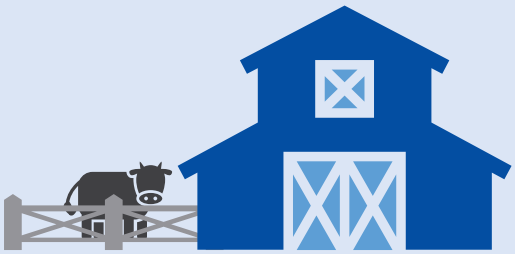
SNAPSHOT

The April 2018 collection covers **54.8 per cent** of Australia's population—about **12.8 million Australians.**

Alcohol and **nicotine** remain the **highest consumed substances** and **methylamphetamine** continues to be the **most consumed illicit drug** tested.

Increased **fentanyl use** is of concern, with **April 2018** capital city and regional average **consumption** at the **highest levels** recorded by the program.

Capital city **cocaine** and **heroin** average consumption exceeded regional consumption.

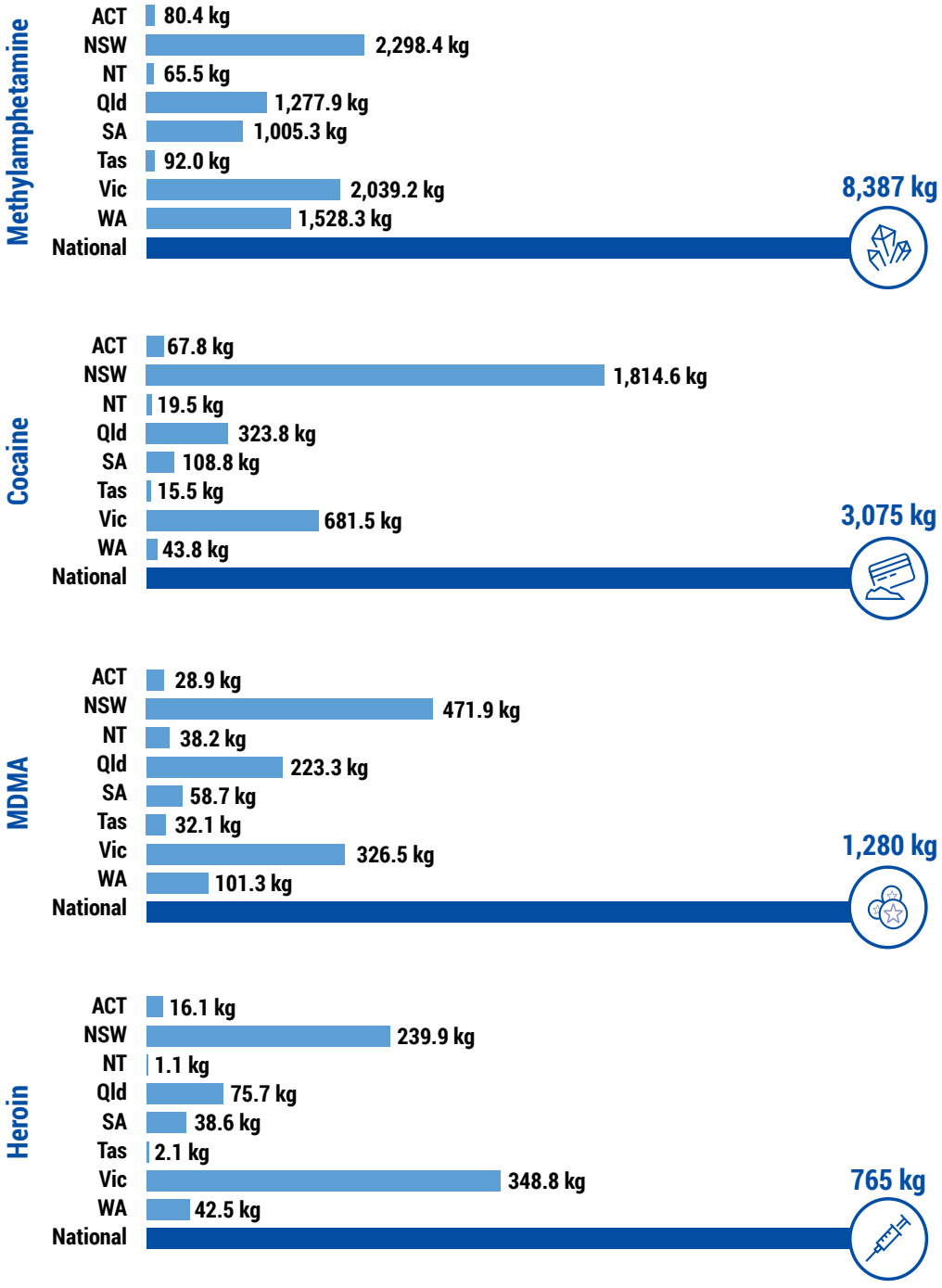


Regional **nicotine, alcohol, methylamphetamine, MDMA, MDA, oxycodone** and **fentanyl** average consumption exceeded capital city consumption.

SCORE INTERNATIONAL COMPARISONS

Of the 23 countries with comparable reported data for the **four common stimulants** considered (MDMA, cocaine, amphetamine and methylamphetamine), **Australia** has the **second highest** total estimated **consumption overall** after the United States of America.

Australia ranks **second** for **methylamphetamine** consumption, with **median MDMA** consumption and relatively **low cocaine** consumption.



Estimated state and territory annual consumption of methylamphetamine, cocaine, MDMA and heroin (based on NWDMP data for August 2016 to August 2017).

INTRODUCTION

This is the fifth 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 11 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 presence[1] of the following substances:

- methylamphetamine
- amphetamine
- cocaine
- 3,4-methylenedioxymethylamphetamine (MDMA)
- 3,4-methylenedioxyamphetamine (MDA)
- heroin
- mephedrone
- methylone
- oxycodone
- fentanyl
- nicotine
- 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.

The first five substances are widely recognised illicit stimulants. Heroin is an illicit depressant. The next two substances, mephedrone and methylone, are illicit synthetic stimulants and are described as new psychoactive substances (NPS).[2] Oxycodone and fentanyl are opioid pharmaceuticals with therapeutic application, but are also diverted to the illicit market. Nicotine and alcohol are licit drugs. The Australian Criminal Intelligence Commission will continue to review the appropriateness of the monitored substances with its partners, stakeholders and the universities.

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 program, while the remaining sites will be re-assessed periodically. 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 April 2018, 47 wastewater treatment plants participated nationally.

The breakdown of sites by jurisdiction for April 2018 is as follows:

2 From Report 4, the two synthetic cannabinoids JWH-018 and JWH-073 are no longer monitored by the National Wastewater Drug Monitoring Program as they had not been detected since monitoring commenced in August 2016.

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.

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.

In order to inform appropriate responses, stakeholders in law enforcement, health and other relevant policy agencies may be provided with classified information identifying actual sampling locations.

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 fifth National Wastewater Drug Monitoring Program report measures drug use by approximately 54.8 per cent of the Australian population.[3] 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.

The Australian Criminal Intelligence Commission continues to engage with academic institutions, industry and public sector agencies concerning potential uses for data generated by the National Wastewater Drug Monitoring Program. Discussions have centred upon focusing responses in particular high risk areas, measuring drug use in particular local areas, estimating the size of specific illicit markets, comparing wastewater data with

3 The April 2018 population estimate is based on the Australian Bureau of Statistics 2016 Census data and catchment data supplied by the operators of the wastewater facilities and service providers.

other drug-related data and exploring options for monitoring the effectiveness of existing demand, supply and harm reduction initiatives. The advantage the National Wastewater Drug Monitoring Program offers in all these contexts is that the data is collected on an ongoing basis, is reported regularly and can be shaped to accommodate changing circumstances.

Making the National Wastewater Drug Monitoring Program data available to the public and to stakeholder agencies enriches understanding and informs the national conversation on drug trends and related demand. Because the collection and analysis protocols are similar, it is also possible to compare domestic drug consumption with international drug consumption. This report includes a comparison of national methylamphetamine, amphetamine, cocaine and MDMA consumption data with recent Sewage analysis CORe group Europe (SCORE) consumption data for a number of European countries and the United States of America. This again illustrates the variation that exists in drug preferences within and between countries and may stimulate further discussions on alternative responses to the threat posed by drug use.

Wastewater has been identified as offering an important, unified and consistent guiding tool in developing holistic drug responses. 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. Australia is one of the few countries in the world where the program is funded by a national government, with the scope of sampling in Australia generating data which will help governments at both a state and national level to formulate appropriate responses.

ESTIMATED NATIONAL CONSUMPTION

The Australian Criminal Intelligence Commission used wastewater data collected between August 2016 and August 2017 to estimate the annual weight of methylamphetamine, MDMA, cocaine and heroin consumed nationally (see Table 1). While the estimates are conservative, they provide valuable insight into Australia's demand for illicit drugs that could not have been gained without the program. Also included in the table is the weight of amphetamines, cocaine, MDMA and heroin seized nationally in 2016–17.

Table 1: Estimated annual national methylamphetamine, cocaine, MDMA and heroin consumption between August 2016 and August 2017 and national seizures for 2016–17.

Drug	Estimated consumption (kilograms)	Weight of national seizures (kilograms)
Methylamphetamine	8,387	3,821[a]
Cocaine	3,075	4,623
MDMA	1,280	1,426
Heroin	765	224

[a] Granularity within drugs categorised as amphetamine-type stimulants is determined by available data. At this time it is not possible at a national level to provide a further breakdown of drugs within the amphetamines category. Amphetamines include amphetamine, methylamphetamine, dexamphetamine and amphetamines not elsewhere classified. Based on available data, methylamphetamine accounts for the greatest proportion of amphetamines seized nationally.

To put the size of the Australian methylamphetamine market into context, the total combined estimated weight of cocaine, MDMA and heroin consumed annually equates to around 60 per cent of the estimated weight of methylamphetamine consumed annually. This data also illustrates the variation in the size of these markets, with the estimated weight of methylamphetamine consumed annually being 6½ times that of MDMA and the estimated weight of cocaine consumed annually being four times that of heroin.

In addition to providing insight into how use of the different drugs in the program compare, when compared with the national seizure data as reported in the *Illicit Drug Data Report 2016–17:*

- The weight of amphetamines seized nationally equated to 45.6 of the total estimated weight of methylamphetamine needed to meet national demand.
- The weight of cocaine seized nationally was one and a half times the total estimated weight of cocaine needed to meet national demand (150.3 per cent).
- The weight of MDMA seized nationally exceeded the total estimated weight of MDMA needed to meet national demand (111.4 per cent).
- The weight of heroin seized nationally equated to 29.3 per cent of the total estimated weight of heroin required to meet national demand.

ESTIMATED STATE AND TERRITORY CONSUMPTION

The Australian Criminal Intelligence Commission used wastewater data collected between August 2016 and August 2017 to estimate the annual weight of methylamphetamine, MDMA, cocaine and heroin consumed in each Australian state and territory (see Table 2).[4] While the estimates are conservative, they provide valuable insight into Australia's demand for illicit drugs that could not have been gained without the program.

Table 2: Estimated annual state and territory methylamphetamine, cocaine, MDMA and heroin consumption.

State / territory	Estimated drug consumption (kilograms per annum)				
	Methylamphetamine	Cocaine	MDMA	Heroin	Total
ACT	80.4	67.8	28.9	16.1	**193.2**
NSW	2,298.4	1,814.6	471.9	239.9	**4,824.8**
NT	65.5	19.5	38.2	1.1	**124.3**
Qld	1,277.9	323.8	223.3	75.7	**1,900.7**
SA	1,005.3	108.8	58.7	38.6	**1,211.4**
Tas	92.0	15.5	32.1	2.1	**141.7**
Vic	2,039.2	681.5	326.5	348.8	**3,396.0**
WA	1,528.3	43.8	101.3	42.5	**1,715.9**
National	**8,387**	**3,075**	**1,280**	**765**	

4 State and territory consumption estimates were calculated using data from the first year of the program and provide further insight into the breakdown of the previously provided national consumption estimates for methylamphetamine, cocaine, MDMA and heroin. When the data is available, annual consumption estimates will be calculated for the second and third year of the program to enable comparison and the identification of any changes across the three year program.

While it is not unexpected that that the larger jurisdictions generally consume more drugs, population size is not the only influencing factor on drug use, as illustrated by the variation in consumption across the four drug types. This becomes more evident when the same data is presented as a proportion of the weight of drugs consumed (see Table 3). By expressing annual consumption estimates derived from the program as a proportion of the total weight of methylamphetamine, cocaine, MDMA and heroin consumed in each state and territory we are more readily able to see the variation that exists.

Table 3: Estimated annual methylamphetamine, cocaine, MDMA and heroin consumption, as a proportion of the total weight consumed per state and territory.

State / territory	Estimated annual consumption (proportion of state/territory total consumption)			
	Methylamphetamine	Cocaine	MDMA	Heroin
ACT	41.6%	**35.1%**	15.0%	**8.3%**
NSW	47.6%	**37.6%**	9.8%	5.0%
NT	52.7%	15.7%	**30.7%**	0.9%
Qld	67.2%	17.0%	11.7%	4.0%
SA	**83.0%**	9.0%	4.8%	3.2%
Tas	64.9%	10.9%	**22.7%**	1.5%
Vic	60.0%	20.1%	9.6%	**10.3%**
WA	**89.1%**	2.5%	5.9%	2.5%

Highest consumption in Australia (as a proportion of state / territory consumption) per drug type
Second highest consumption in Australia (as a proportion of state / territory consumption) per drug type

While methylamphetamine is the most consumed illicit drug measured by the National Wastewater Drug Monitoring Program in all states and territories, there is variation in drug preferences within and between the individual states and territories. Understanding these preferences is important in the development and delivery of tailored responses to suit the specific needs of individual jurisdictions. Demand for these drugs remains robust and a shared approach that targets supply, demand and harm reduction is critical to addressing drug use in Australia. Drug consumption estimates derived from wastewater data, when used in combination with other data—such as seizure, arrest, price, purity, health and self-report data—provide greater insight into the related markets and the potential impact of supply, demand and harm reduction strategies.

EVOLUTION OF THE PROGRAM

The Australian Criminal Intelligence Commission will continue to work with the participating universities to enhance the program. Since its launch, the program has explored and implemented various enhancements that contribute to the delivery of better data and building a better and more granular understanding of drug consumption in Australia. These enhancements include the ability to compare Australia's drug consumption with measured consumption in different countries, and the inclusion of additional substances in the monitoring program as new methodologies are developed and endorsed by the scientific community. Discussions also include whether it may be possible to use alternative metabolites of some substances to more precisely measure their consumption in the community.

The fifth National Wastewater Drug Monitoring Program report continues to provide valuable insight into drug consumption in Australia. In addition to placing Australian drug use in context with other countries, this report incorporates 'bubble maps'[5] which provide a visual representation of average capital city and regional consumption. These maps facilitate the interpretation of consumption patterns at a glance for the individual drug types in relation to national consumption averages and European consumption averages when available.

As the report evolves, so too does the program of work, with cannabis to be included as one of the drugs monitored by the National Wastewater Drug Monitoring Program from Report 6 in December 2018. This will provide further insight into one of the largest illicit drug markets in Australia.

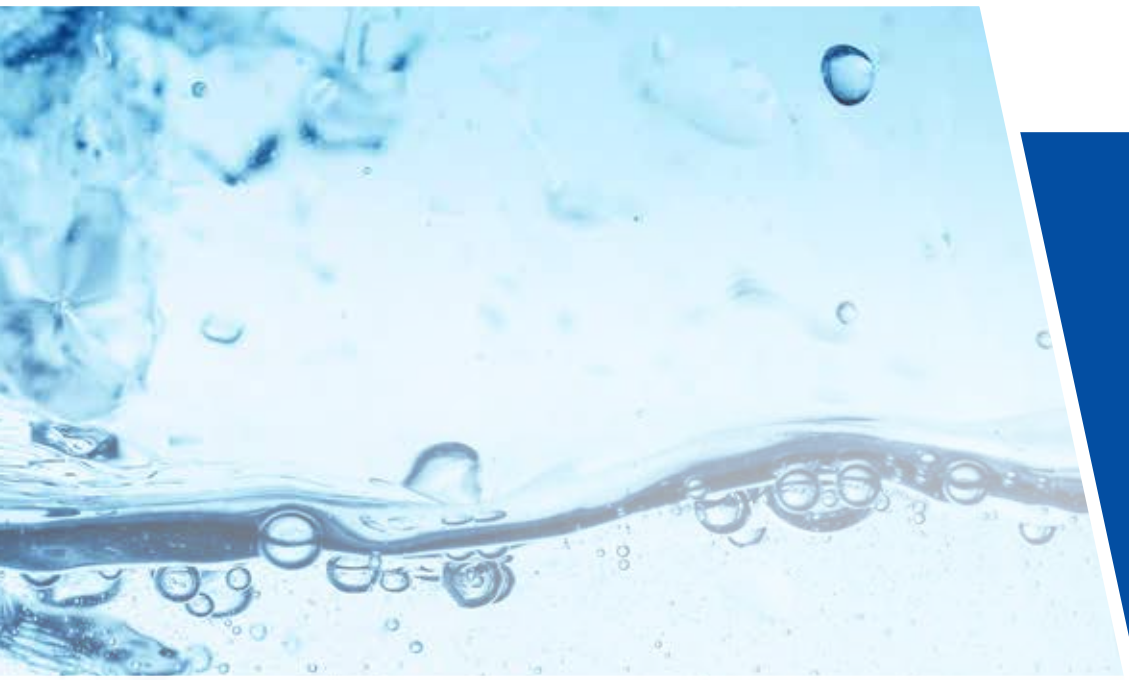
Wastewater data is an important part of the suite of datasets available to increase our understanding of drug consumption, demand and supply in Australia. The Australian Criminal Intelligence Commission is working to ensure the broadest possible range of stakeholders are engaged throughout the life of the program, consulting with stakeholders through existing drug forums and direct discussions with agencies. This includes working with industry to increase our understanding of drug markets in Australia.

RESULTS FROM THE INITIAL COLLECTION

This fifth report of the National Wastewater Drug Monitoring Program builds on national drug consumption data contained in the preceding four public reports to identify 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 and internationally. 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. Benefits of longitudinal wastewater data include the identification of emerging trends and patterns of use. This concept is best illustrated by the fentanyl data. The weighted average consumption of fentanyl in both capital city and regional sites increased from December 2017 to April 2018 and are both currently the highest recorded levels since the program began.

Reported results reflect per capita use in all locations and, with the exception of MDA (for which a reliable dose figure is not available), 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.

5 Bubble maps display graduated symbols showing different magnitudes of drug use derived from consumption estimates.



RESEARCH FINDINGS

Prepared by the University of Queensland (B Tscharke, R Mackie, J O'Brien, S Grant, J Mueller) and 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 has become 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 twelve licit and illicit drugs, including nicotine, alcohol, methylamphetamine, cocaine, MDMA (ecstasy) and heroin. Trends in estimated drug consumption are being 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. An additional graph set has been included for the first time in this report, comparing aggregated consumption estimates per jurisdiction on a bubble map of Australia. Additionally, this report has included updated international comparisons, comparing recent Australian results to the Sewage analysis CORe group Europe (SCORE) dataset for sites involved in the 2017 SCORE study.

For this fifth report, wastewater samples were collected during weeks of February and April 2018. 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 by evaluating census data vs catchment maps, together with excretion and dose data obtained from the scientific literature. A total of 20 WWTPs in capital cities and a further 27 regional sites participated in the project for the April 2018 period, covering a population of more than 12 million Australians. To maintain treatment plant confidentiality, each site was allocated a unique code and site names are not included in this report. Data from this report equates to coverage of approximately 48 per cent and 55 per cent of Australia's population for February and April, respectively. A total of 2,284 individual daily samples have been assessed since the beginning of the program, with new results from 445 additional samples added in this report. The collected samples provide relatively comprehensive, Australia-wide baseline data against which subsequent results can continue to be compared to ascertain both spatial and temporal trends.

The estimated drug usage across the 47 sites (April 2018) 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 results 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. 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 and shows no tendency to decline. The highest methylamphetamine levels were seen in Northern Territory (capital city) and Western Australia (regional).

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, with high levels of consumption also recorded in the Australian Capital Territory. 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 prescription pharmaceutical substances with abuse potential, had elevated consumption levels at several regional sites. Regional areas had average oxycodone use well above capital city sites in many states. Consumption of heroin varied widely, with minimal amounts detected in the Northern Territory and high levels recorded in Victoria.

After removing the proportion of MDA attributable from MDMA metabolism, use of the drug appeared variable across the nation. For the other drugs included in this study, methylone and mephedrone concentrations were generally at or below detection levels at all participating sites.

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 South Australia and Western Australia are clear reversals in longer term trends.

2: INTRODUCTION

2.1 PREAMBLE

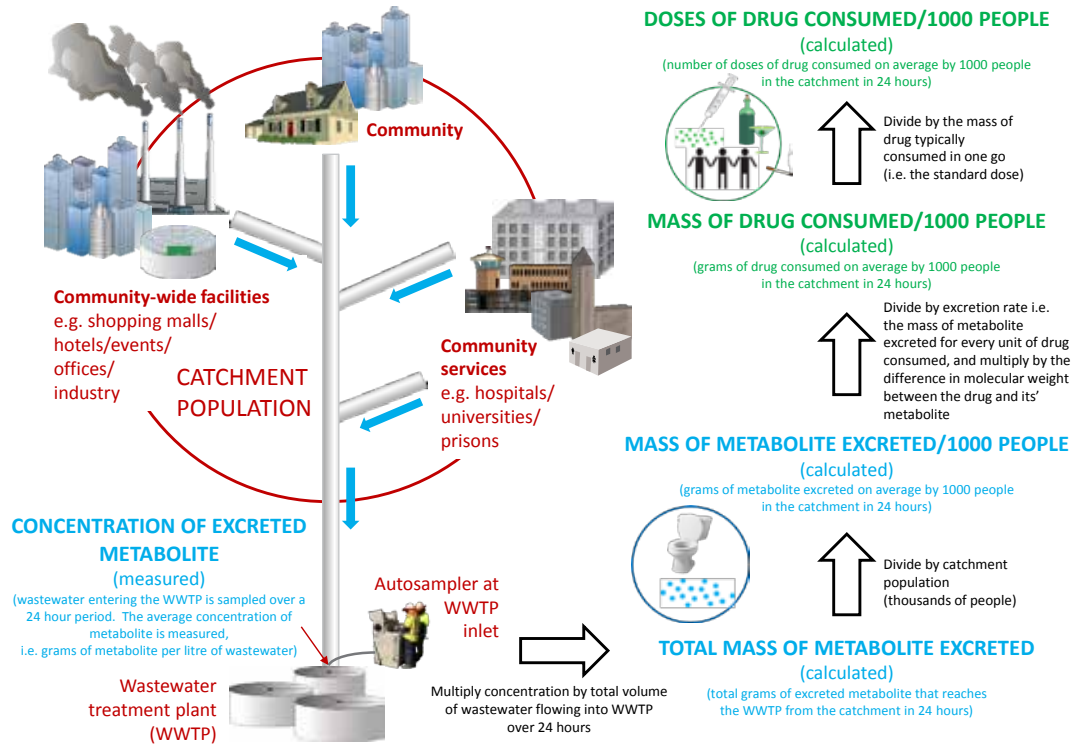
Wastewater analysis is a technique for delivering population-scale consumption of substances. The University of Queensland and University of South Australia have been commissioned to provide drug consumption data to ACIC for a period of three years, beginning in August 2016. Wastewater treatment sites are 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 fifth NWDMP report compares consumption data from the first four reports with results obtained subsequently from February and April 2018.

Compounds of concern include nicotine from nicotine intake (cigarettes, gum, patches, e-cigarettes, etc.), ethanol from alcohol intake, pharmaceutical opioids with abuse potential, illicit substances such as methylamphetamine, MDMA, cocaine and heroin as well as a number of new psychoactive substances (NPS). The compounds amphetamine and MDA were measured but not included in the initial reports. Amphetamine is a by-product of methylamphetamine pyrolysis and is also one of its metabolites. We found the levels of amphetamine to correspond consistently with the expected values from the excretion of methylamphetamine. 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 (Pizarro et al. 2002; Khan & Nicell 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 NWDMP report (available at www.acic.gov.au), as well as an in-depth description of the methodologies involved.[6] Collectively, waste products in the sewer system arrive at a 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 Report 1.

6 Information in relation to heroin appears in Report 3.

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 Report 1. An updated excretion and dose table including the heroin specific metabolite, 6-monoacetylmorphine, can be found in Appendix 1.

3.1 PARTICIPATING WASTEWATER TREATMENT PLANTS (WWTPS)

Forty-seven WWTPs across Australia participated in this study for the April 2018 collection (Figure 2). Of these, 20 sites were located in capital cities and a further 27 were regional sites, covering a wide range of catchment population sizes. Sites were selected by the ACIC. The number of participating sites for February and April 2018 is listed in Table 4 and Appendix 2. A complete list of participating sites, number of samples and relative catchment sizes are listed in Appendix 3. 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 April 2018, showing the number of capital city and regional plants by state and territory. The colours in this figure are matched with others in the remainder of the report to identify results relating to individual states and territories.

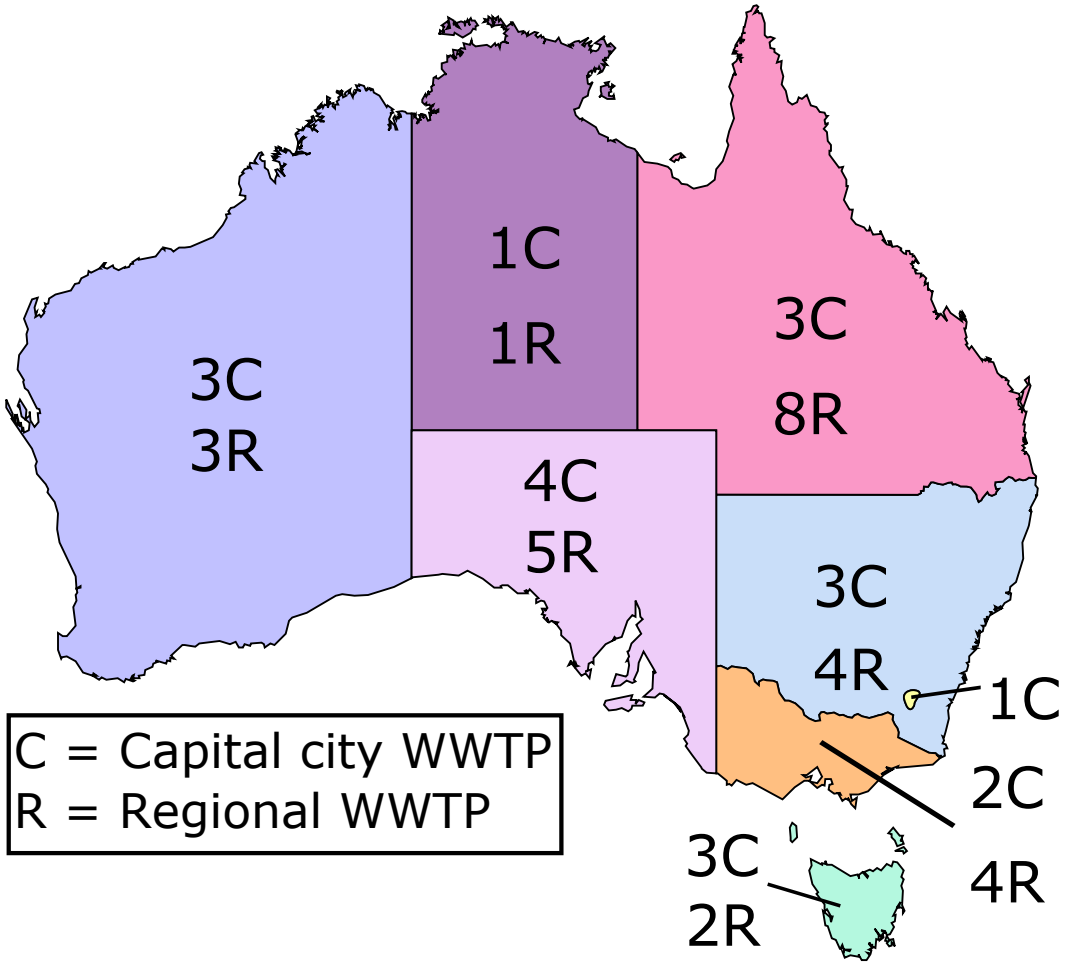


Table 4: Number of participating WWTPs for the periods covered in this report. Every second collection period aims to collect data from both regional (R) and capital city (C) sites (April), while the in-between collection periods (February) aim to collect data from capital city sites only.

	Feb–18		Apr–18	
State/territory	**C**	**R**	**C**	**R**
ACT	1	-	1	-
NSW	3	-	3	4
NT	-	-	1	1
Qld	3	-	3	8
SA	4	-	4	5
Tas	3	-	3	2
Vic	2	-	2	4
WA	3	-	3	3
Population (millions) C & R	**11.2**	**-**	**11.2**	**1.6**
Total population (millions)	**11.2**		**12.8**	
% of Australian population	**47.9%**		**54.8%**	

Estimates have been rounded to the nearest 0.1 million. 2016 Census population used for population percentage estimates.

3.2 SAMPLE COLLECTION AND PREPARATION

Daily composite samples were collected by treatment plant staff on seven consecutive days, or where seven days was not feasible, across as many consecutive days as possible. Regional sites in South Australia provided weekend samples for the first time, which should be considered when interpreting historical results—see Appendix 3. 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) and Tscharke et al. (2016). All other descriptions of calculations, extractions and analytical methods are outlined in Report 1 (available at www.acic.gov.au).

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 and bubble maps 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.

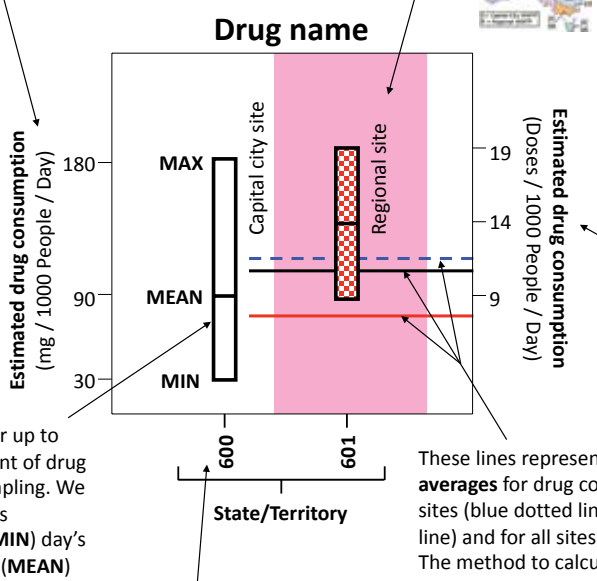
Figure 3: Explanation of the graphical representation of data for individual sites and bubble maps.

The **left hand axis** shows the estimated total mass consumed (in milligrams, mg) of a drug which is calculated by measuring the concentration of the drug's metabolite in a 24 hour wastewater composite sample, multiplying by the flow volume in the 24 hours, dividing by the population size and applying an excretion factor for the metabolite (see Equation 1, Report 1 for details).

Colours help identify the state or territory that the data relates to (colours are consistent between Figures).

The **right hand axis** shows the estimated number of doses of a drug consumed by 1,000 people in the catchment in a 24 hour period; e.g., one dose would be 1 cigarette, 1 standard drink or 1 injected amount of drug. In this example, at Site 601, the minimum consumption was 9 doses in one day, the maximum was 19 and average was 14 per day over the sampling period (for every 1,000 people).

To convert the mass consumed (left axis) to the estimated doses consumed (right axis), we divide the estimated mass consumed by the standard dose amount. Dose amount and excretion factors are given in Appendix 1. In this example, at Site 600, the minimum consumption was 30 mg in one day, the maximum was 180 mg and average was 90 mg per day over the sampling period (for every 1,000 people).



We collect wastewater data for up to 7 days and estimate the amount of drug consumed for each day of sampling. We plot the maximum (**MAX**) day's consumption, the minimum (**MIN**) day's consumption and the average (**MEAN**) across the 7 days. If the box is long, there is a large difference in consumption patterns over the week; for example, if drugs are used excessively at weekends but not often during the week. Alternatively, a short box suggests a similar drug usage every day of the week. See also main text.

Unique number allocated to each WWTP to maintain confidentiality. WWTP names will not be disclosed publicly.

These lines represent the **population weighted averages** for drug consumption for all capital city sites (blue dotted line), all regional sites (red line) and for all sites combined (black line). The method to calculate weighted population averages is given in the main text. In this example, the average consumption for regional Site 601 (horizontal bar within red checked box) is above both the average for regional sites and all sites nationally. In contrast, the average consumption for capital city Site 600 is below the national average.

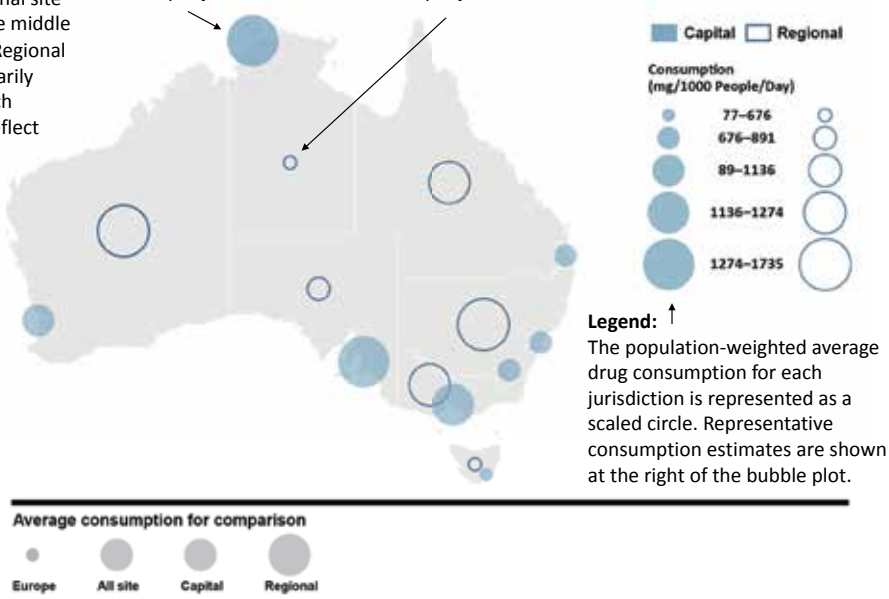
Figure 3 (continued): Explanation of the graphical representation of data for individual sites and bubble maps.

Bubbles:
Capital city site averages are drawn over the capital city of a jurisdiction and the regional site averages are drawn in the middle of the state or territory. Regional bubbles are drawn arbitrarily close to the centre of each jurisdiction and do not reflect location of sites.

Aggregated data:
The population-weighted average drug consumption of all regional sites, all capital city sites and all sites tested for **all jurisdictions** are also represented as scaled circles at the bottom of the plot. Where available, the European average is also compared.

Capital city average:
Population-weighted average of all capital sites tested per jurisdiction.

Regional city average:
Population-weighted average of all regional sites tested per jurisdiction.



Legend:
The population-weighted average drug consumption for each jurisdiction is represented as a scaled circle. Representative consumption estimates are shown at the right of the bubble plot.

This type of plot gives a rough overview of drug consumption per jurisdiction. The other temporal and spatial comparison graphs give greater resolution to compare between locations and should be used for analysis. Bubble sizes are comparable only within the same drug type, not between drug types.

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 determined 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 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 as a value of LOD. A concentration above the LOD but below LOR, is included at the midpoint between the LOD and LOR (i.e. (LOD + 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 since the start of collection weeks did not always correspond for every plant. We present only maximum, minimum and average (for the individual sites) 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 lower daily variation suggesting that their consumption is consistent throughout the week (Lai et al. 2015; Tscharke et al. 2016).

4: RESULTS

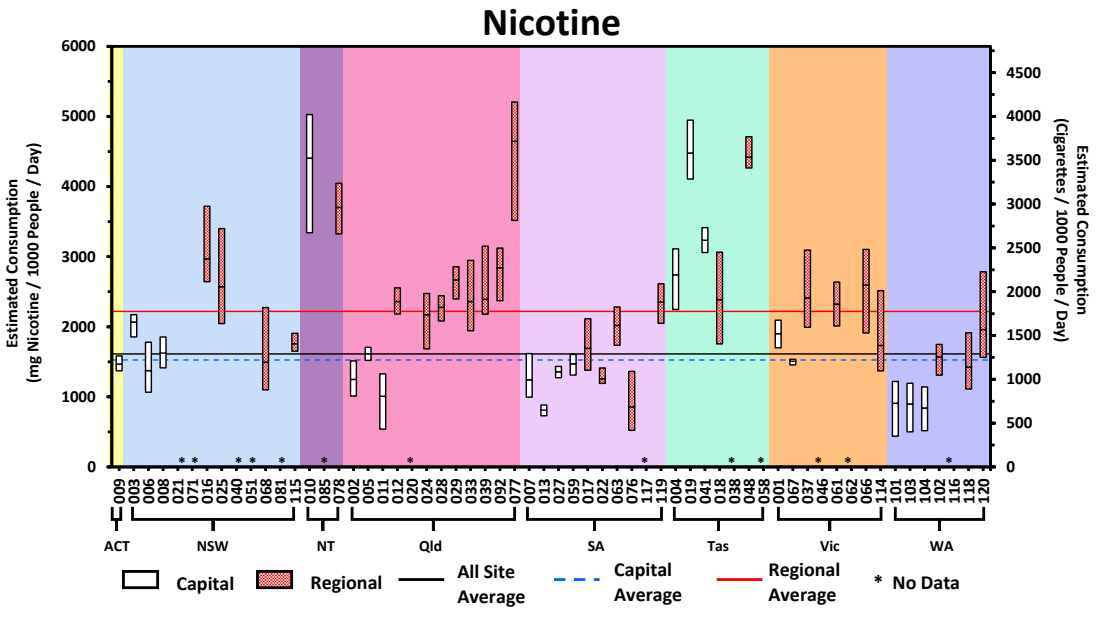
Estimated drug consumption data are presented in several different ways in the following sections to allow comparisons of drug use at the individual site level (section 4.1), between states and territories (section 4.2) and within each state and territory (section 4.3).
We recommend exercising caution when comparing results between sites as some plants provided samples for fewer days than others and the collection week did not correspond in all instances. A list of the detection frequency for each drug can be found in Appendix 4.
This report retained the current population estimates introduced in Report 4 by integrating the specific wastewater catchment areas against the high-resolution population data recently released from the 2016 Census. 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 APRIL 2018

4.1.1 NICOTINE AND ALCOHOL

Consumption of tobacco was estimated by measuring two nicotine metabolites. Since the method does not distinguish between nicotine intake from tobacco or electronic cigarettes and nicotine replacement therapies such as patches and gums, the estimate is reported as nicotine in this report. 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 April 2018 than capital city precincts. This was evident from the regional vs capital city averages for the sampling period (red horizontal and dotted blue lines, Figure 4). Capital city sites in Northern Territory and Tasmania had the highest weekly consumption, while some regional New South Wales, Northern Territory, Queensland and Tasmania sites had well above average levels.

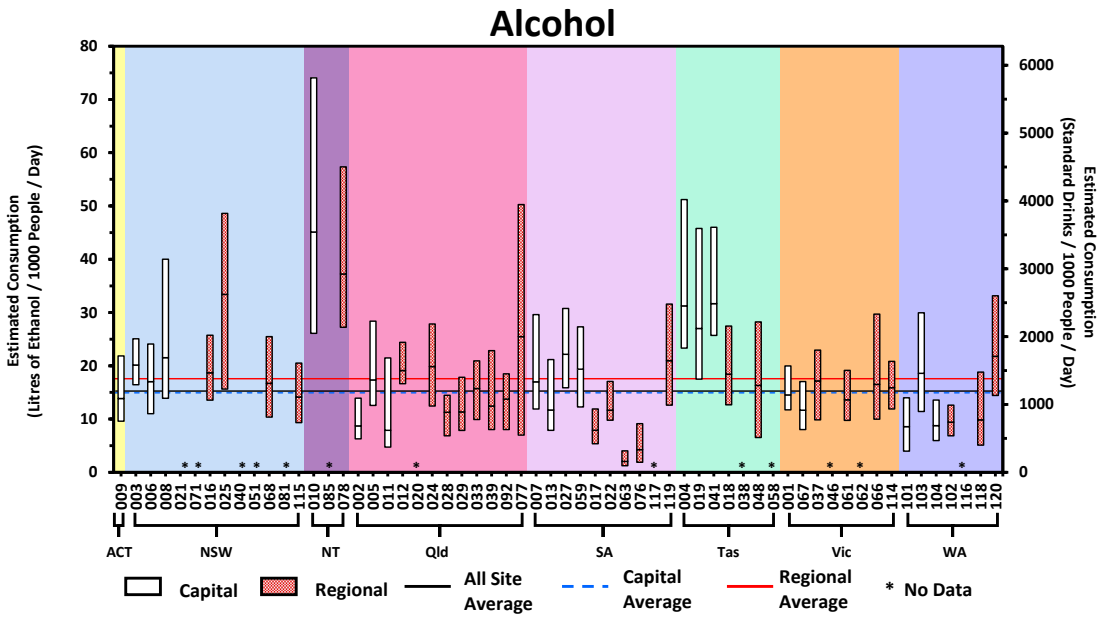
Figure 4: Estimated nicotine consumption for April 2018 in mass of nicotine consumed per day (left axis) and number of cigarettes per day (right axis) per thousand people. The number of collection days varied from 5-7.



- High regional average
- Variable weekly levels

Alcohol was measured using a specific metabolite of ethanol. The capital city average was lower than the regional centre alcohol consumption, but the difference was less pronounced than for nicotine (Figure 5). Many sites showed a wide range over the collection week. Alcohol consumption in some regional areas of Western Australia and South Australia were well below the national average. The Northern Territory, capital sites of Tasmania and a couple of Western Australian sites were above the national capital city and regional averages.

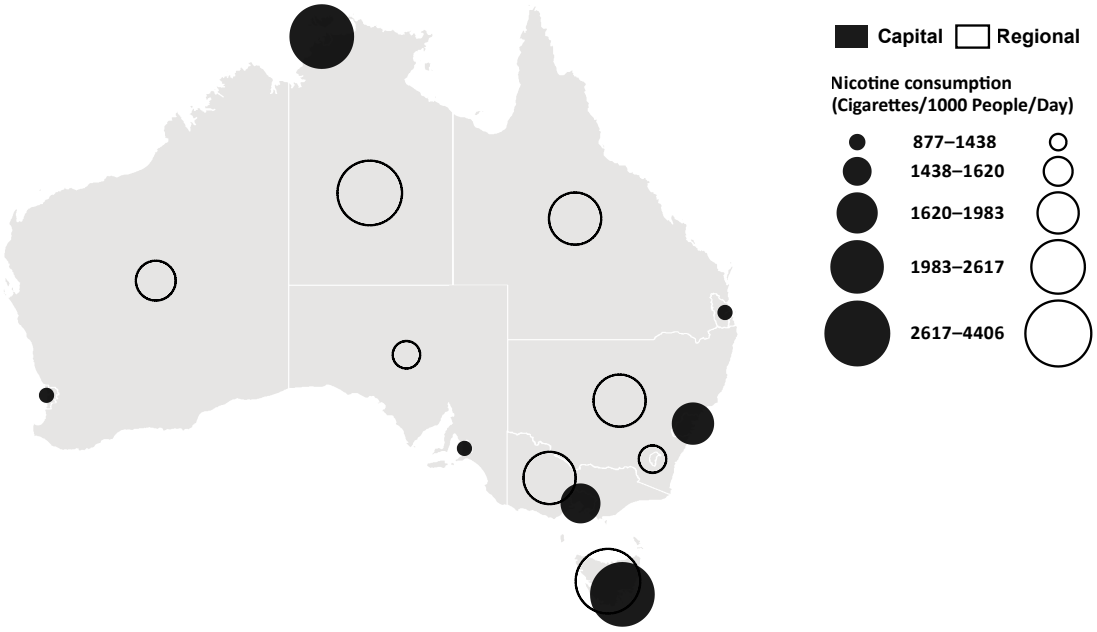
Figure 5: Estimated alcohol consumption for April 2018 in volume consumed per day (left axis) and standard drinks per day (right axis) per thousand people. The number of collection days varied from 5-7.



- Capital city averages higher than regional
- Wide weekly spread
- Relatively high level in the Northern Territory

The same information can be represented in a pictorial way by showing the relative scale of use of nicotine (Figure 6) and alcohol (Figure 7) as capital city or regional ‘bubbles’ for each state and territory.

Figure 6: Estimated nicotine consumption per jurisdiction for April 2018 in number of cigarettes per day per thousand people. The number of collection days varied from 5-7.



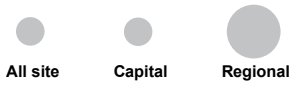
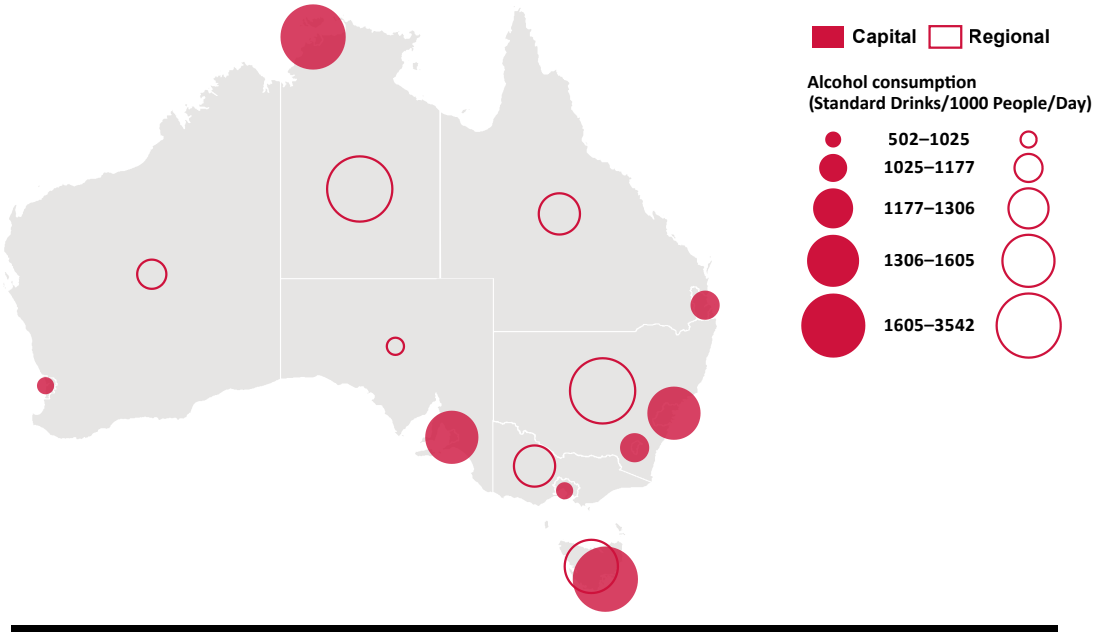
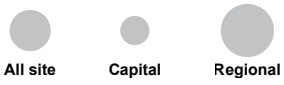


Figure 7: Estimated alcohol consumption per jurisdiction for April 2018 in number of standard drinks per day per thousand people. The number of collection days varied from 5-7.





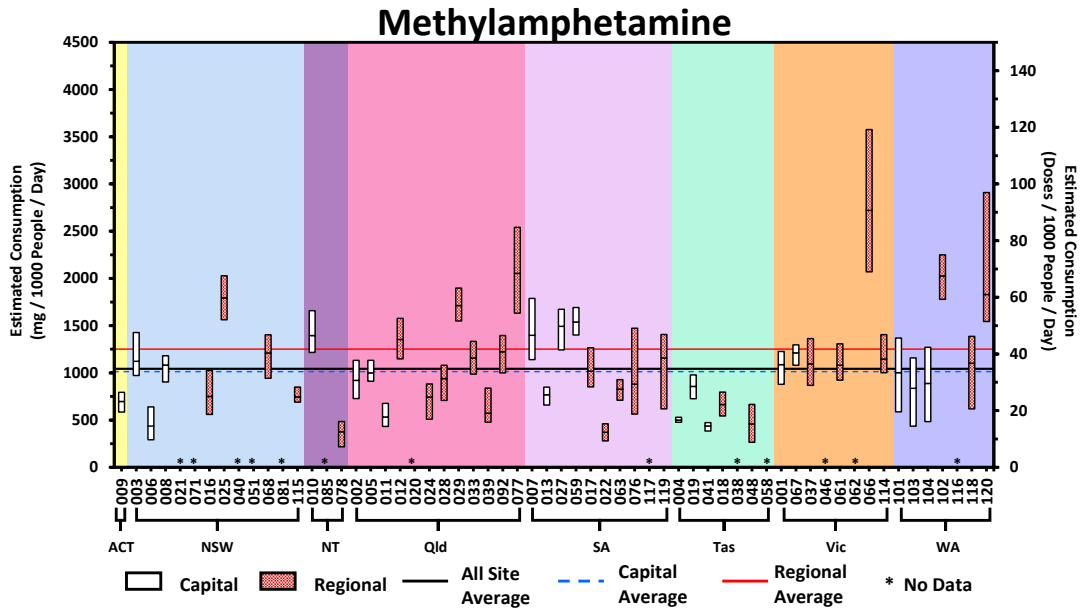
4.1.2 STIMULANTS

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. Unlike previous reports, the average regional loads were well above capital city consumption levels (Figure 8). However, large site differences were still evident, particularly in regional areas. The high variability in consumption was observed across all states. Differences in mass loads between capital cities were less obvious in April 2018 than in previous periods. The highest regional levels appeared at sites in Queensland, Victoria and Western Australia. Some sites showed a wide range in levels over the sampling week, which is unusual for a habitually used substance.

Figure 8: Estimated methylamphetamine consumption for April 2018 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5-7.



- **Regional averages higher than capital cities**
- **Capital city levels relatively similar**
- **Highest mass load in a regional Victoria site**
- **Variable across sites**

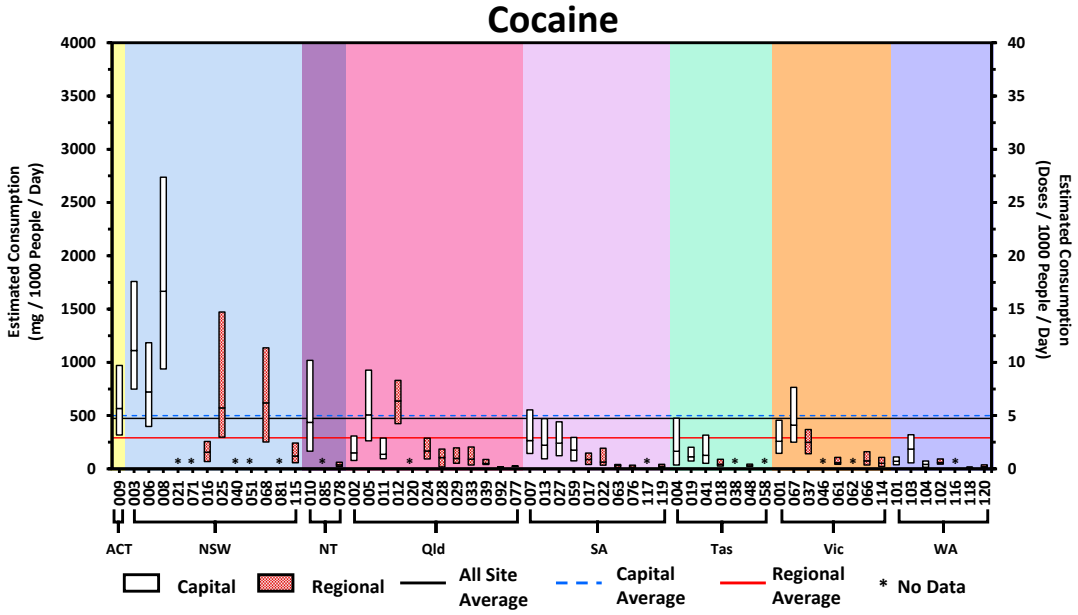
4.1.2.2 AMPHETAMINE

The concentration of amphetamine observed in the August 2016 and December 2017 samples strongly correlated with the methylamphetamine concentrations, with approximately 7 times higher methylamphetamine measured than amphetamine for both periods (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 9). Tasmania, South Australia and 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.

Figure 9: Estimated cocaine consumption for April 2018 in mass consumed per day per thousand people (left axis) and doses per day (right axis). The number of collection days varied from 5-7.

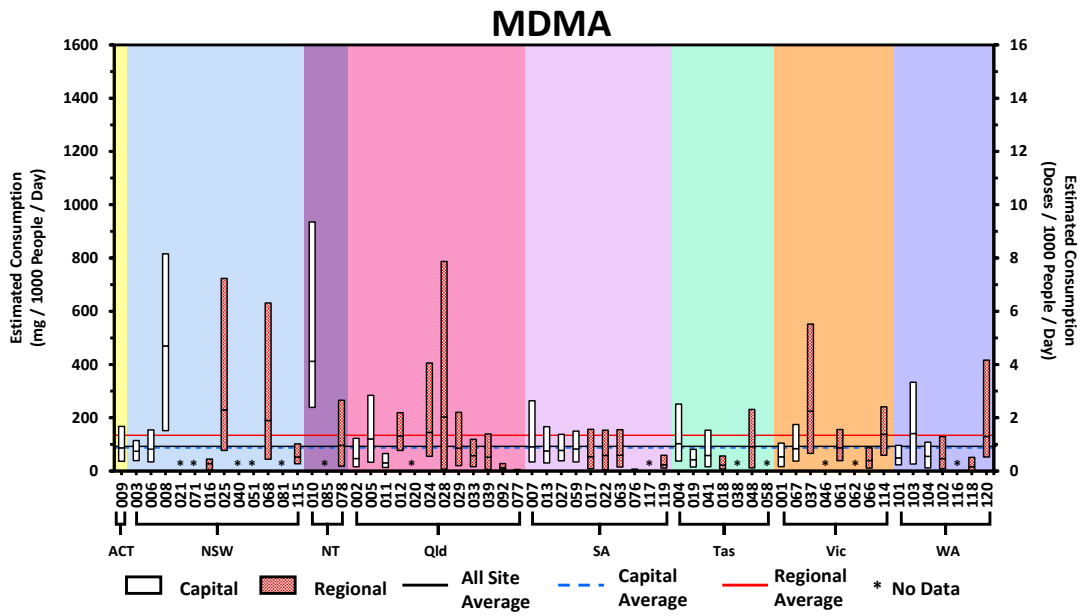


- **High levels in city sites**
- **Regional consumption low**

4.1.2.4 MDMA (3,4-METHYLENEDIOXYMETHYLAMPHETAMINE)

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

Figure 10: Estimated MDMA consumption for April 2018 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5-7.

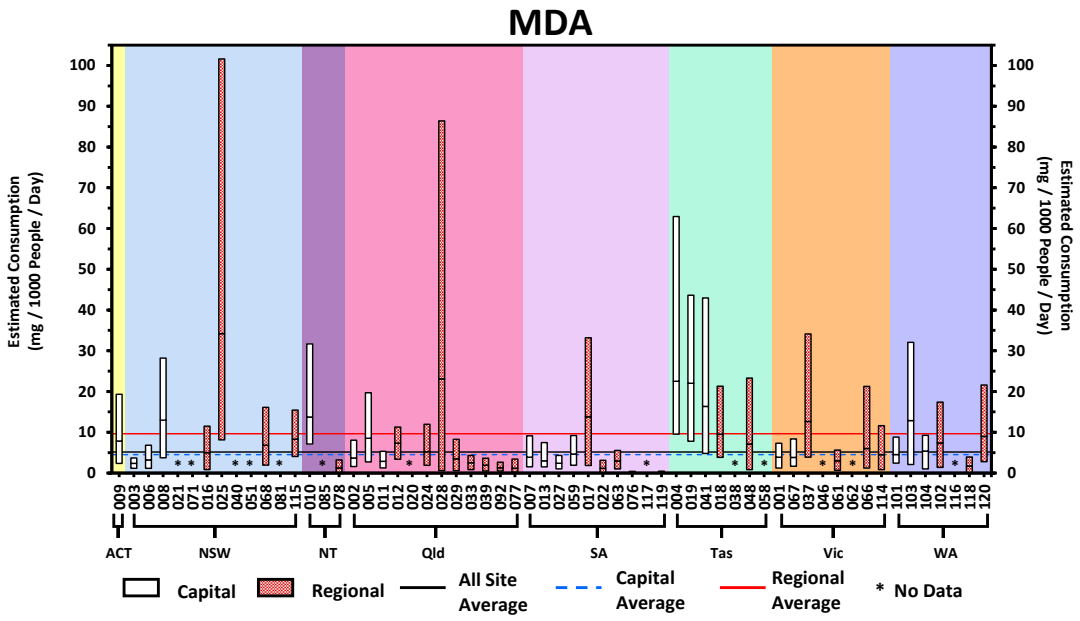


- Low use across the country
- Wide weekly spread indicates higher weekend use

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 around 100 mg. The daily mass loads for regional sites were on average higher than capital cities (Figure 11). Sites 25 in New South Wales and 28 in Queensland had very high levels on some sampling days compared to other sites in the states and elsewhere. Since the parent drug is measured in wastewater, disposal of unused drug into the sewer system may result in unusually high values being recorded. Tasmania generally had the highest levels of MDA in capital city cites.

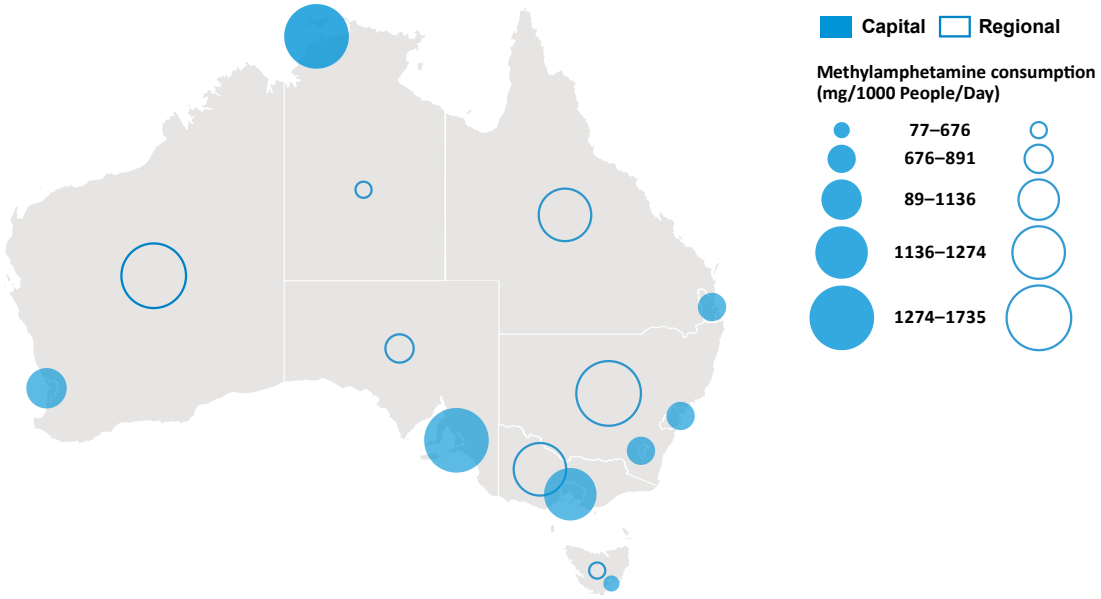
Figure 11: Estimated MDA consumption for April 2018 in mass consumed per day per thousand people. The number of collection days varied from 5-7.



- **Higher regional average**
- **Very high levels on some days at sites 25 and 28**
- **Tasmania capital city levels highest**

The scale of use of each stimulant is showed as bubble graphs. Regional and capital city use of methamphetamine (Figure 12), cocaine (Figure 13), MDMA (Figure 14) and MDA (Figure 15) are all represented to reflect the proportion of drug use across the country. The popularity of cocaine on the eastern seaboard is apparent. Compared to European levels, methamphetamine use is the clear exception, being much more prominent in Australia. All the other stimulants were below European averages.

Figure 12: Estimated methylamphetamine consumption per jurisdiction for April 2018 in mg consumed per day per thousand people. The number of collection days varied from 5-7. The Europe population-weighted average is from the SCORE dataset, March 2017.



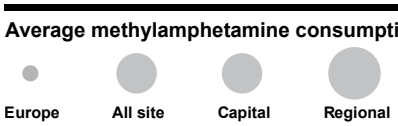
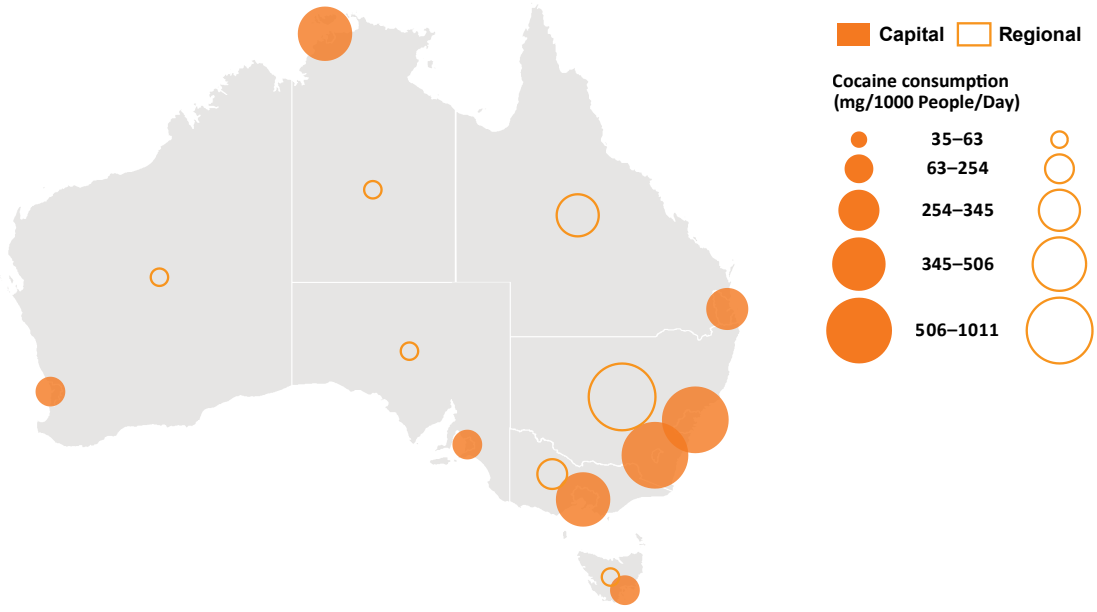


Figure 13: Estimated cocaine consumption per jurisdiction for April 2018 in mg consumed per day per thousand people. The number of collection days varied from 5-7. The Europe population-weighted average is from the SCORE dataset, March 2017.



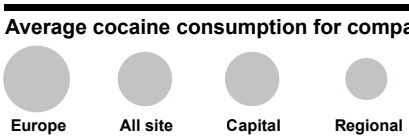


Figure 14: Estimated MDMA consumption per jurisdiction for April 2018 in mg consumed per day per thousand people. The number of collection days varied from 5-7. The Europe population-weighted average is from the SCORE dataset, March 2017.

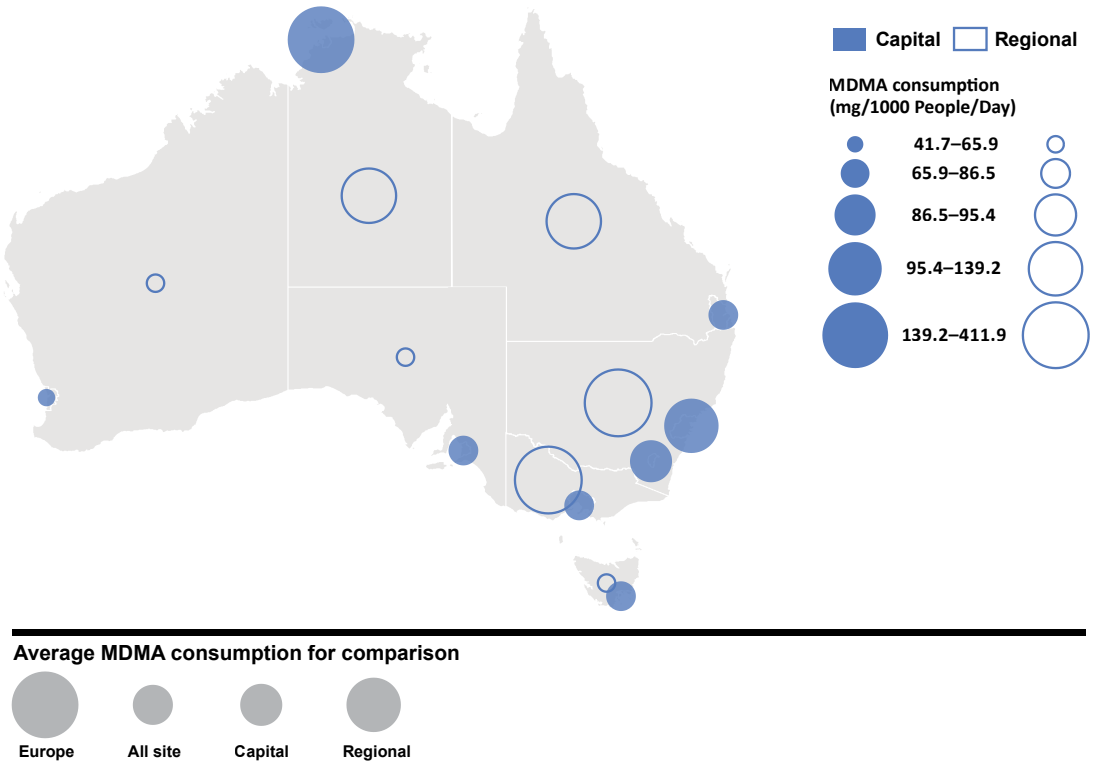
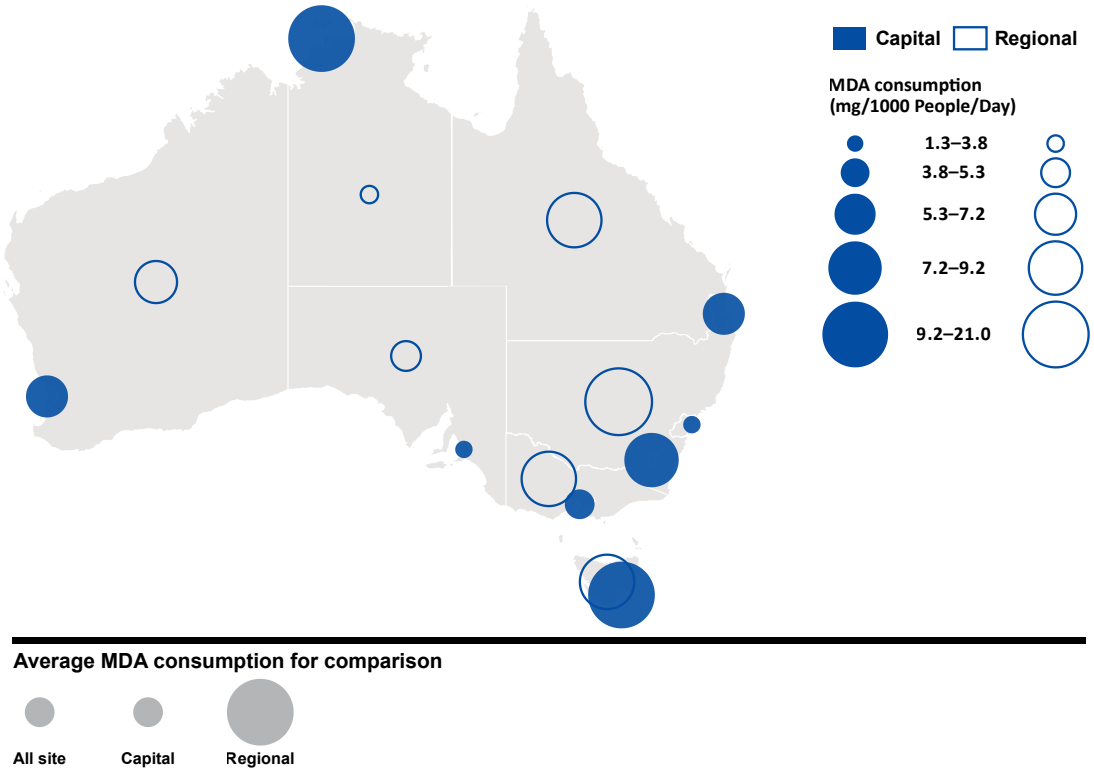


Figure 15: Estimated MDA consumption per jurisdiction for April 2018 in mg consumed per day per thousand people. The number of collection days varied from 5-7.



4.1.3 OPIOIDS

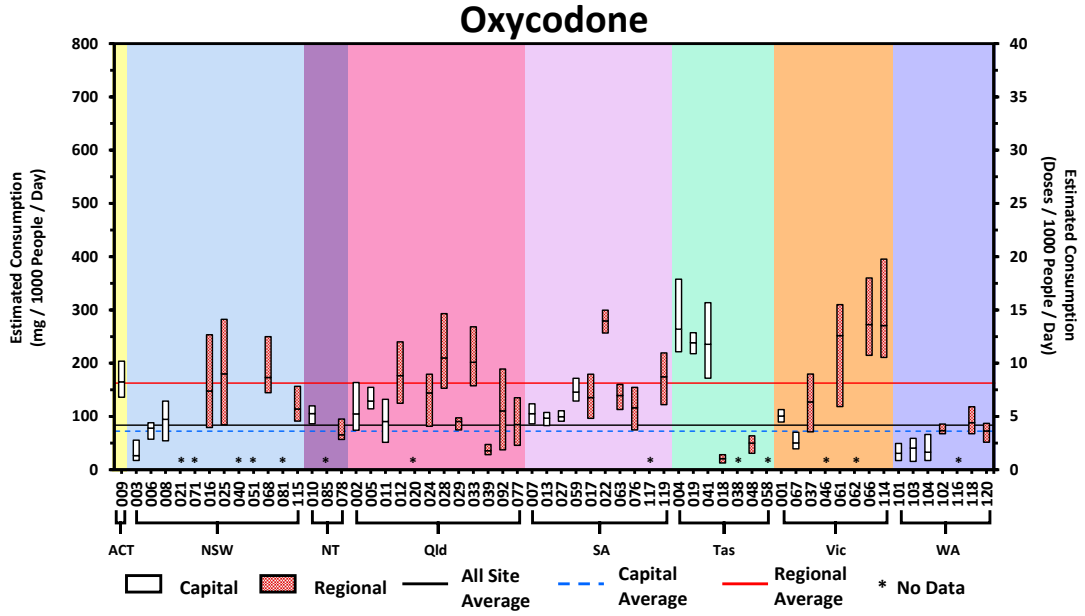
Two pharmaceutical opioids were measured, as well as heroin, an illicit drug.

4.1.3.1 PHARMACEUTICAL OPIOIDS

Oxycodone and fentanyl are legally prescribed pharmaceuticals with abuse potential. Although wastewater analysis cannot be used to differentiate between prescribed and illicit use, the relative scale of use of these substances remain of interest. 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 substantially higher than that of the capital cities (Figure 16). Regional Victoria and capital city sites of Tasmania were amongst the highest overall users of oxycodone.

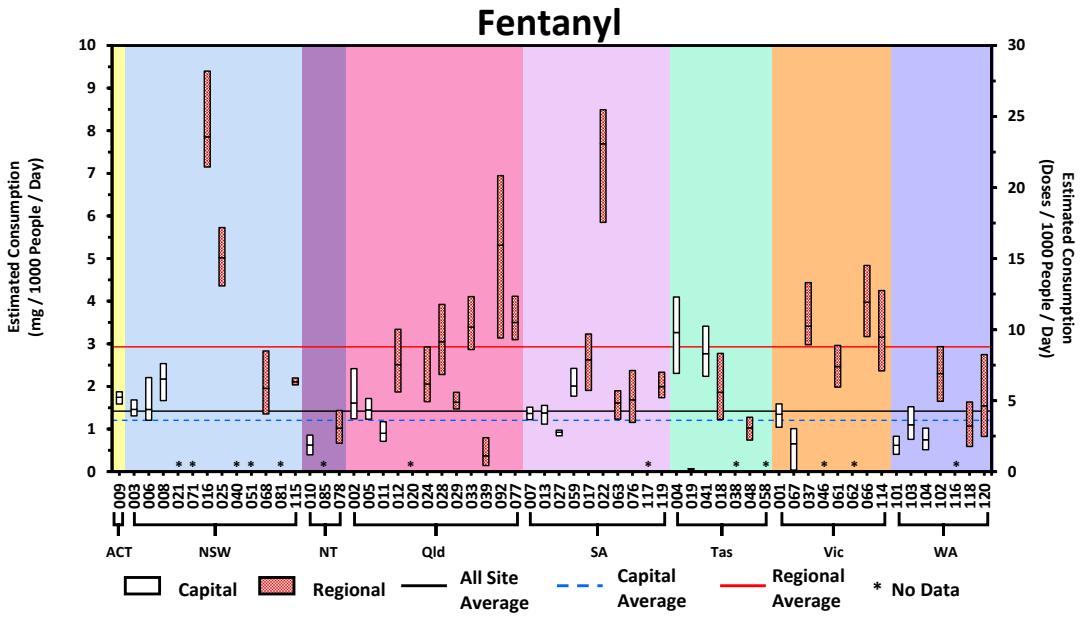
Figure 16: Estimated oxycodone consumption for April 2018 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5-7.



- **Higher and variable regional average**
- **Highest capital sites in Tasmania**

The extent of fentanyl use was very variable across the nation. The regional average exceeded the capital city by a large margin, mainly because of some regional centres in New South Wales, Queensland and South Australia increasing the national average (Figure 17). Tasmania was the exception. Rates of fentanyl use in capital cities across Australia were of comparable levels, apart from high levels in Tasmania and a few sites in other states with very low measured amounts.

Figure 17: Estimated fentanyl consumption for April 2018 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5-7.



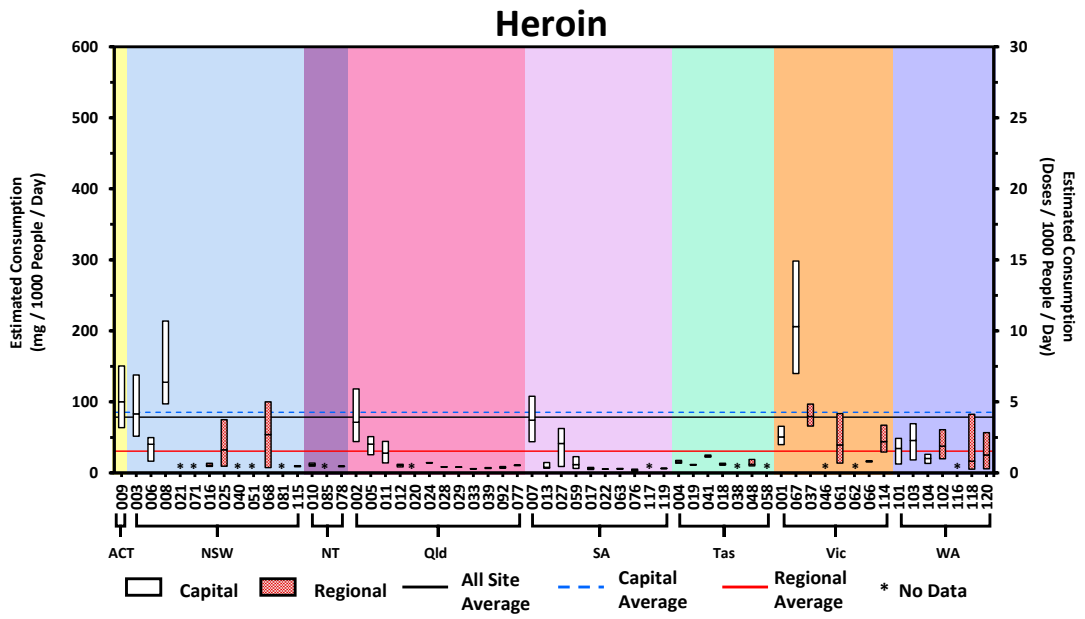
- **Higher and variable regional average**
- **Regional sites in New South Wales, Queensland and South Australia unusually high**
  - **Raises regional average**

4.1.3.2 HEROIN

Heroin is metabolised by users and excreted in low amounts as the unique metabolite, 6-monoacetylmorphine (6-MAM). A method to detect heroin by 6-monoacetylmorphine was described in a paper by Tscharke 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 April 2018 was relatively low, with regional centres having lower consumption on average compared to capital cities (Figure 18). Some capital city areas of New South Wales and Victoria recorded the highest levels of all measured locations.

The relative scale of oxycodone and fentanyl use is apparent when results are presented in bubble graph form. Oxycodone consumption in capital cities and Western Australia are noticeably lower (Figure 19), while fentanyl use in regional centres is high compared to capital cities (Figure 20). The elevated heroin consumption in the south eastern parts of the country is clearly evident from the bubble graph (Figure 21).

Figure 18: Estimated heroin consumption for April 2018 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5-7.



- Lower regional use
- High consumption in Victoria Site 67

Figure 19: Estimated oxycodone consumption per jurisdiction for April 2018 in mg consumed per day per thousand people. The number of collection days varied from 5-7.

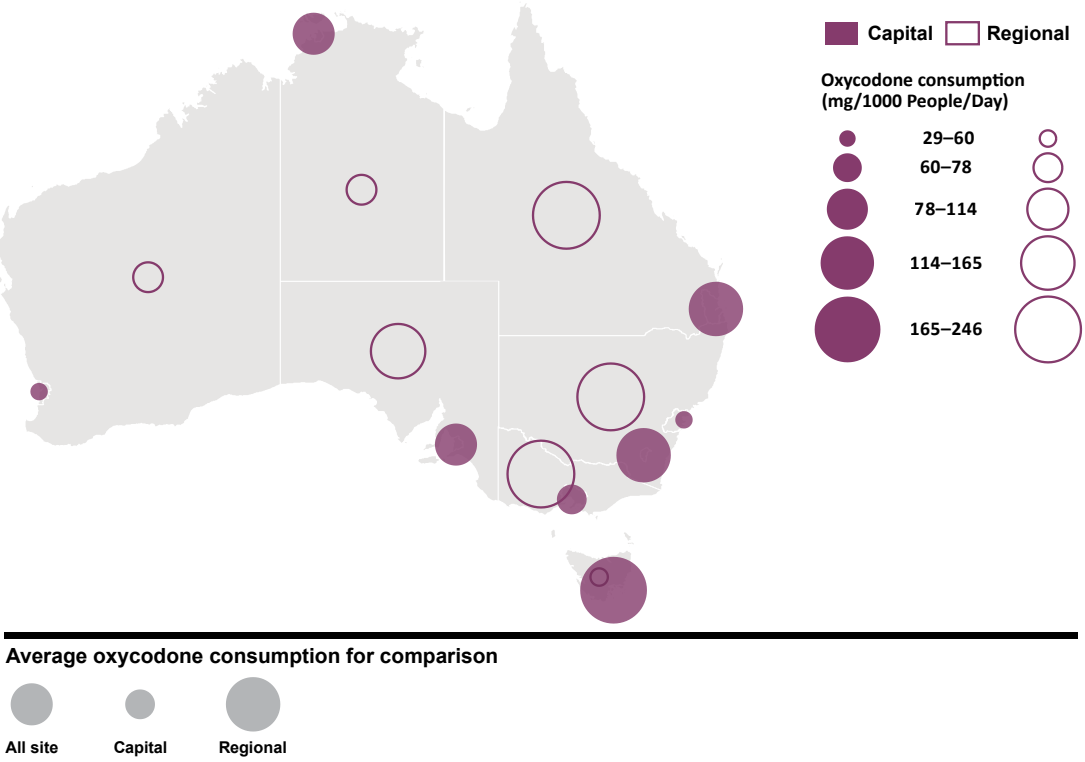


Figure 20: Estimated fentanyl consumption per jurisdiction for April 2018 in mg consumed per day per thousand people. The number of collection days varied from 5-7.

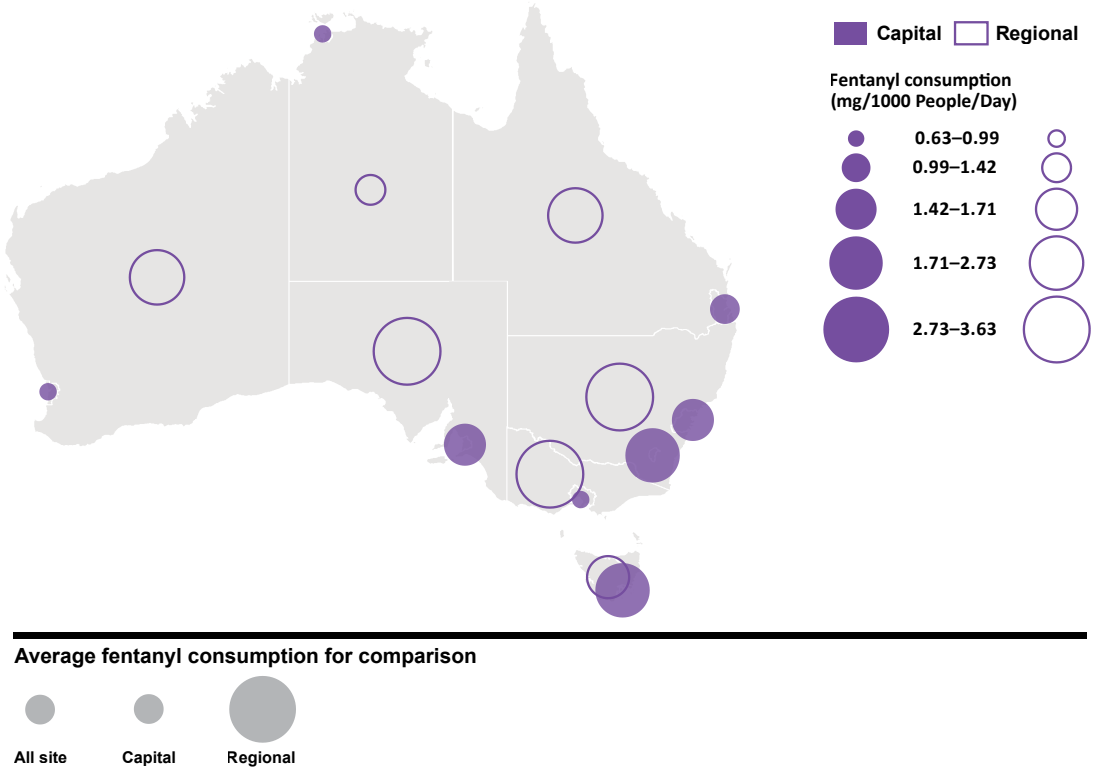
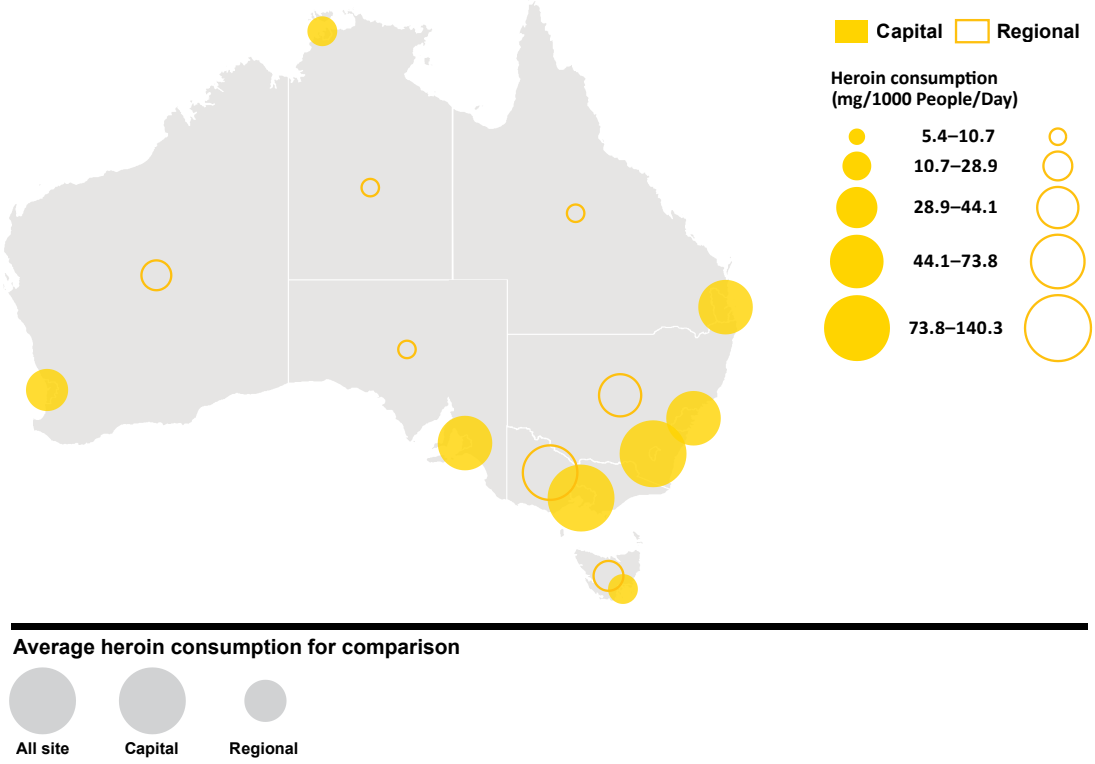


Figure 21: Estimated heroin consumption per jurisdiction for April 2018 in mg consumed per day per thousand people. The number of collection days varied from 5-7.



4.1.4 NEW PSYCHOACTIVE SUBSTANCES

The compounds included under the NPS class in this study were methylone and mephedrone. 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. There were a number of instances of mephedrone detections in New South Wales and Queensland, but methylone use appeared to be largely confined to New South Wales. The measured levels were mostly below the limits of reporting. Sites that showed the presence of the two compounds are qualitatively listed in Table 5 for the April 2018 period. Detections in April 2018 are almost exclusively confined to the eastern states (Figure 22).

Table 5: The number and code of sites per state and territory where mephedrone and methylone were detected in April 2018. The total number of daily samples that were assessed was 319.

	Number of detections Apr 2018		Sites detected Apr 2018	
State/territory	**Mephedrone**	**Methylone**	**Mephedrone**	**Methylone**
NT	0	0		
ACT	0	0		
NSW	5	6	006, 008, 068	003, 008, 016, 025, 068
Qld	5	1	005, 011, 024	028
SA	0	0		
Tas	0	0		
Vic	0	0		
WA	0	1		129
Total	**10**	**8**	**6 sites**	**7 sites**

Figure 22: Estimated percentage positive detections per jurisdiction for mephedrone and methylone for April 2018. This is the number of detections as a percentage of the total number of samples analysed per jurisdiction. The number of collection days varied from 5-7.

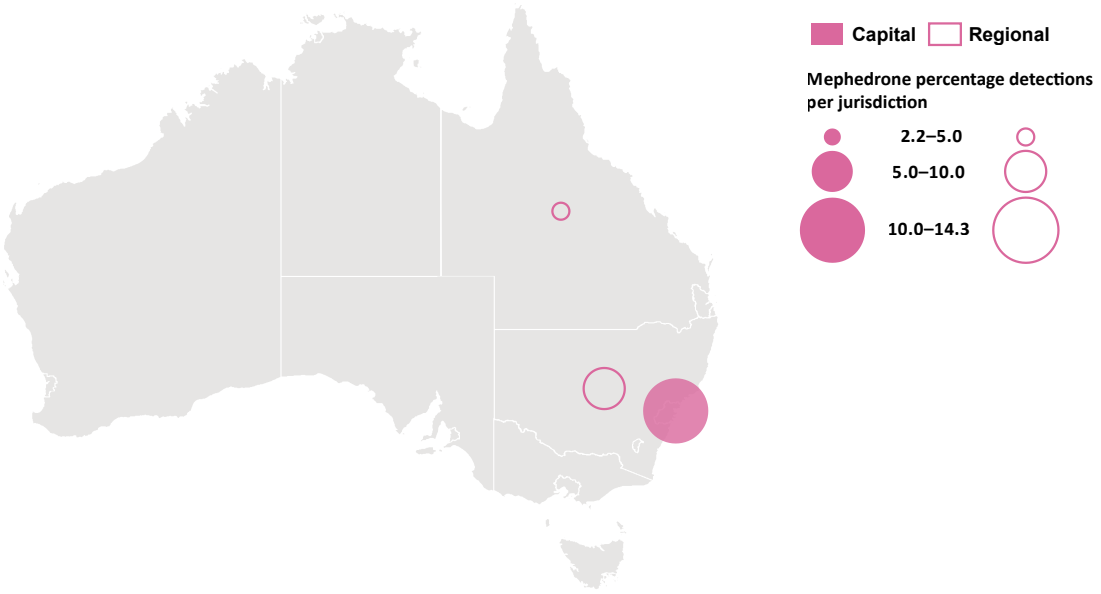
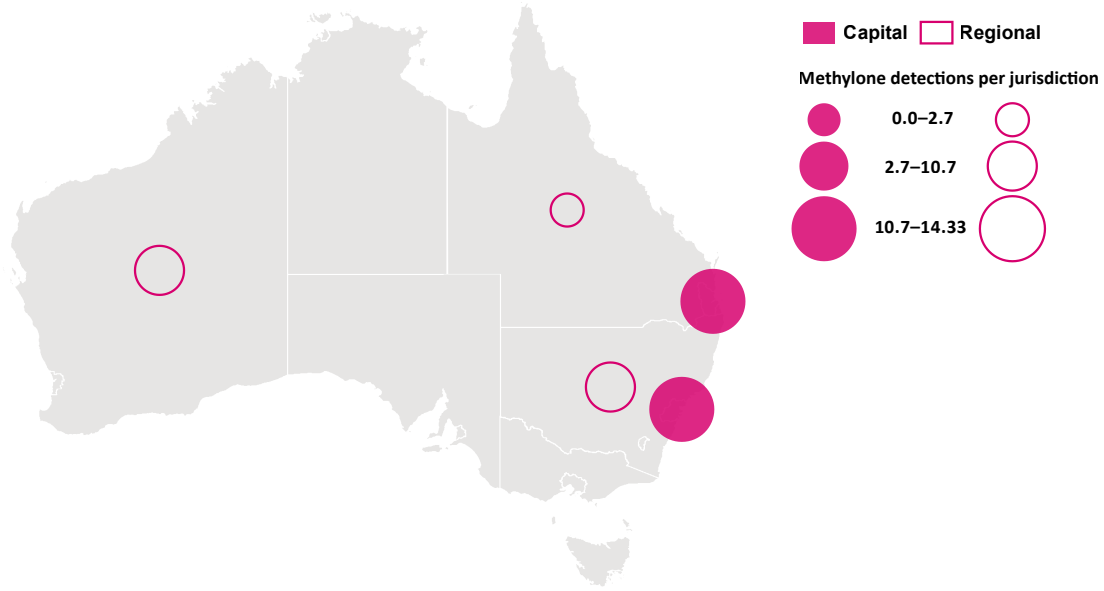


Figure 22 (continued): Estimated percentage positive detections per jurisdiction for mephedrone and methylone for April 2018. This is the number of detections as a percentage of the total number of samples analysed per jurisdiction. The number of collection days varied from 5-7.



4.2 TEMPORAL CHANGES IN DRUG CONSUMPTION ESTIMATES BY JURISDICTION

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 3 for a comprehensive list of participating sites and number of days assessed per sampling campaign).

Note: the lines on each graph representing averages are the cumulative average across all sampling time points.

4.2.1 NICOTINE AND ALCOHOL

Average nicotine consumption in samples collected from regional sites were generally higher when compared to the capital cities (see section 4.2.5, Figure 26). In most states, nicotine consumption remained steady over the total collection periods. Western Australia continued to show an overall decrease for both capital city and regional areas, while regional Tasmania is on the rise.

In the case of alcohol, the difference between overall capital city and regional centre consumption within each state or territory was minimal, except for South Australia where regional use remained at almost half that of the capital city (see section 4.2.5, Figure 27). This finding was interesting. Usually consumption of alcohol is elevated on the weekend. The April 2018 collection period was the first time regional South Australia centres provided weekend samples. However, alcohol consumption remained similar to historical levels. For the most part national consumption levels remained steady, with no apparent trend in terms of changes in use over time within each region, Western Australia being the obvious exception.

4.2.2 ILLICIT DRUGS

The trend in methylamphetamine use was variable in many parts of the country (see section 4.2.5, Figure 28). Consumption in the Australian Capital Territory, New South Wales, Tasmania and Victoria remained largely stable. Western Australia had the highest regional levels of methylamphetamine. However, both in Western Australia and South Australia, consumption declined dramatically after December 2017. These were the states where use was historically highest in the nation. Capital city Northern Territory and Queensland were the only areas where levels continued to rise.

When plotted against historical levels recorded in the three regions, the sudden drop-off in use of methylamphetamine use in South Australia was striking (Figure 23). While not as dramatic, decreased use in Western Australia was evident. Levels in Queensland and Victoria remained essentially steady over the current and historical periods.

Figure 23: Change in methylamphetamine consumption for sites with historical data.

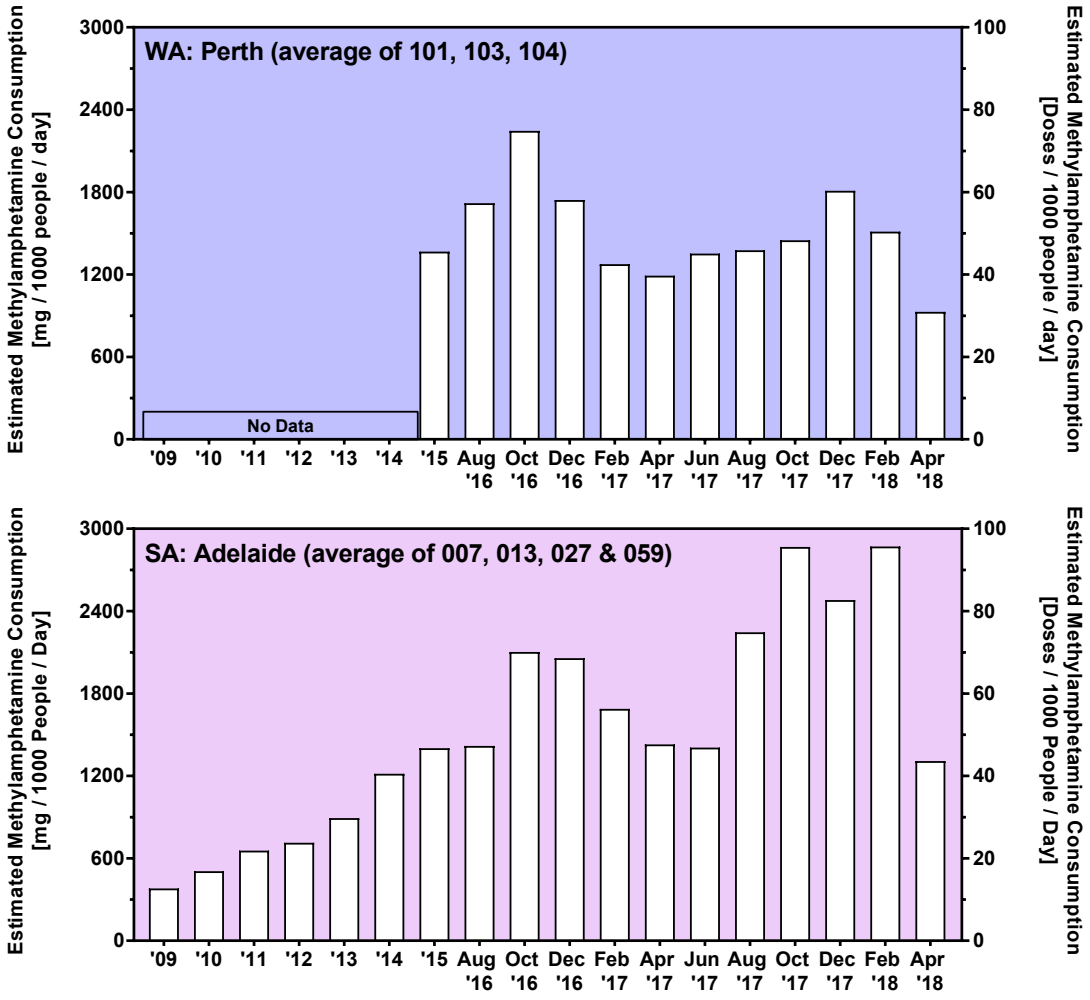


Figure 23 (continued): Change in methylamphetamine consumption for sites with historical data.

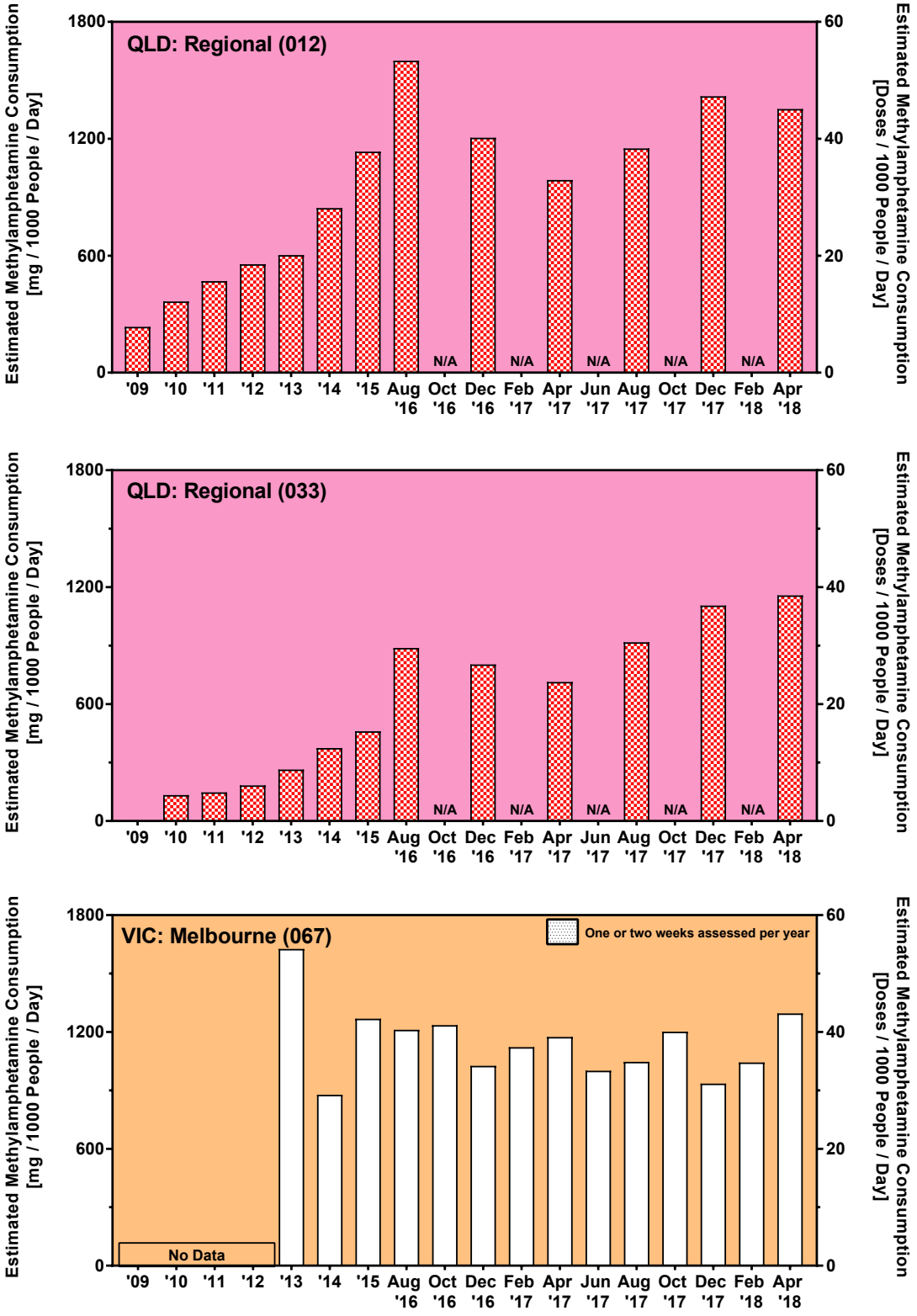
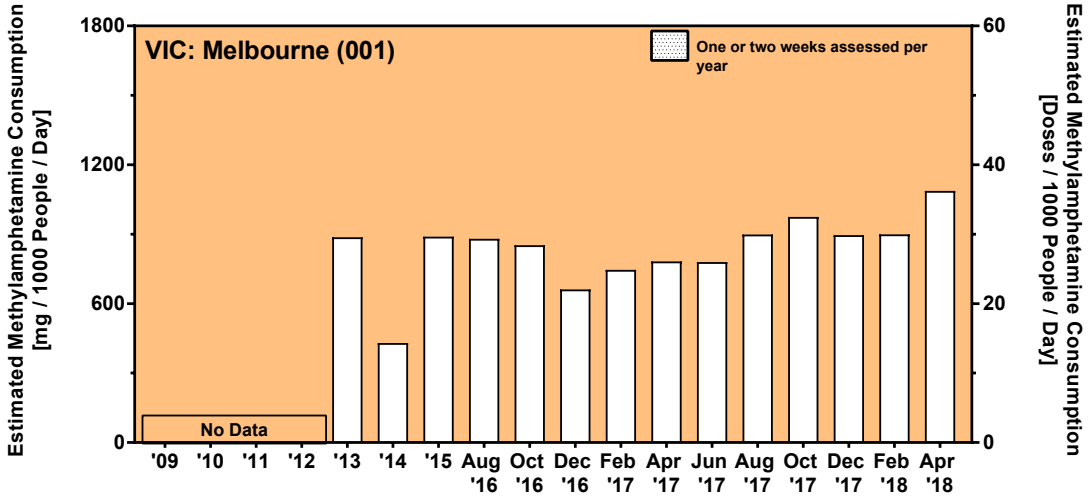


Figure 23 (continued): Change in methylamphetamine consumption for sites with historical data.



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 (see section 4.2.5, Figure 29). The upward trend in consumption observed in the previous report for the Australian Capital Territory stalled after December 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 or steady in all states and territories (see section 4.2.5, Figure 30). The Northern Territory remained high compared to other parts of the country. Regional centres showed levels slightly above the capital city locations. Regional South Australia sites provided weekend samples for the first time in April 2018, but the overall levels for that state remained unchanged.

MDA use, corrected for the proportion derived from MDMA (Khan 2011), showed that levels in regional Queensland were dropping from initial highs to amounts found elsewhere in regional Australia (see section 4.2.5, Figure 31). 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 012 in Queensland in August 2017.

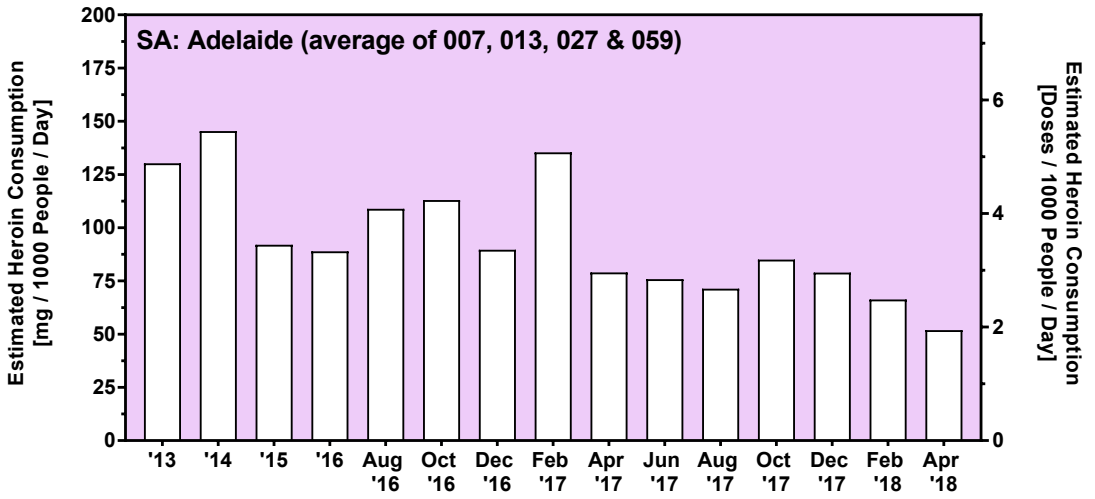
4.2.3 OPIOIDS

The average levels of oxycodone use were higher in regional areas of several states (see section 4.2.5, Figure 32). Since the first report in March 2017, which contained analysis of samples collected in August 2016, consumption of oxycodone declined in some regions, for example, capital city New South Wales, South Australia and Western Australia. A similar decline was only evident in regional Tasmania, with other regional areas remaining either flat or slightly on the increase. The variation in participating rural sites (and hence the sampled populations) may also influence the observed trend of the population-weighted averages.

Fentanyl use in regional Australia remains high in comparison to capital cities (see section 4.2.5, Figure 33). In Queensland and Victoria, fentanyl use is on the increase. This is also the case in regional Western Australia.

The state and territory comparison of the use of heroin show that consumption was highest in Victoria (see section 4.2.5, Figure 34). In general, regional areas of each state had lower levels of heroin consumption. 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 24).

Figure 24: Change in heroin consumption for South Australia.



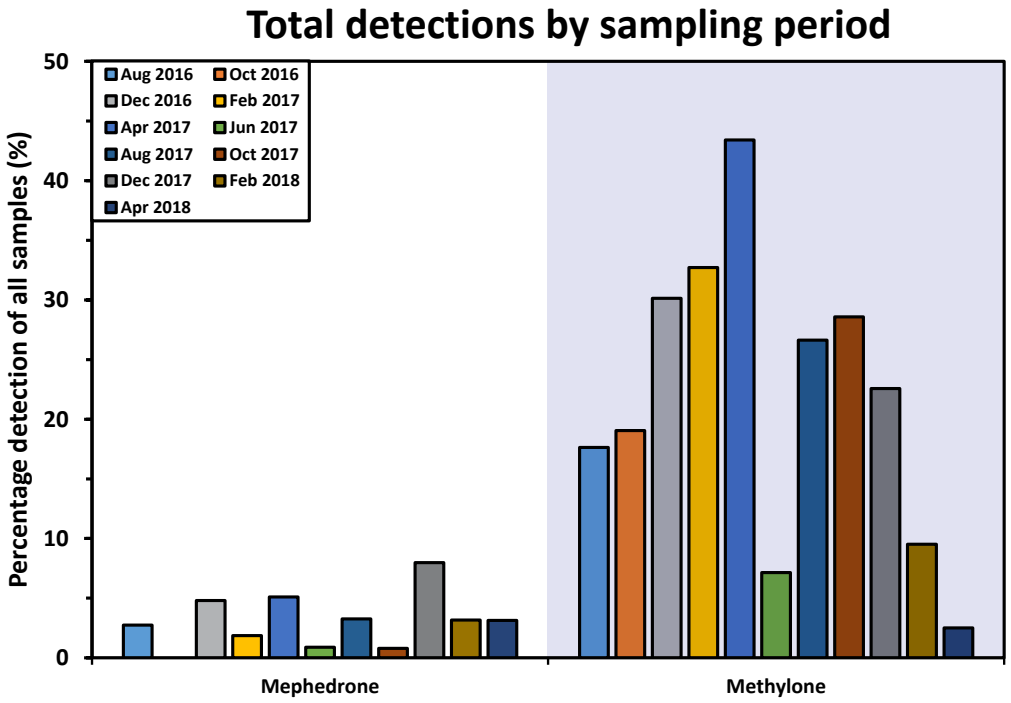
- The '16 bar represents the average of Feb, Apr and Jun

4.2.4 NEW PSYCHOACTIVE SUBSTANCES (NPS)

Methylone and mephedrone were only detected sporadically and at very low levels compared to other substances included in the report (April mephedrone and methylone results are shown in Table 5).

The temporal changes in detections per state/territory (number of samples above LOD) is shown in Figure 25 and section 4.2.5, Figure 35. It is evident that the number of detections of these two substances has decreased since the start of the project in August 2016. Methylone detections peaked in April 2017 and have declined steadily since then.

Figure 25: The percentage of all samples where mephedrone and methylone were detected.



4.2.5 ESTIMATED AVERAGE CONSUMPTION FIGURES

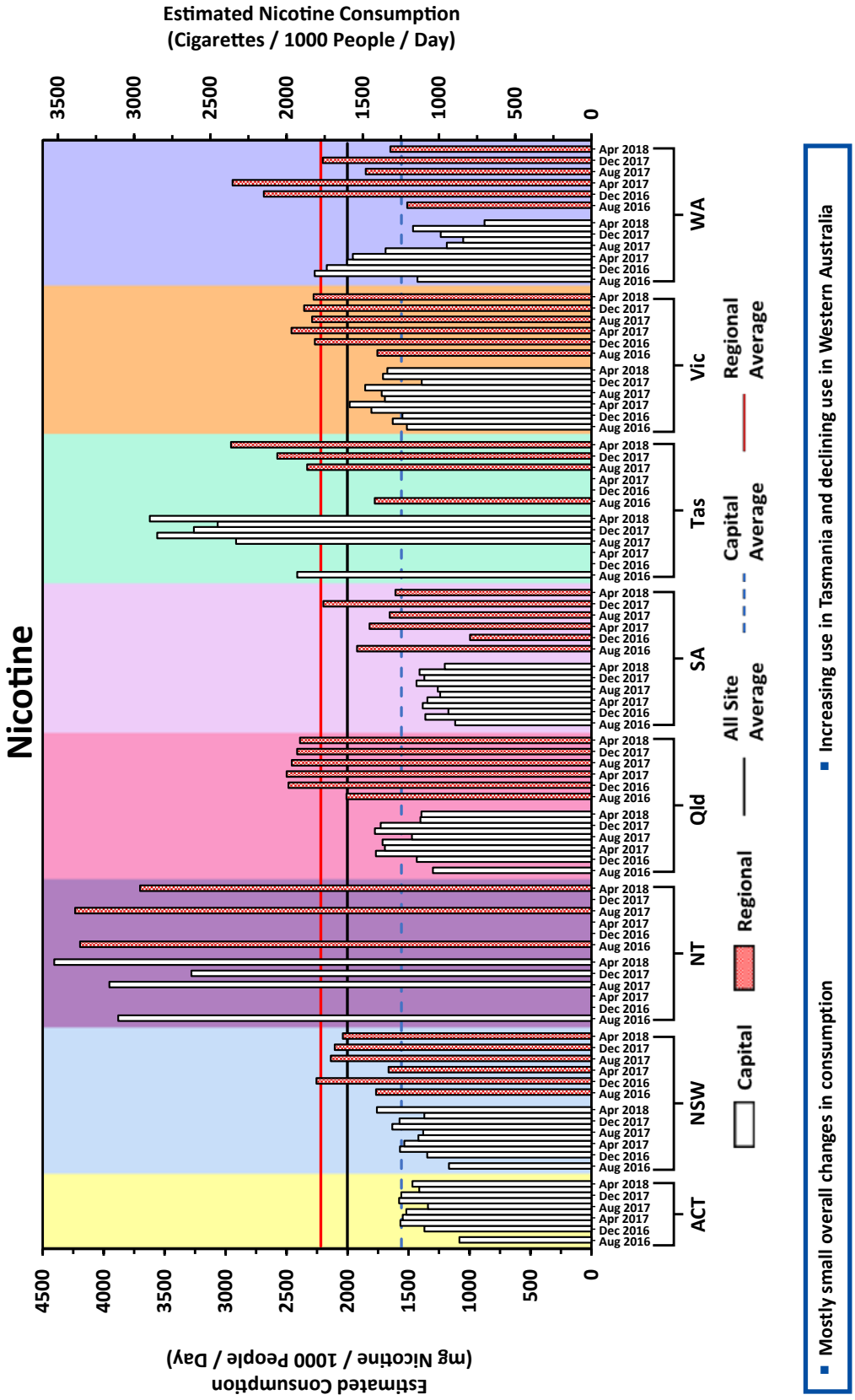


Figure 26: Estimated average consumption of nicotine by state/territory, where 1 cigarette provides 1.25 mg of nicotine.

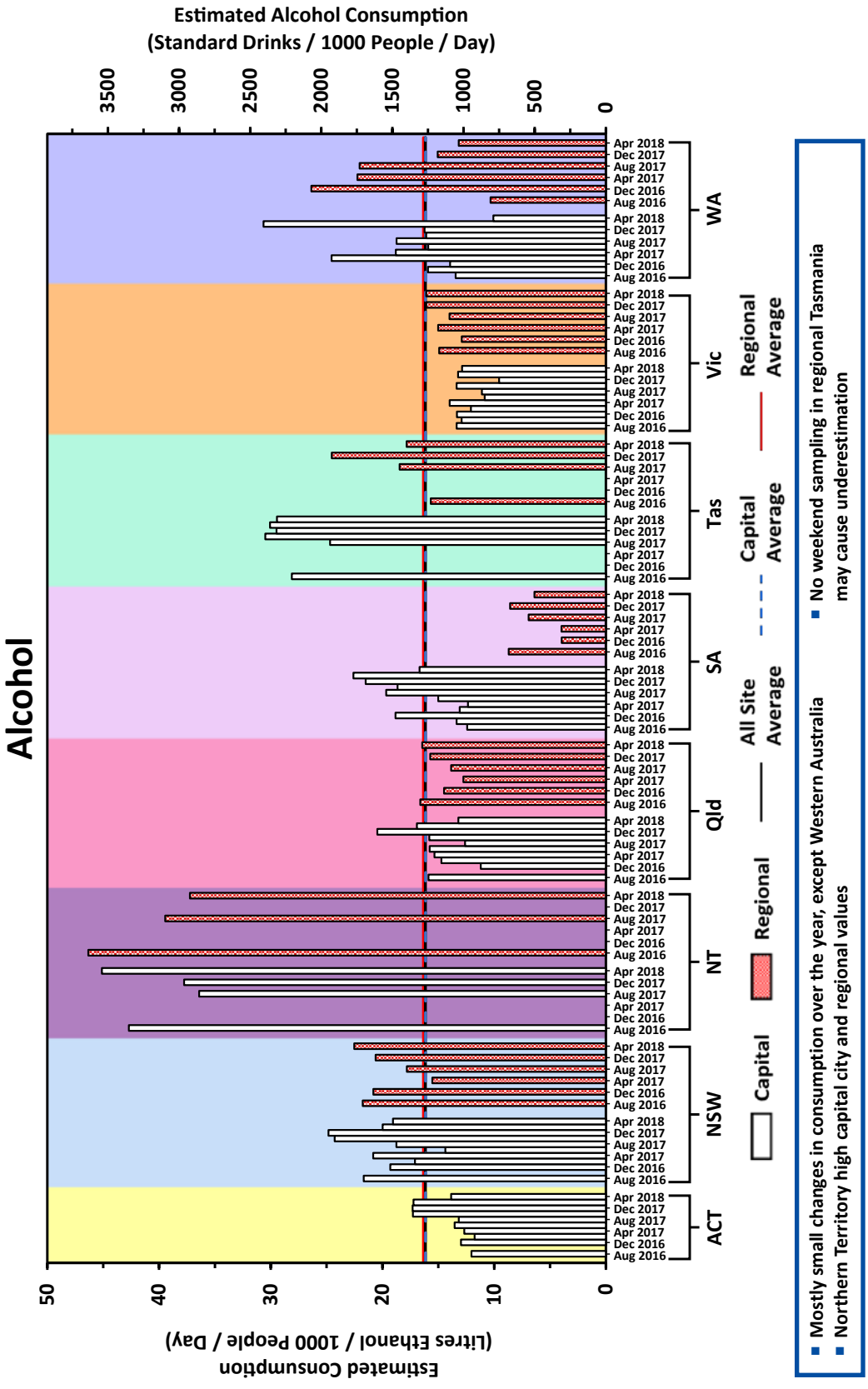


Figure 27: Estimated average consumption of alcohol by state/territory. A standard drink is 10.0 g or 12.5 mL.

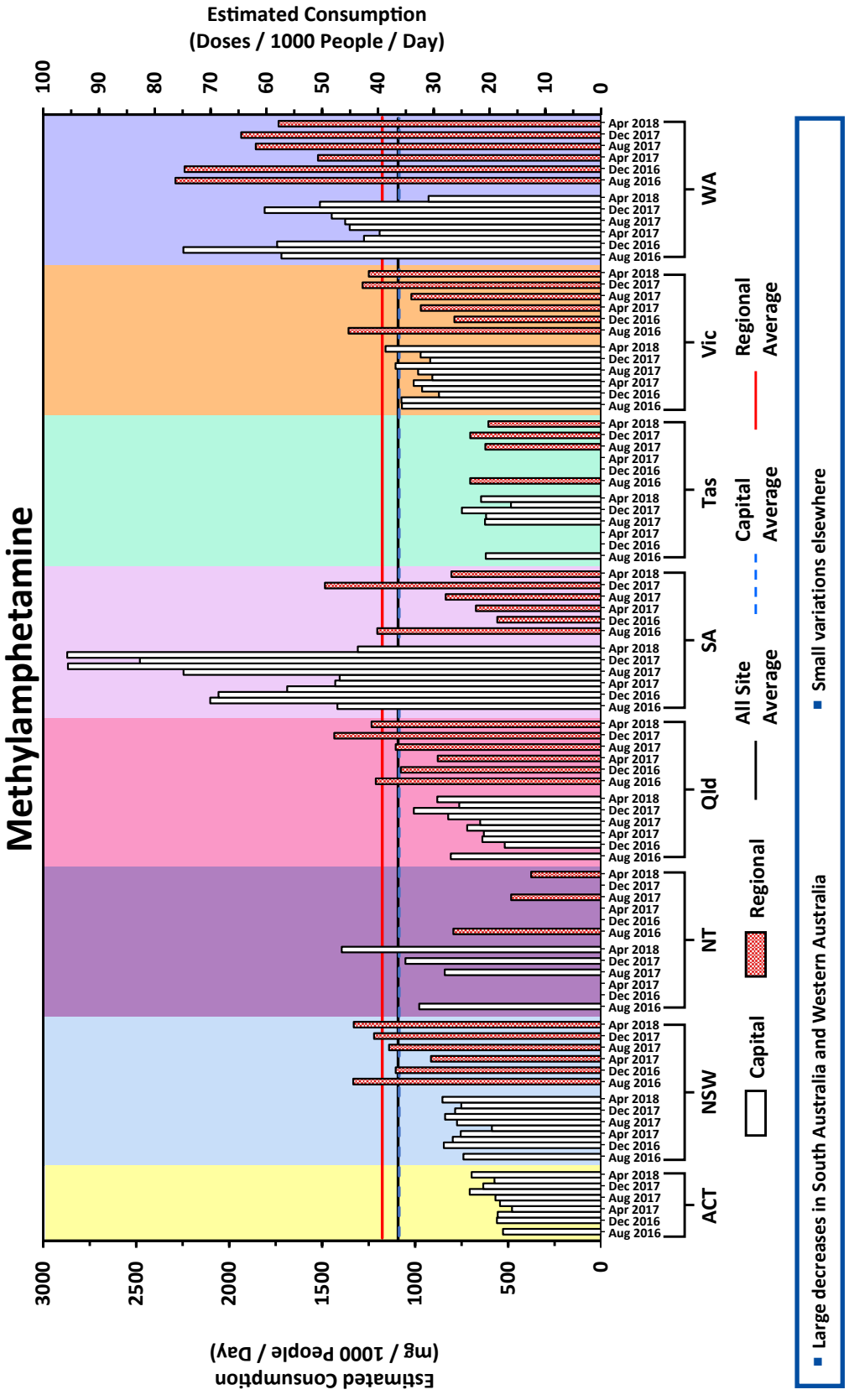


Figure 28: Estimated average consumption of methylamphetamine by state/territory.

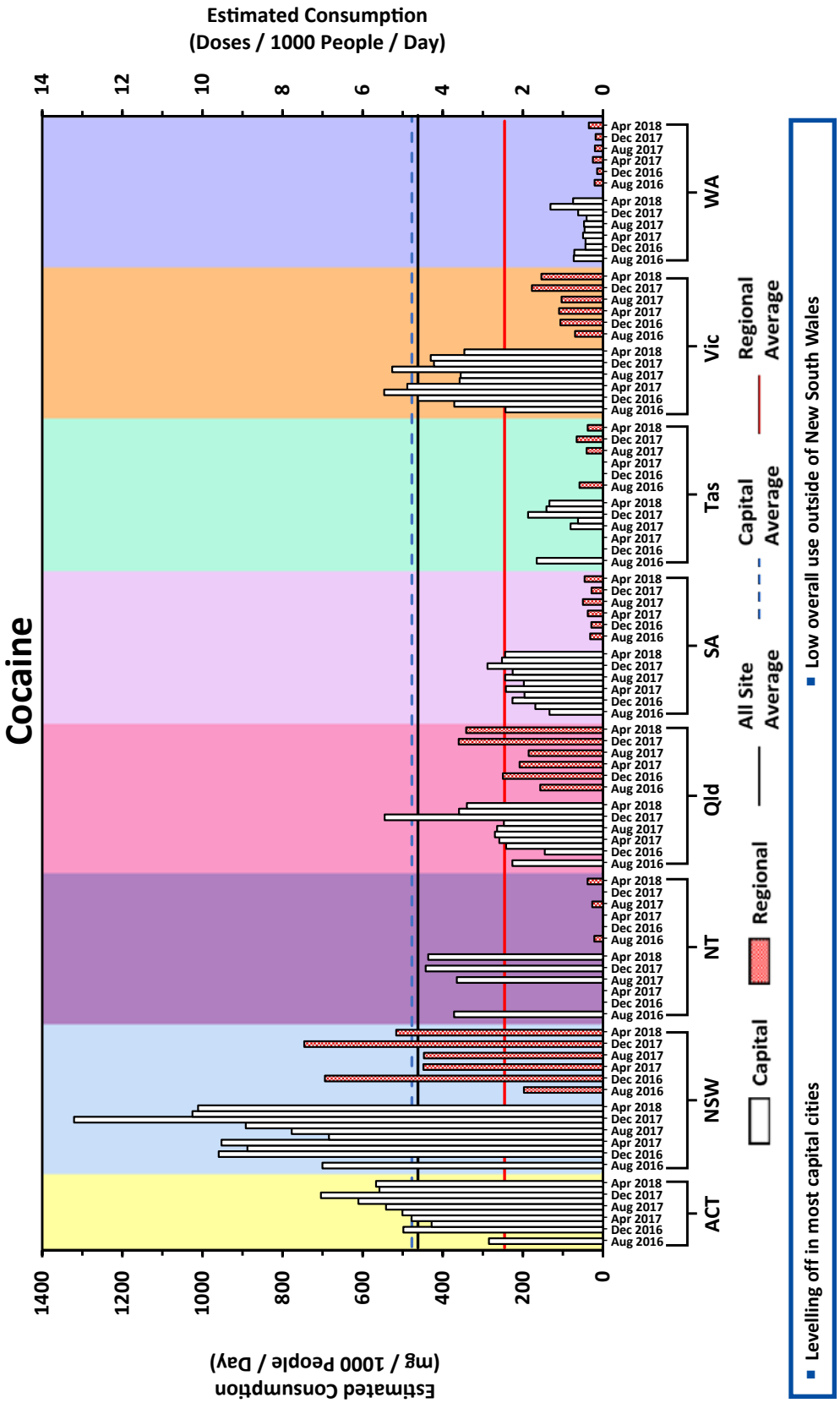


Figure 29: Estimated average consumption of cocaine by state/territory.

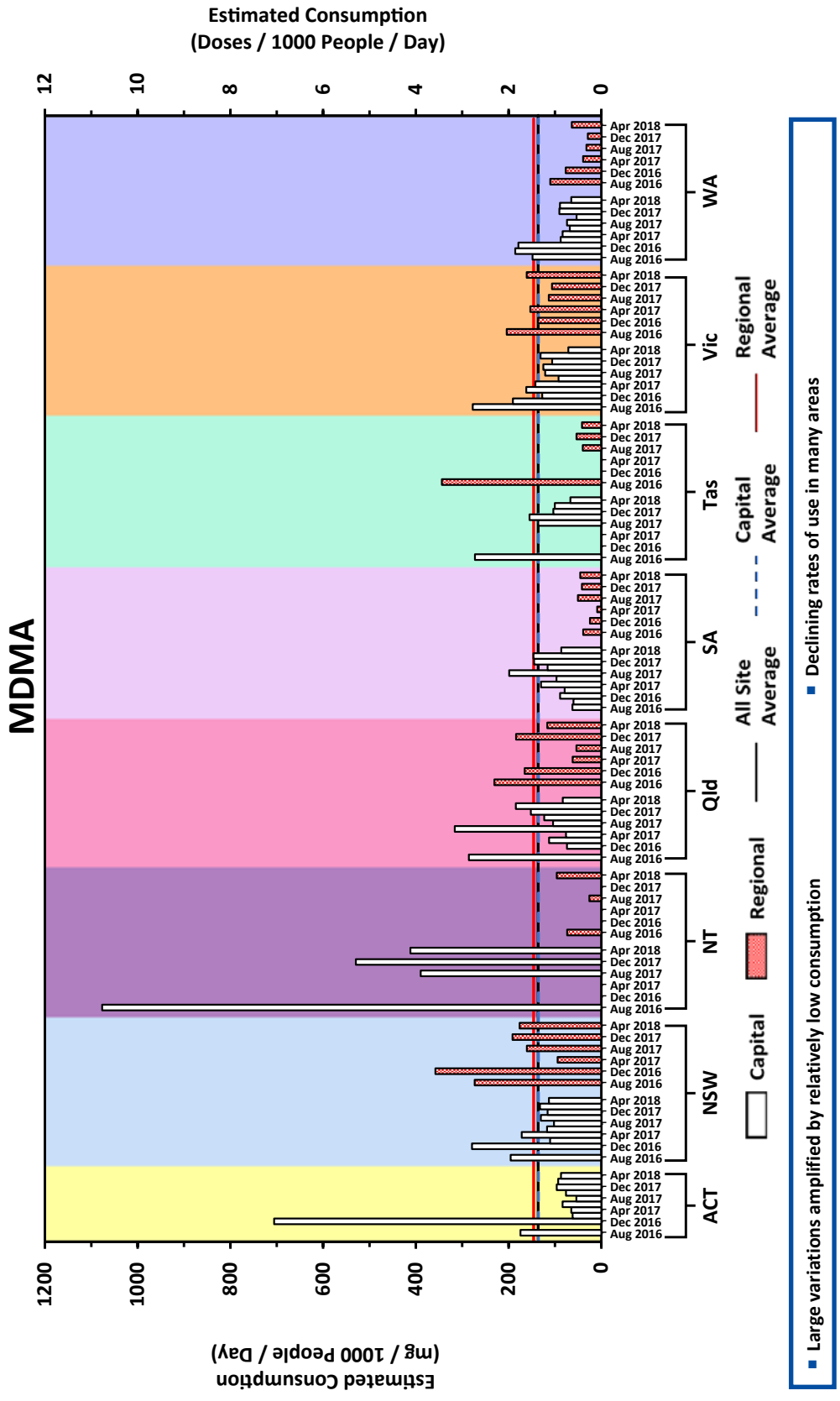


Figure 30: Estimated average consumption of MDMA by state/territory.

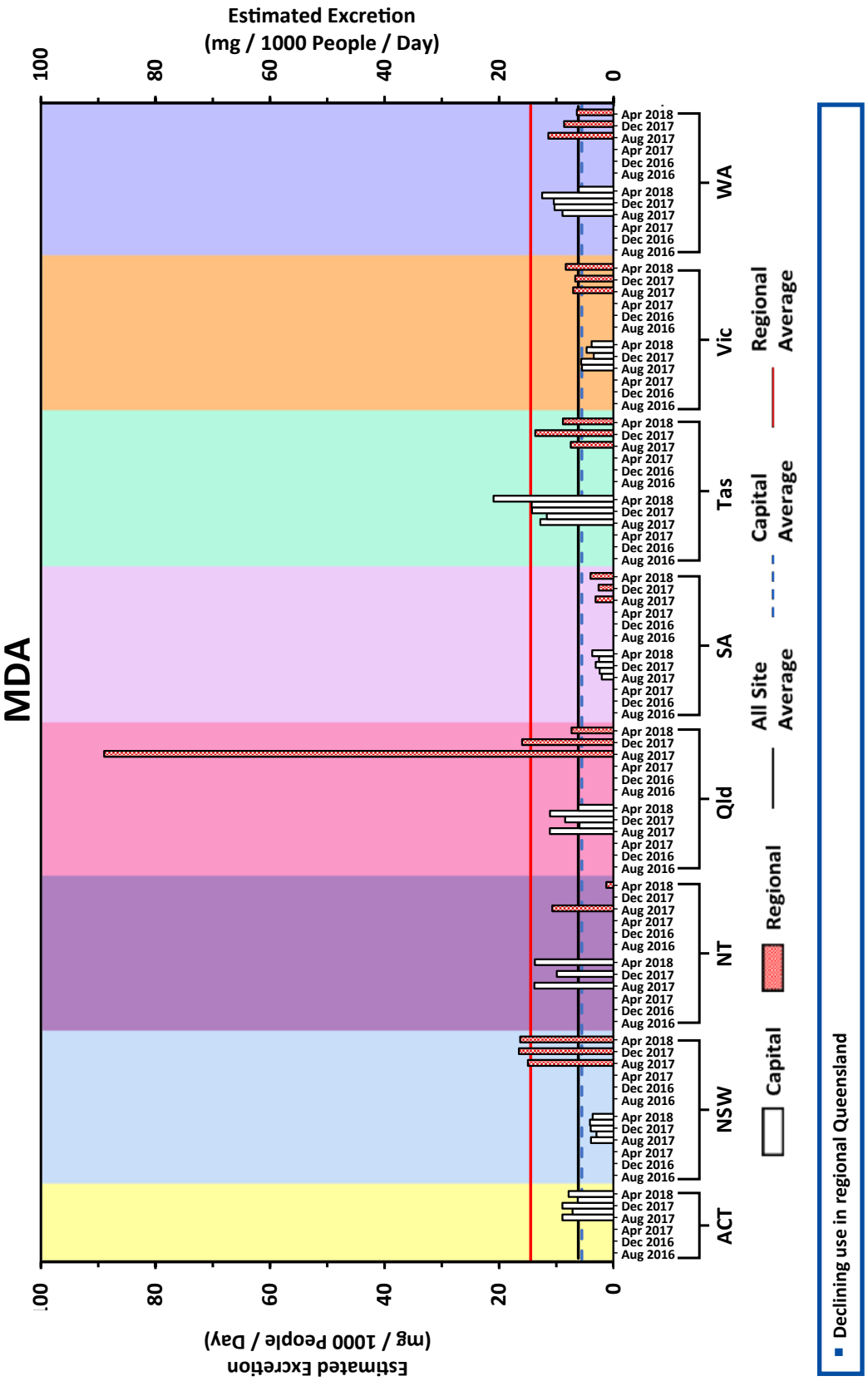


Figure 31: Estimated average consumption of MDA by state/territory.

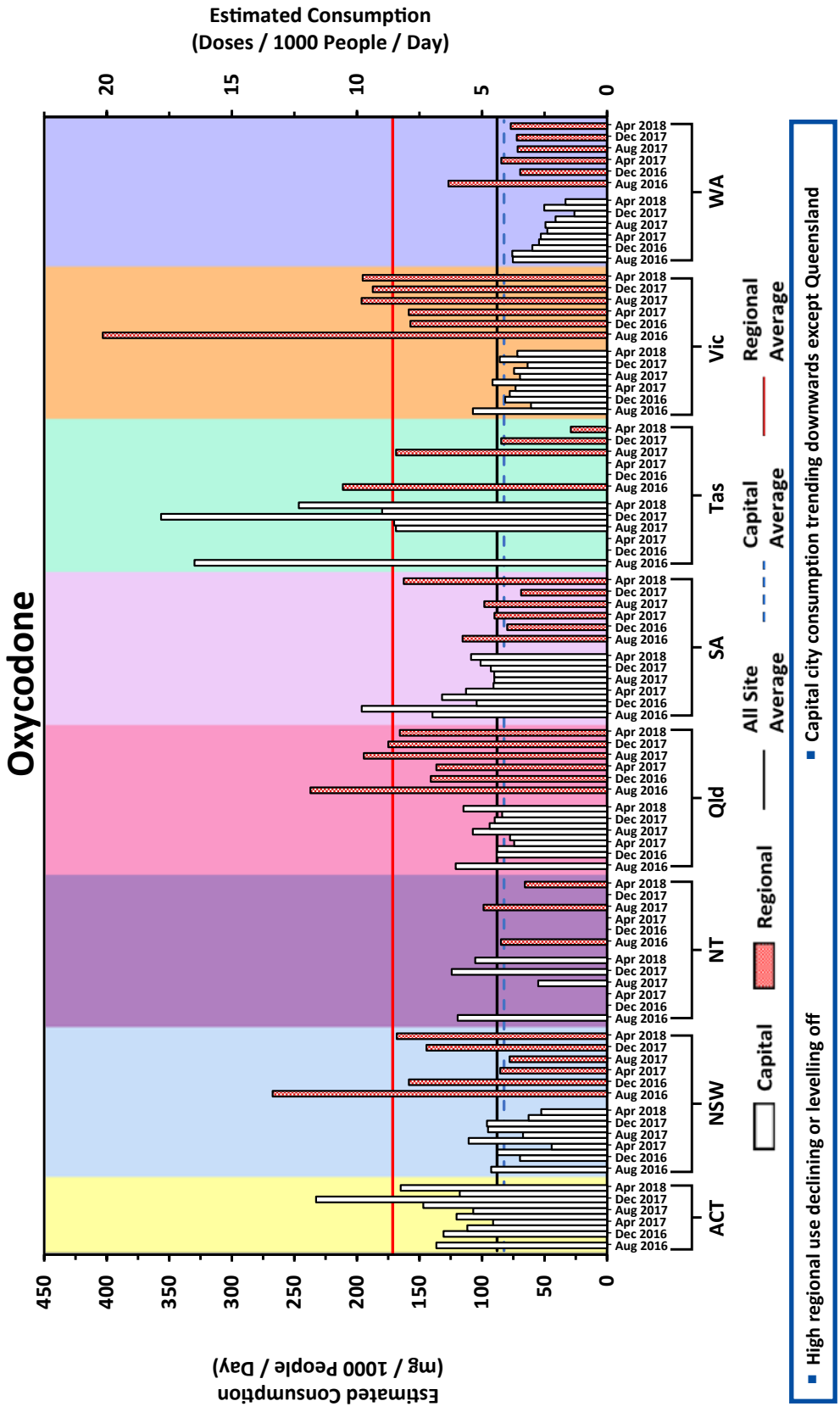


Figure 32: Estimated average consumption of oxycodone by state/territory.

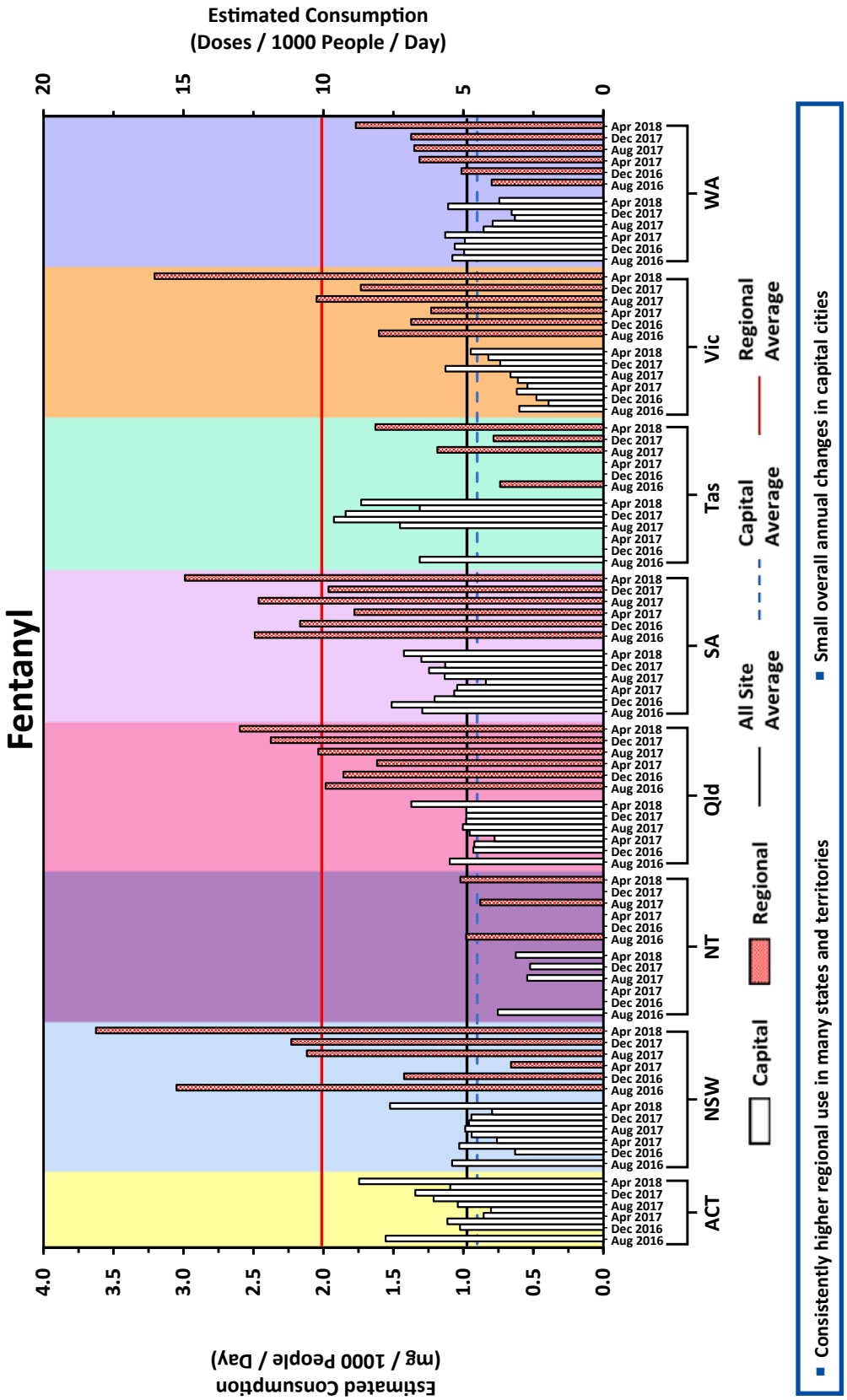


Figure 33: Estimated average consumption of fentanyl by state/territory.

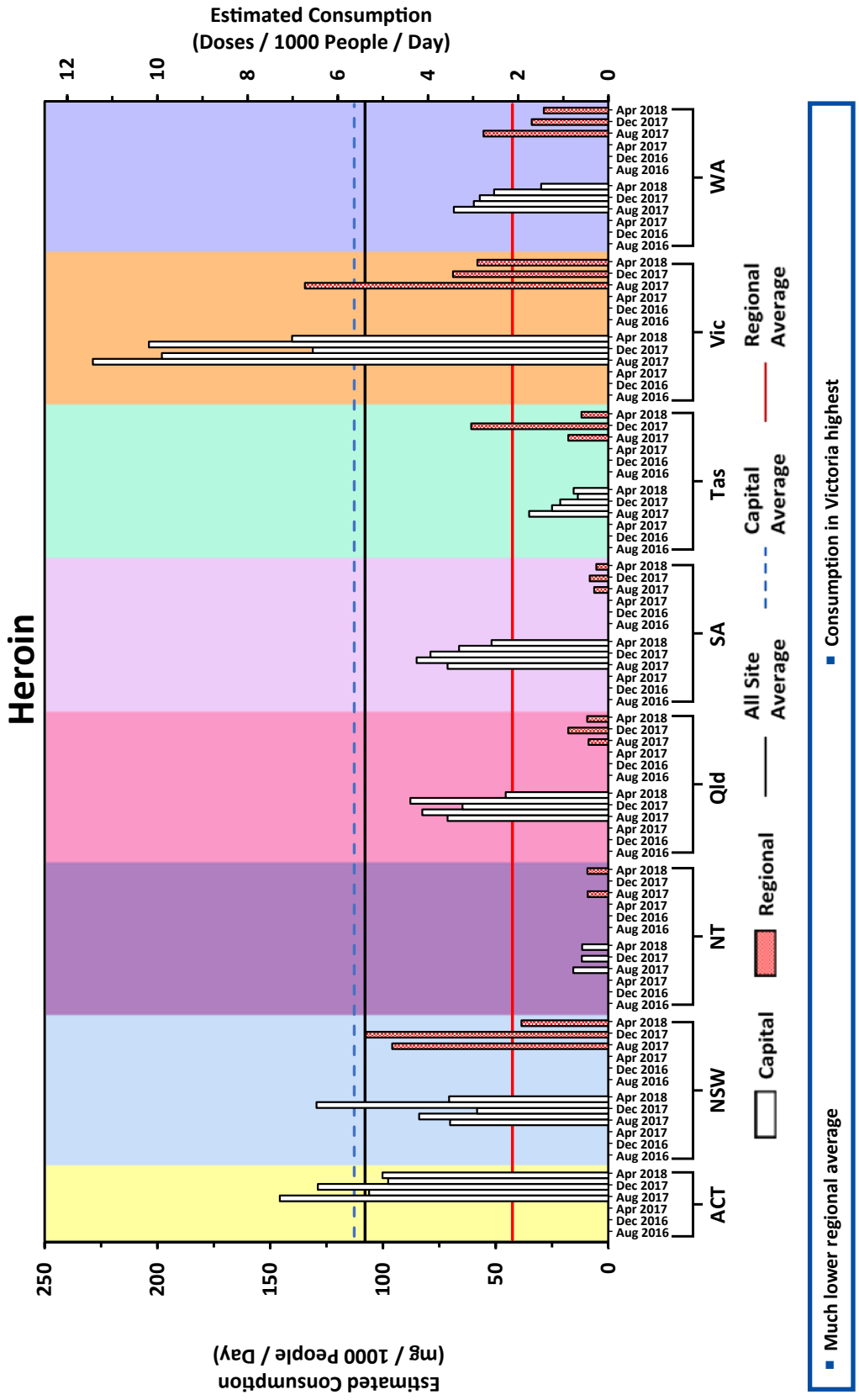


Figure 34: Estimated average consumption of heroin by state/territory.

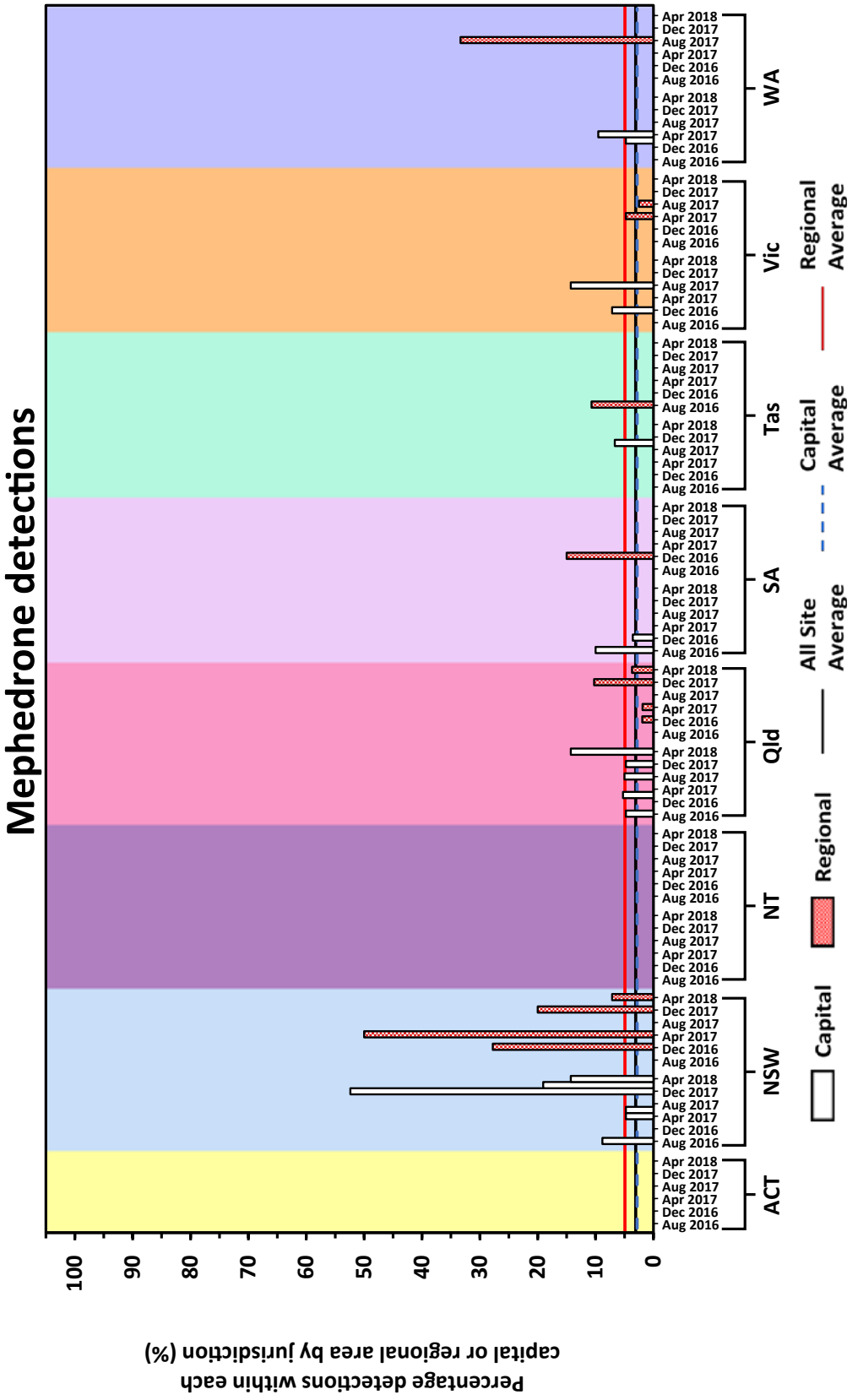


Figure 35: The percentage of all samples where mephedrone and methylone were detected.

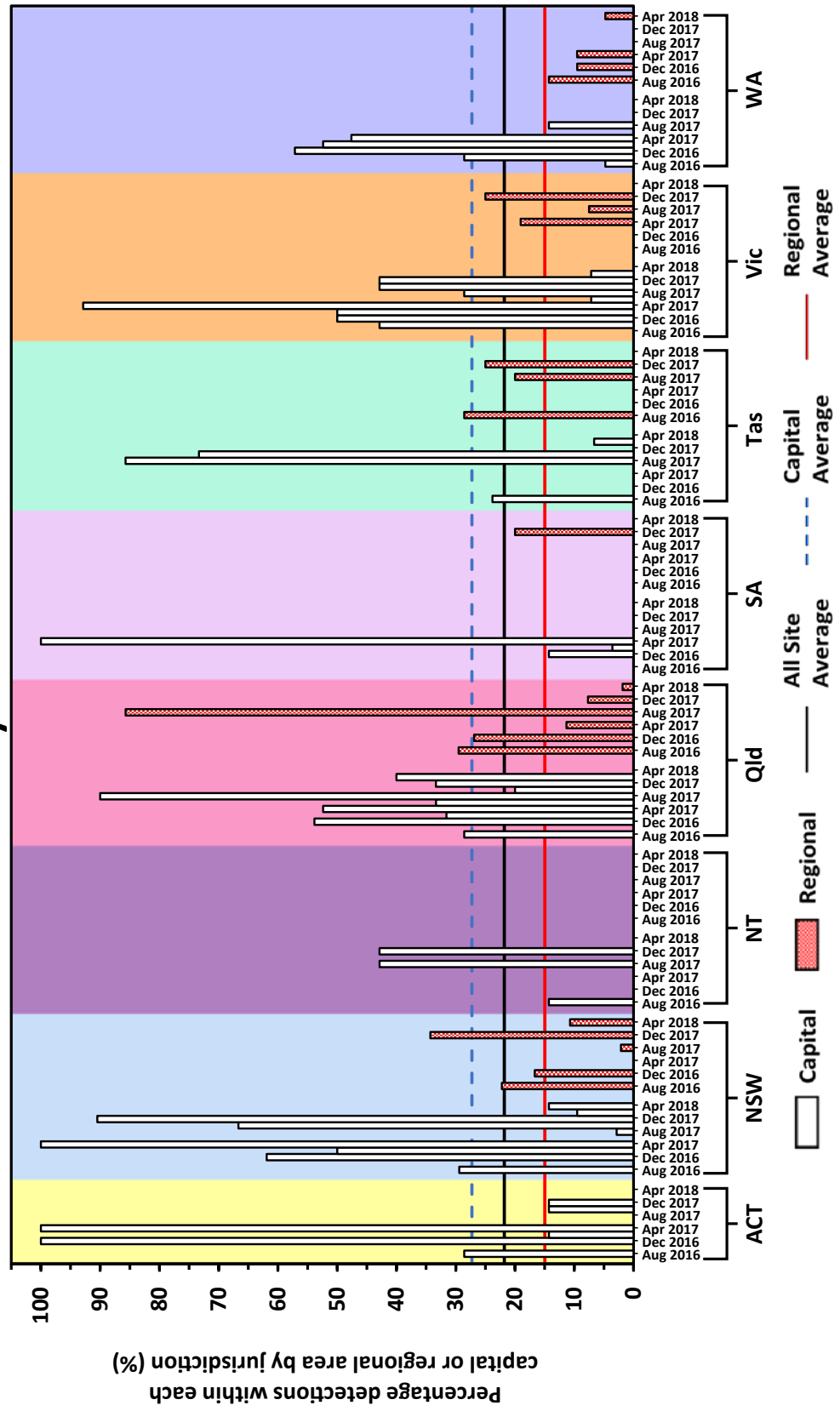


Figure 35 (continued): The percentage of all samples where mephedrone and methylone were detected.

4.2.6 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 and regional site populations were expressed as the total capital or regional average consumption of illicit stimulants (Figure 36). A complication with this type of analysis was that fewer sites were sampled in between August 2016 and December 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 to October 2017, followed by another downward trend. MDMA levels declined overall over the first part of the project, after which regional areas increased slightly. Since detected levels are very low, the result may not be significant. Cocaine consumption showed some short-term variations. In terms of legal substances with abuse potential, alcohol and nicotine consumption remained largely unchanged over the reporting period (Figure 37). The two pharmaceutical opioids included in the study showed contrasting trends. Fentanyl in regional areas have been on the increase, while oxycodone use has declined. Capital city fentanyl and oxycodone levels have remained largely stable.

Figure 36: The population-weighted average of all sites for methylamphetamine, MDMA and cocaine.

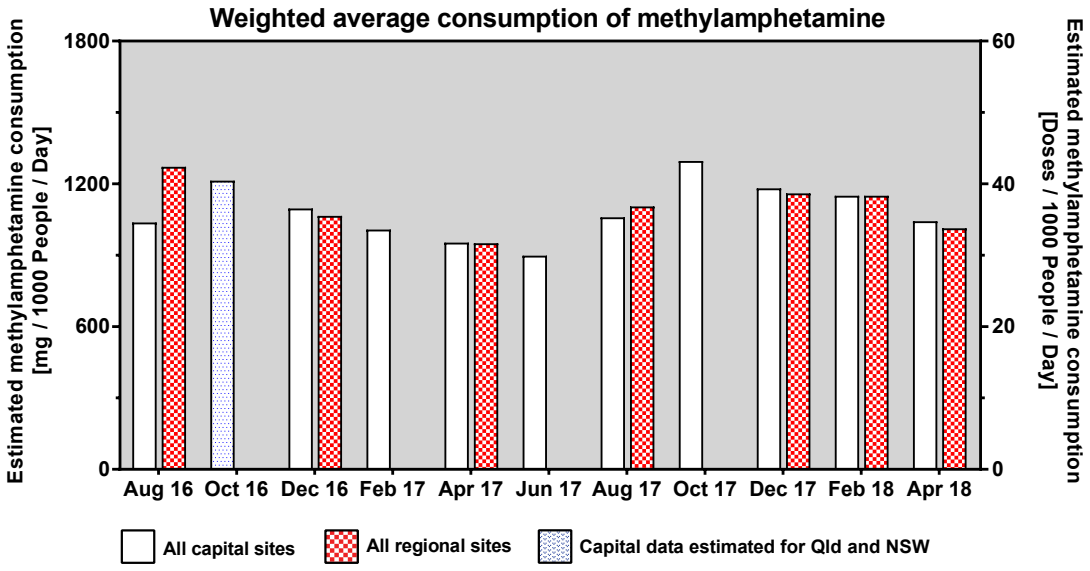
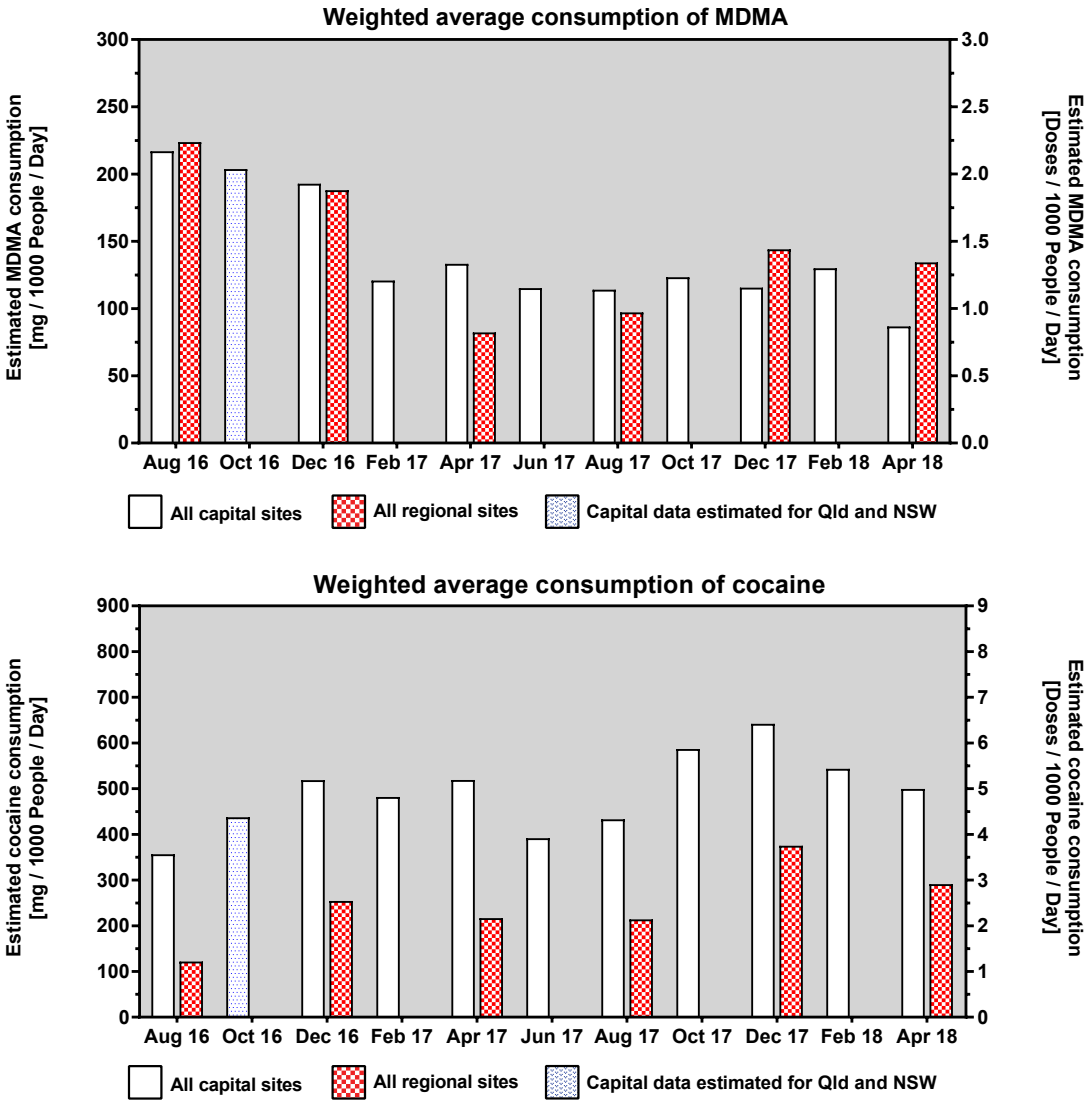


Figure 36 (continued): The population-weighted average of all sites for methylamphetamine, MDMA and cocaine.



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

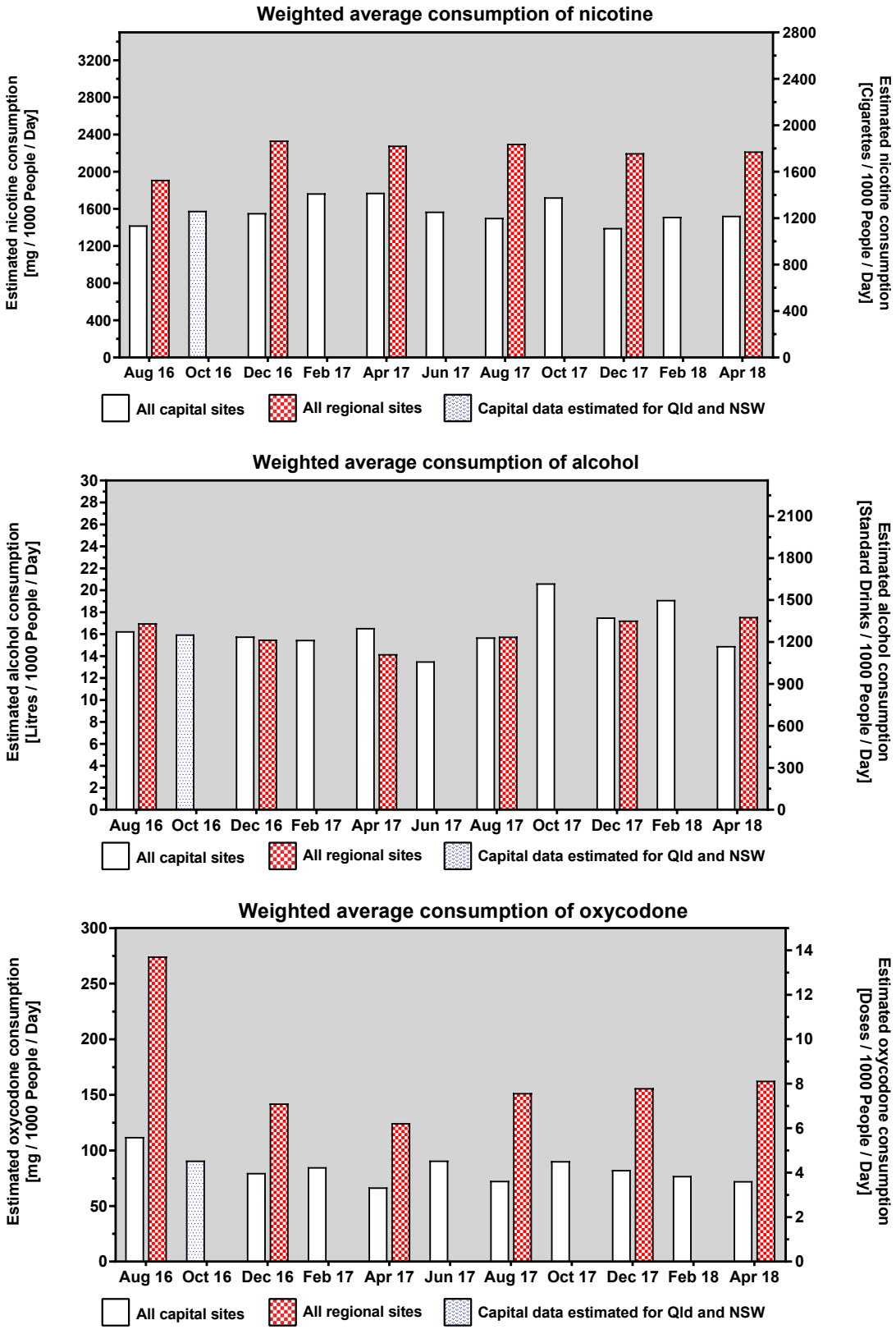
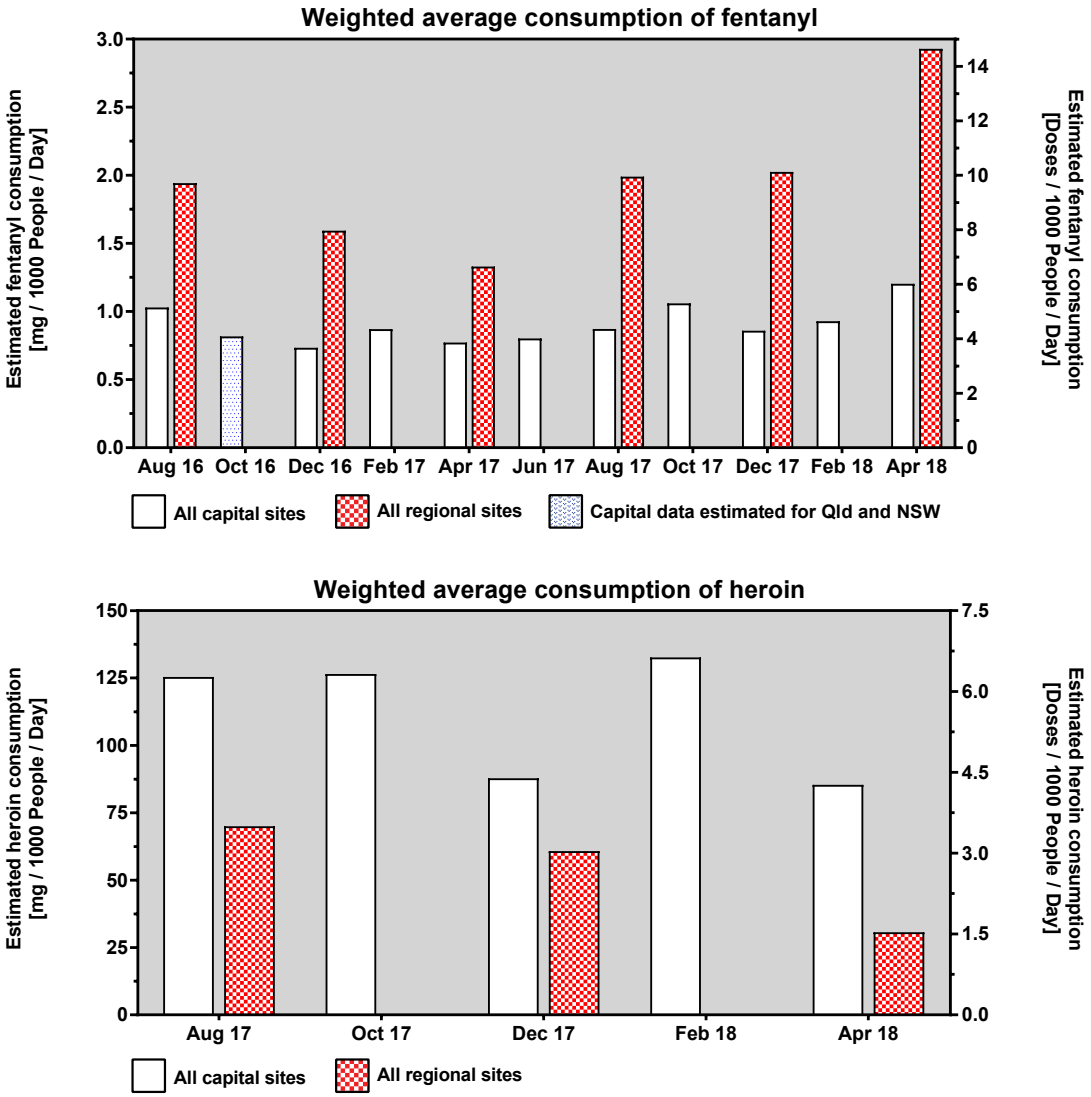


Figure 37 (continued): The population-weighted average of all sites for nicotine, alcohol, oxycodone and fentanyl.



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

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 Report 1, and in Appendix 1), alcohol and nicotine remained consistently the highest consumed drugs in all states and territories. For example, the national average consumption of nicotine and alcohol per 1,000 people per day were approximately 1,300 cigarettes per 1,000 people (Figure 4) and 1,200 standard drinks per day per 1,000 (Figure 5), whereas for methylamphetamine, the national average consumption was closer to 35 doses per 1,000 people per day (Figure 8).

In agreement with previous reports, methylamphetamine consumption remained the highest amongst the measured illicit drugs and opioids in this report, across all regions of Australia (Figure 38). 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 were very similar within almost all states and territories, with the relative proportions favouring regional over capital city areas.

Figure 38: Profile of average drug consumption by state or territory. 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).

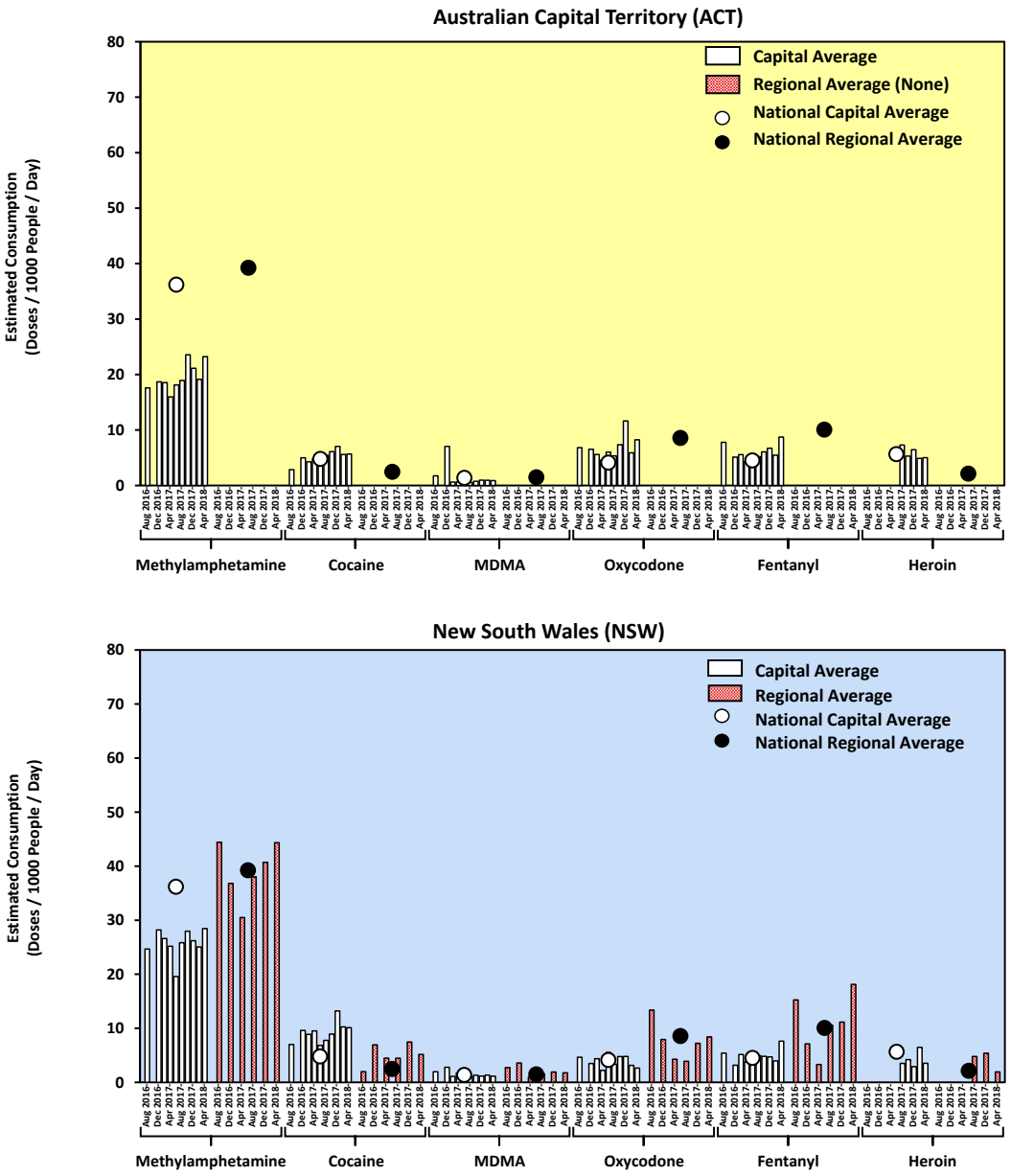


Figure 38 (continued): Profile of average drug consumption by state or territory. Consumption is shown as the number of doses per 1,000 people per day to allow comparison of drugs of different types within the same region (state or territory).

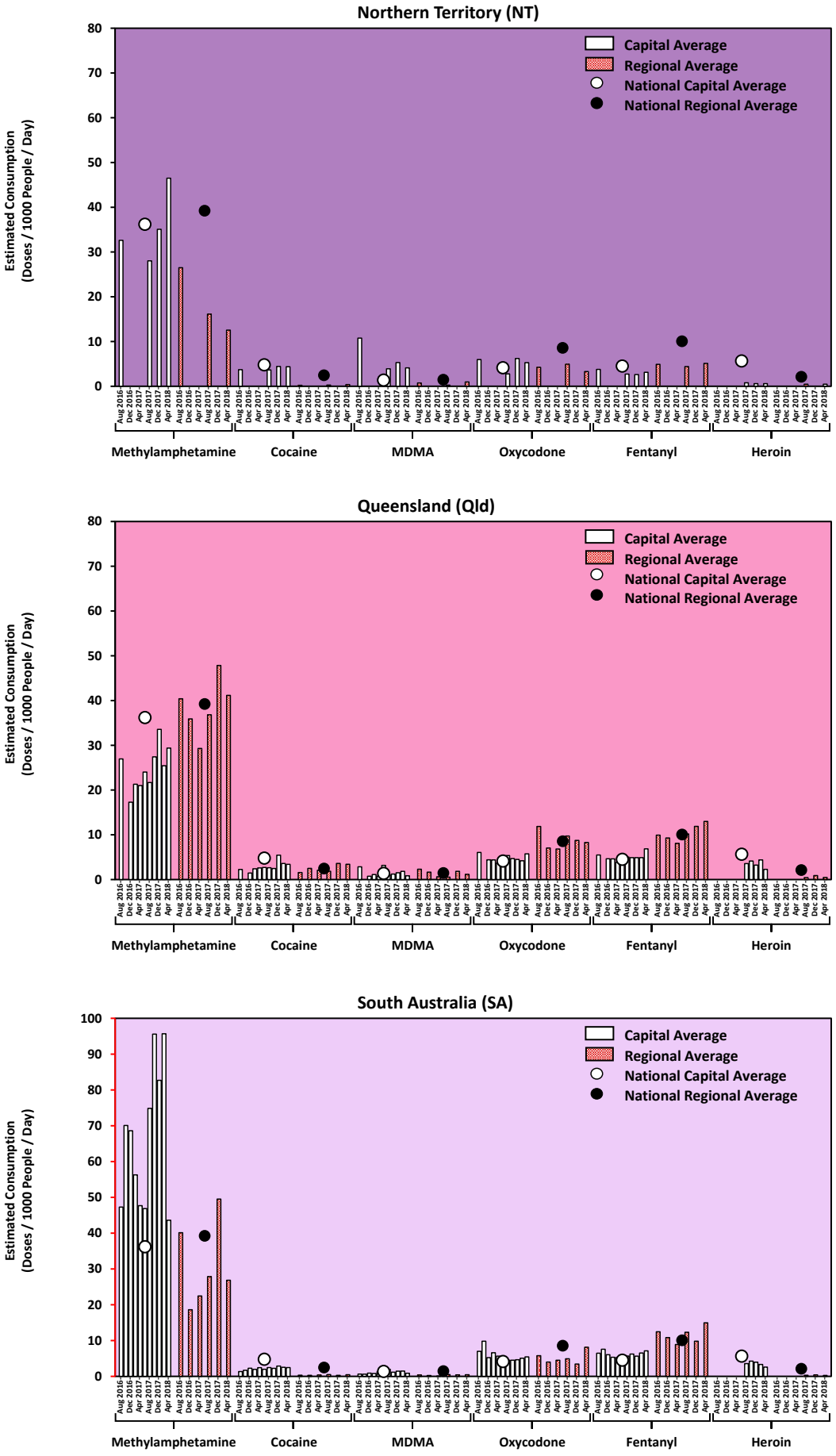
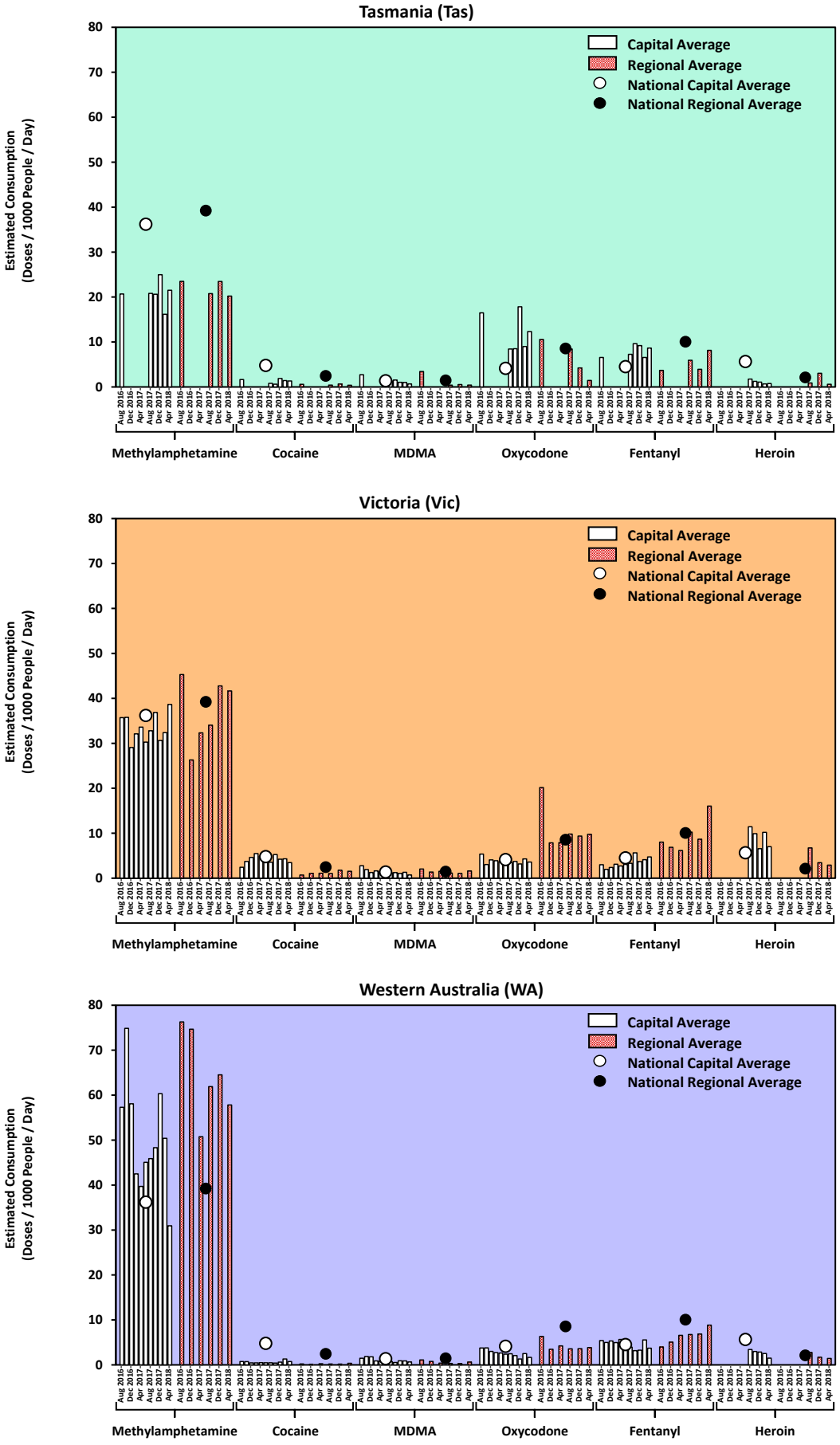


Figure 38 (continued): Profile of average drug consumption by state or territory. Consumption is shown as the number of doses per 1,000 people per day to allow comparison of drugs of different types within the same region (state or territory).

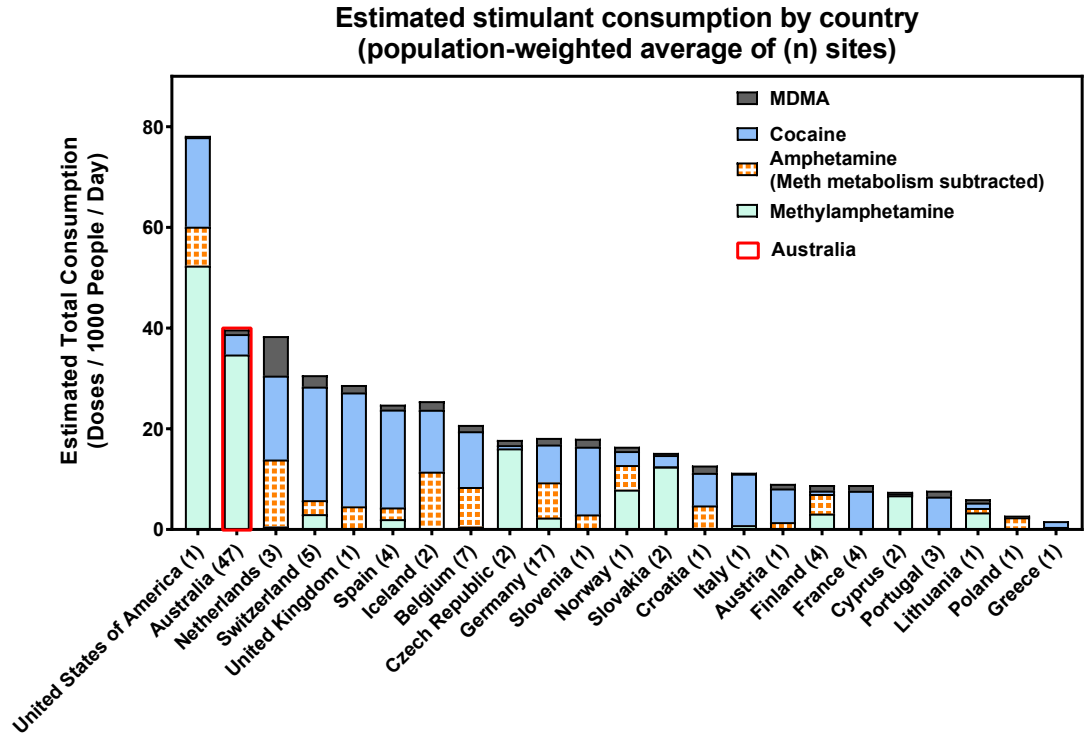


5: INTERNATIONAL COMPARISON OF DRUG USE

5.1 STIMULANT USE

When comparing stimulant use in Australia with international levels, it should be recognised that cultures have different drug preferences and availability of drugs may differ between countries. Throughout many parts of Europe amphetamine is more commonly used than methylamphetamine, while the opposite is true in Australia. Therefore, to make international comparisons, the four common stimulants were added together and expressed as doses per day per normalised population (Figure 39). Latest international data for Europe and the United States of America (USA) were used as reported by SCORE (2018).

Figure 39: The total amount of stimulant consumed (as doses per 1,000 people per day) by a country as a population weighted average of the number of reported sites (given in brackets after country name).



Note: the European estimates are based on data of a few WWTPs per country only and, therefore, may not represent the national per capita consumption for a given analyte in a given country. The number of reported cities is given in brackets after country name. European and USA data are from SCORE (2018) and various excretion factors applied are reported in Appendix 1. SCORE reports measured raw loads in sewers and doses were calculated for the purposes of this report in the same way as for Australia. All SCORE data were from March 2017. Australian data is from April 2018.

Comparing these drugs individually between Australia and other countries, Australia's ranking in Figure 39 is driven by its high methylamphetamine consumption. Methylamphetamine levels are the second highest compared to the other reported countries. It must be noted that the other countries in the world with reasonably high methylamphetamine use, in Asia and other parts of North America, are not necessarily represented here. Compared to European drug usage patterns, Australian cocaine consumption is relatively low, while MDMA is at median levels (Figure 40).

Figure 40: National population weighted average consumption for cities in Europe, the United States of America and Australia for methylamphetamine, cocaine and MDMA consumed on a per capita basis.

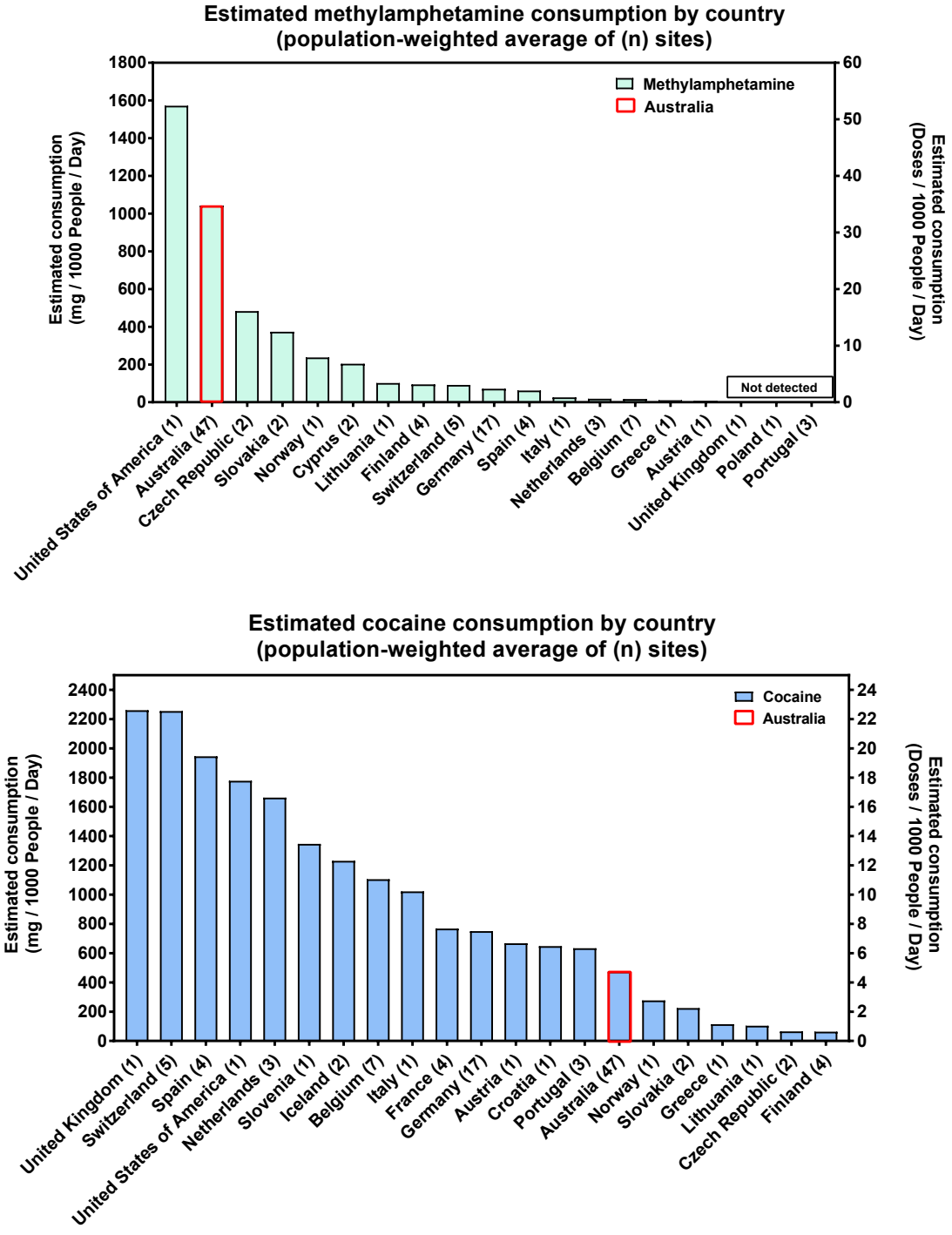
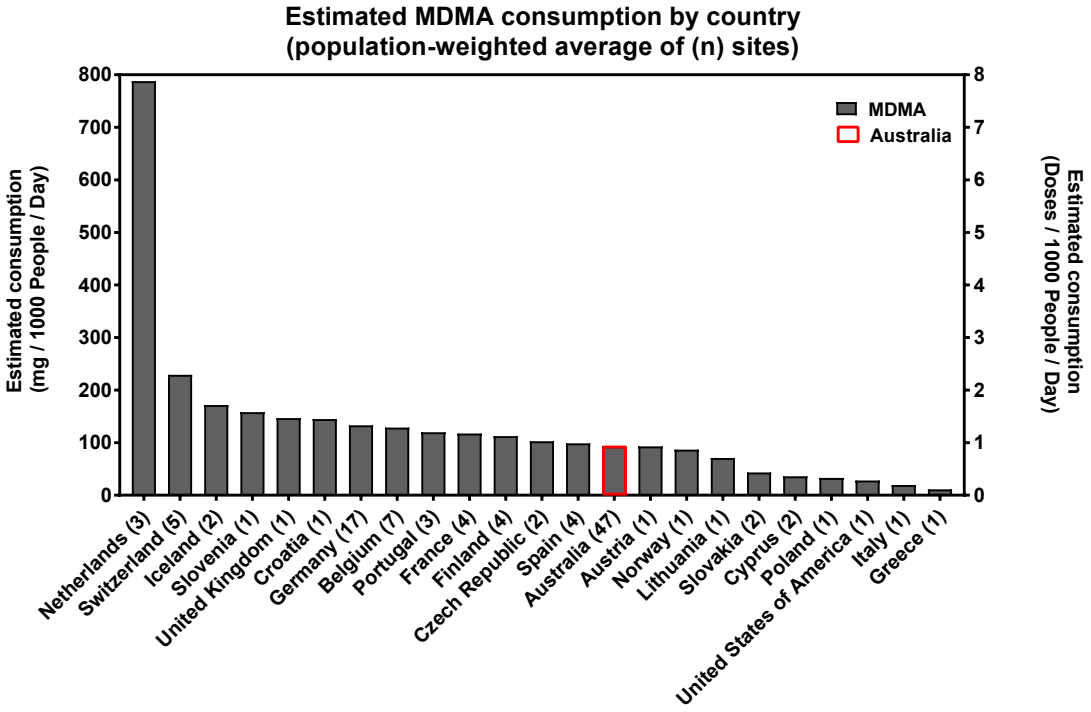


Figure 40 (continued): National population weighted average consumption for cities in Europe, the United States of America and Australia for methylamphetamine, cocaine and MDMA consumed on a per capita basis.

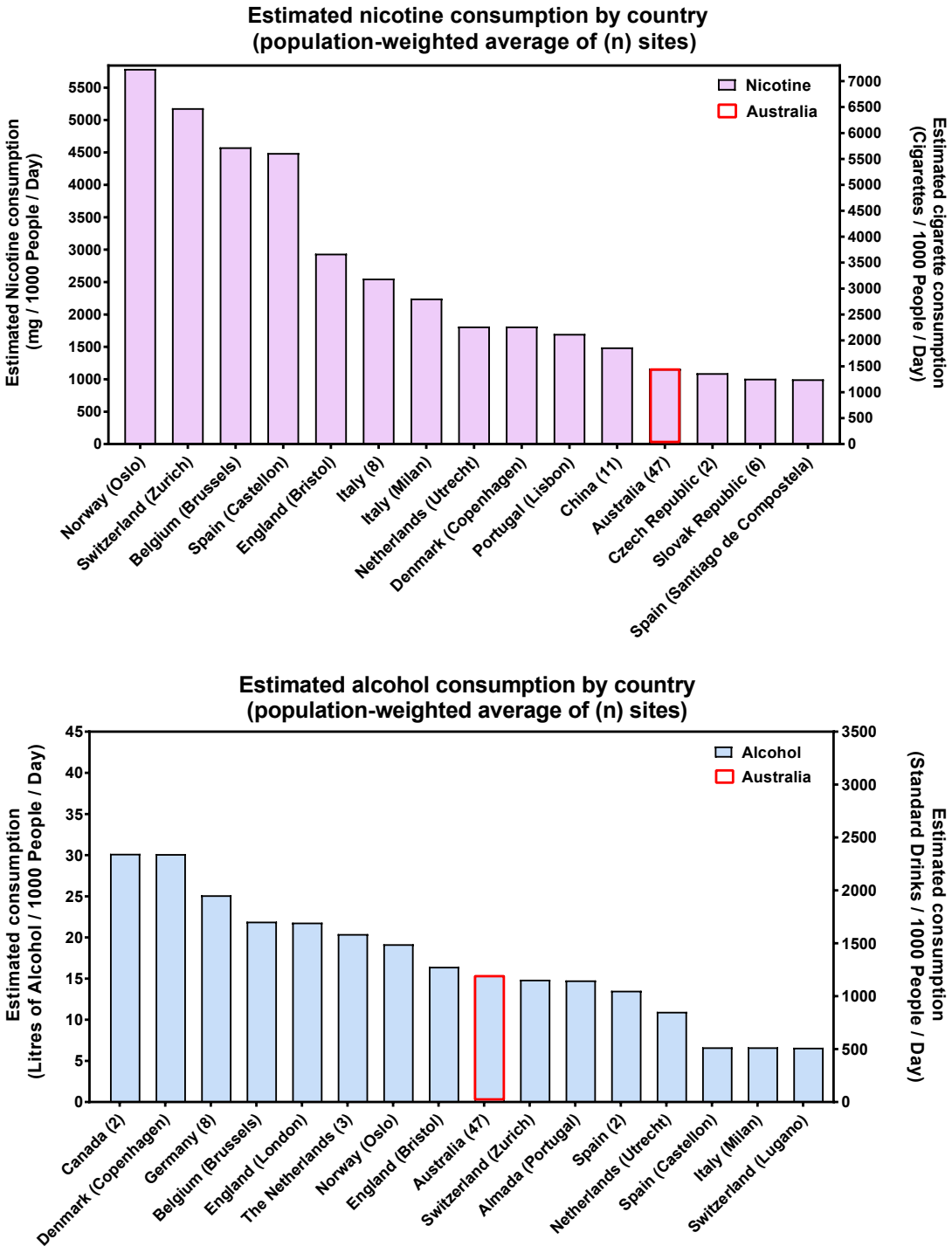


Note: the European estimates are based on data of a few WWTPs per country only and, therefore, may not represent the national per capita consumption for a given analyte in a given country. The number of reported cities is given in brackets after country name. European and USA data are from SCORE (2018) and various excretion factors applied are reported in Appendix 1. SCORE reports measured raw loads in sewers and doses were calculated in the same way as for Australia. All SCORE data were from March 2017. Australian data is from April 2018.

5.2 NICOTINE AND ALCOHOL USE

In the case of nicotine and tobacco, Australian consumption was compared with countries for which wastewater-based data are available (Figure 41). Although the periods in which the international studies were conducted are not matched, Australia ranks well below the European countries in terms of nicotine consumption, while alcohol use is slightly more towards the European average.

Figure 41. National population weighted average consumption for studies outside Australia and Australia for nicotine and alcohol consumed on a per capita basis.



Note: the study estimates are based on data from available scientific publications. The number of reported cities is given in brackets after country name. Various excretion factors applied are reported in Appendix 1. Reported mass loads in sewers have been collated on a population weighted basis per city where applicable and doses calculated in the same way as for Australia. Nicotine data are from 2011 (Portugal), 2012 (Italy), 2014 (Czech Republic, Slovak Republic), average of 2012-2014 (Spain) and 2015 (China) (Lopes et al. 2014, Rodriguez-Alvarez et al. 2014, Castiglioni et al. 2015, Mackulak et al. 2015, Wang et al. 2016) and for remaining sites from Baz-Lomba et al. (2016). Results for alcohol are from samples collected in 2015 (Ryu et al. 2016). Norway, Spain, Belgium, United Kingdom, Netherlands, Italy, Switzerland and Denmark results are from Baz-Lomba et al. (2016).

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8: 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	12	16	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 *	1	4	n.a.	n.a.[#]
MDMA	1.5	2	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 sulphate	167	500	0.00012[e]	10g[e]
Benzoylecgonine	33	100	0.35[g]	100[b]
6-monoacetylmorphine	0.5	1.0	0.013[h]	20[i]

n.a. = data not available; a = (Khan and Nicell 2012); b = (Zuccato et al. 2008); c = (Castiglioni et al. 2015); d = (Rossi 2016); e = (Ryu et al. 2016); f = (Lalovic 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: NUMBER OF SITES ASSESSED IN EACH REPORT

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

	Report 1		Report 2						Report 3						Report 4				Report 5			
	Aug-16		*Oct-16		Dec-16		*Feb-17		Apr-17		*Jun-17		Aug-17		*Oct-17		Dec-17		*Feb-18		Apr-18	
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	-	5	7	3	-	3	5	3	-	3	4
NT	1	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-	0	-	1	1
Qld	3	9	-	-	2	8	3	-	3	8	3	-	3	7	3	-	3	6	3	-	3	8
SA	4	4	4	-	4	5	4	-	4	5	4	-	4	5	4	-	4	5	4	-	4	5
Tas	3	4	-	-	-	-	-	-	-	-	-	-	3	3	3	-	3	2	3	-	3	2
Vic	2	5	2	-	2	3	2	-	2	2	2	-	2	6	2	-	2	4	2	-	2	4
WA	3	1	3	-	3	3	3	-	3	3	3	-	3	3	3	-	3	3	3	-	3	3
Population (millions) C & R	**11.5**	**1.6**	**6.5**	**-**	**10.6**	**1.3**	**11.1**	**-**	**11.1**	**1.2**	**11.1**	**-**	**11.5**	**1.7**	**11.2**	**-**	**11.2**	**1.5**	**11.2**	**-**	**11.2**	**1.6**
Total Population (millions)	**13.1**		**6.5**		**11.9**		**11.1**		**12.3**		**11.1**		**13.2**		**11.2**		**12.7**		**11.2**		**12.8**	
% of Australian population	**55.9%**		**27.8%**		**50.9%**		**47.4%**		**52.4%**		**47.4%**		**56.3%**		**47.9%**		**54.3%**		**47.9%**		**54.8%**	

* Every second time-point aims to sample from only capital city sites. Census 2016 population used for population percentage estimates. Estimates have been rounded to the nearest 0.1 million. Note: catchment populations have been refined, and so population totals and percentages may have changed accordingly.

APPENDIX 3: FURTHER INFORMATION ON WWTPS

Sampling details of each wastewater treatment plant.

		# Samples											
Site Code	**Capital/Regional**	**Aug 16**	**Oct 16**	**Dec 16**	**Feb 17**	**Apr 17**	**Jun 17**	**Aug 17**	**Oct 17**	**Dec 17**	**Feb 18**	**Apr 18**	**Population Category**
ACT: 009	Capital	7	-	7	7	7	7	7	7	7	7	7	>150,000
NSW: 003	Capital	7	-	7	4	7	7	7	7	7	7	7	>150,000
NSW: 006	Capital	7	-	7	7	7	7	7	7	7	7	7	>150,000
NSW: 008	Capital	6	-	7	7	7	7	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	-	7	-	7	30,000 to 150,000
NSW: 025	Regional	7	-	-	-	-	-	7	-	7	-	7	30,000 to 150,000
NSW: 040	Regional	7	-	-	-	-	-	7	-	-	-	-	<30,000
NSW: 051	Regional	7	-	-	-	-	-	7	-	-	-	-	<30,000
NSW: 068	Regional	1	-	4	-	7	-	7	-	7	-	7	>150,000
NSW: 081	Regional	-	-	-	-	-	-	7	-	7	-	-	<30,000
NSW: 115	Regional	-	-	7	-	7	-	7	-	7	-	7	30,000 to 150,000
NT: 010	Capital	7	-	-	-	-	-	7	-	7	-	7	30,000 to 150,000
NT: 078	Regional	7	-	-	-	-	-	7	-	-	-	7	<30,000
Qld: 002	Capital	7	-	6	6	7	7	7	7	7	7	7	>150,000
Qld: 005	Capital	7	-	-	7	7	7	6	6	7	6	7	>150,000
Qld: 011	Capital	7	-	7	6	7	7	6	7	7	7	7	>150,000
Qld: 012	Regional	5	-	7	-	7	-	7	-	6	-	7	>150,000
Qld: 020	Regional	7	-	-	-	-	-	-	-	-	-	-	<30,000
Qld: 024	Regional	7	-	7	-	7	-	-	-	-	-	7	30,000 to 150,000
Qld: 028	Regional	7	-	7	-	7	-	7	-	-	-	7	30,000 to 150,000
Qld: 029	Regional	7	-	7	-	7	-	7	-	7	-	7	30,000 to 150,000
Qld: 033	Regional	7	-	7	-	7	-	7	-	7	-	6	30,000 to 150,000
Qld: 039	Regional	7	-	7	-	7	-	7	-	7	-	7	<30,000
Qld: 053	Regional	7	-	3	-	5	-	7	-	5	-	6	<30,000
Qld: 077	Regional	7	-	7	-	7	-	7	-	7	-	7	<30,000
SA: 007	Capital	5	7	7	7	7	7	7	7	7	7	7	>150,000
SA: 013	Capital	5	7	7	7	7	7	7	7	7	7	7	>150,000
SA: 027	Capital	5	7	7	7	7	7	7	7	7	7	7	30,000 to 150,000
SA: 059	Capital	5	7	7	7	7	7	7	7	6	7	7	>150,000

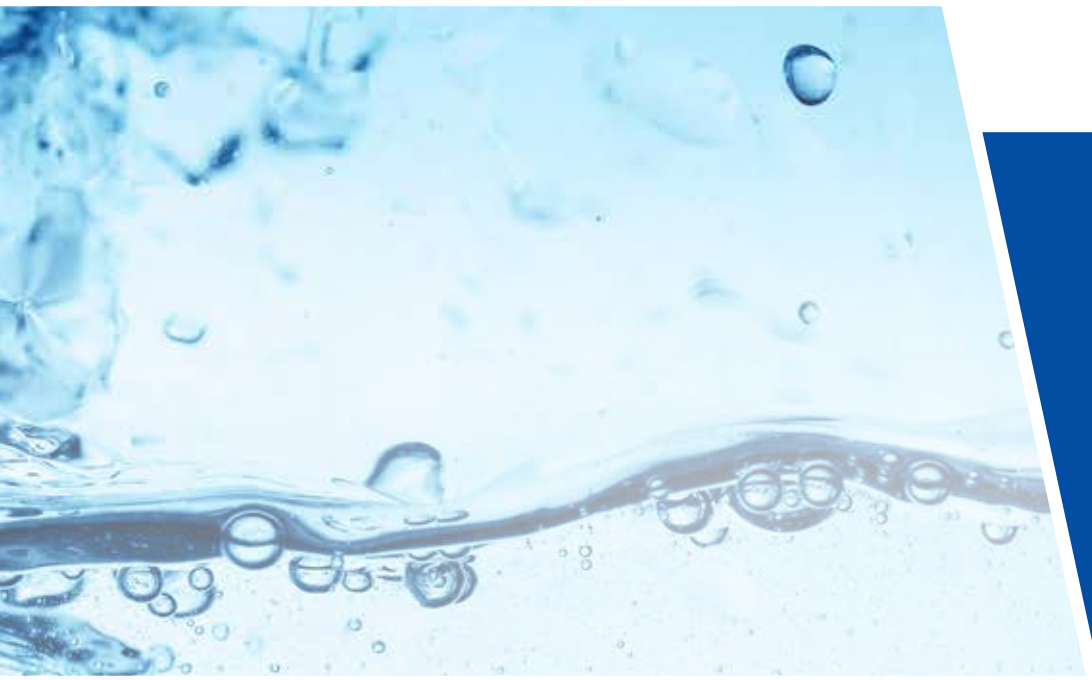
Sampling details of each wastewater treatment plant (continued).

		# Samples											
Site Code	**Capital/Regional**	**Aug 16**	**Oct 16**	**Dec 16**	**Feb 17**	**Apr 17**	**Jun 17**	**Aug 17**	**Oct 17**	**Dec 17**	**Feb 18**	**Apr 18**	**Population Category**
SA: 017	Regional	5	-	4	-	4	-	4	-	4	-	7	<30,000
SA: 022	Regional	5	-	4	-	4	-	4	-	4	-	7	<30,000
SA: 063	Regional	5	-	4	-	5	-	4	-	4	-	7	<30,000
SA: 076	Regional	5	-	4	-	4	-	4	-	4	-	7	<30,000
SA: 119	Regional	-	-	4	-	4	-	4	-	4	-	7	<30,000
Tas: 004	Capital	7	-	-	-	-	-	5	5	5	5	5	<30,000
Tas: 019	Capital	7	-	-	-	-	-	5	5	5	5	5	<30,000
Tas: 041	Capital	7	-	-	-	-	-	4	5	5	5	5	<30,000
Tas: 018	Regional	7	-	-	-	-	-	5	-	7	-	7	<30,000
Tas: 038	Regional	7	-	-	-	-	-	-	-	-	-	-	<30,000
Tas: 048	Regional	7	-	-	-	-	-	5	-	5	-	5	<30,000
Tas: 058	Regional	7	-	-	-	-	-	5	-	-	-	-	<30,000
Vic: 001	Capital	7	7	7	7	7	7	7	7	7	7	7	>150,000
Vic: 067	Capital	7	7	7	7	7	7	7	7	7	7	7	>150,000
Vic: 037	Regional	7	-	7	-	-	-	7	-	7	-	7	>150,000
Vic: 046	Regional	7	-	-	-	-	-	7	-	-	-	-	30,000 to 150,000
Vic: 061	Regional	7	-	7	-	7	-	7	-	7	-	7	30,000 to 150,000
Vic: 062	Regional	7	-	-	-	-	-	5	-	-	-	-	<30,000
Vic: 066	Regional	6	-	7	-	7	-	7	-	7	-	7	30,000 to 150,000
Vic: 114	Regional	-	-	-	-	-	-	5	-	7	-	7	30,000 to 150,000
WA: 101	Capital	7	7	7	7	7	7	7	7	7	7	7	>150,000
WA: 103	Capital	7	7	7	7	7	7	7	7	7	7	7	>150,000
WA: 104	Capital	7	7	7	7	7	7	7	7	7	7	7	>150,000
WA: 102	Regional	7	-	7	-	7	-	7	-	7	-	7	30,000 to 150,000
WA: 118	Regional	-	-	7	-	7	-	7	-	-	-	-	<30,000
WA: 120	Regional	-	-	7	-	7	-	7	-	7	-	7	30,000 to 150,000
WA: 129	Regional	-	-	-	-	-	-	-	-	7	-	7	<30,000
	Total Days	329	63	236	107	236	112	342	126	288	126	319	
	Total Sites	51	9	37	16	36	16	54	19	45	19	47	
	Total Capital	22	9	15	16	16	16	22	19	20	19	20	
	Total Regional	29	0	22	0	20	0	32	0	25	0	27	
		Total samples: 329 Report 1; Aug 2016		**Total samples: 406 Report 2; Oct & Dec 2016, Feb 2017**			**Total samples: 690 Report 3; Apr, Jun & Aug 2017**		**Total samples: 414 Report 4; Oct & Dec 2017**	**Total samples: 445 Report 5; Feb & Apr 2018**		**Grand total number of samples: 2,284 Report 1-5**

APPENDIX 4: PERCENTAGE OF SAMPLES ABOVE LOD (%) FOR EACH DRUG AND PERIOD ASSESSED.

The proportion of samples that each drug was detected above LOD for Report 1 to 5. Note: regional sites are only sampled every second period.

		Drug detections % (above LOD) Report 1–5										
		Aug 2016	Oct 2016	Dec 2016	Feb 2017	Apr 2017	Jun 2017	Aug 2017	Oct 2017	Dec 2017	Feb 2018	Apr 2018
Methylamphetamine	**Capital**	100	100	100	100	100	100	100	100	100	100	100
Methylamphetamine	**Regional**	100	-	100	-	100	-	100	-	100	100	100
Cocaine	**Capital**	97	97	96	96	97	96	90	90	95	99	97
Cocaine	**Regional**	45	-	52	-	53	-	53	-	56	100	82
MDMA	**Capital**	100	100	100	100	100	96	100	100	100	100	100
MDMA	**Regional**	95	-	96	-	100	-	98	-	100	-	98
MDA	**Capital**							98	92	100	100	100
MDA	**Regional**							86	-	95	-	95
Oxycodone	**Capital**	100	100	100	100	100	100	100	100	100	100	100
Oxycodone	**Regional**	100	-	100	-	100	-	100	-	100	-	100
Fentanyl	**Capital**	100	97	100	99	100	100	100	100	100	100	96
Fentanyl	**Regional**	96	-	94	-	99	-	100	-	100	-	100
Heroin	**Capital**							83	92	84	85	76
Heroin	**Regional**							37	-	59	-	22
Alcohol	**Capital**	100	100	100	100	100	100	100	100	100	100	100
Alcohol	**Regional**	100	-	100	-	100	-	100	-	100	100	100
Nicotine	**Capital**	100	100	100	100	100	97	100	100	100	100	100
Nicotine	**Regional**	100	-	100	-	100	-	100	-	100	100	100
Mephedrone	**Capital**	2	-	-	-	-	1	-	1	24	3	4
Mephedrone	**Regional**	-	-	3	-	3	-	1	-	12	-	3
Methylone	**Capital**	45	19	47	28	79	7	28	46	59	10	2
Methylone	**Regional**	41	-	14	-	9	-	22	-	22	-	3



CONCLUSIONS

CONCLUSIONS

For the fifth report of the National Wastewater Drug Monitoring Program, wastewater analysis was conducted in February and April 2018. The program has identified variations in patterns of drug consumption, both over time and within and between jurisdictions. Consistent with previous reports, findings show that of the substances monitored, nicotine and alcohol are the most consumed drugs in Australia.[7] While there have been decreases in methylamphetamine consumption this reporting period from the previous reporting period, it remains the most consumed illicit drug, with estimated consumption significantly exceeding that of other monitored illicit drugs.

METHYLAMPHETAMINE

When comparing data from April 2017 and April 2018, population-weighted averages for methylamphetamine consumption in capital city and regional sites increased.

The population-weighted average consumption of methylamphetamine for both capital city and regional sites decreased from December 2017 to April 2018. Of note this reporting period are the decreases in average capital city and regional methylamphetamine consumption recorded in both South Australia and Western Australia. The regional average consumption of methylamphetamine continues to exceed capital city average consumption. The Northern Territory had the highest estimated average capital city consumption of methylamphetamine in April 2018, with Western Australia having the highest estimated average regional consumption.

AMPHETAMINE

Amphetamine is a metabolite of methylamphetamine consumption. While the program measured amphetamine consumption, measured consumption was not reported separately as levels measured were consistent with observed levels related to methylamphetamine consumption.

COCAINE

When comparing data from April 2017 and April 2018, population-weighted averages for cocaine consumption in capital city sites decreased, while consumptions in regional sites increased.

The population-weighted average consumption of cocaine for both capital city and regional sites decreased from December 2017 to April 2018 . The capital city average consumption of cocaine was almost double the regional average. New South Wales continues to have the highest estimated average capital city and regional consumption of cocaine in Australia.

3,4-METHYLENEDIOXYMETHYLAMPHETAMINE (MDMA)

When comparing data from April 2017 and April 2018, population-weighted averages for MDMA consumption in capital city sites decreased, while consumption in regional sites increased.

The population-weighted average consumption of MDMA for both capital city and regional sites decreased from December 2017 to April 2018. The regional average consumption of MDMA was higher than capital city average consumption. The Northern Territory had the highest estimated average capital city consumption of MDMA in April 2018, with New South Wales having the highest estimated average regional consumption, closely followed by Victoria.

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

3,4-METHYLENEDIOXYAMPHETAMINE (MDA)

MDA is a metabolite of MDMA. As the proportion of MDA derived from MDMA is known, it has been possible from Report 3 to estimate MDA consumption rather that its presence solely as a metabolite of MDMA use. The regional average consumption of MDA exceeds capital city average consumption. While in previous reporting periods Site 12 in Queensland was identified as a site of particular concern given the very high consumption levels reported, this is no longer the case. Tasmania had the highest estimated average capital city consumption of MDA in April 2018, with New South Wales having the highest estimated average regional consumption.

HEROIN

The population-weighted average consumption of heroin in capital city sites remained relatively stable, while consumption in regional sites decreased from December 2017 to April 2018. The capital city average consumption of heroin was more than double the regional average. Victoria had the highest estimated capital city and regional average consumption of heroin in April 2018.

MEPHEDRONE

Consistent with previous reporting periods, mephedrone was mostly detected below the level at which it could be reliably quantified. The number of national detections of mephedrone more than halved this reporting period, from 23 in December 2017 to 10 in April 2018. The number of sites where mephedrone was detected remained stable at six this reporting period, with mephedrone detected in New South Wales and Queensland in April 2018.

METHYLONE

Consistent with previous reporting periods, methylone was mostly detected below the level at which it could be reliably quantified. The number of national detections of methylone decreased considerably this reporting period, from 65 in December 2017 to eight in April 2018. Methylone was detected at seven sites in April 2018, a decrease from the 17 sites in December 2017. While methylone was detected in New South Wales, Queensland and Western Australia in April 2018, use appears to be largely concentrated in New South Wales.

OXYCODONE

When comparing data from April 2017 and April 2018, population-weighted averages for oxycodone consumption remained relatively stable in capital city sites and increased in regional sites.

The population-weighted average consumption of oxycodone decreased in capital city sites and increased in regional sites from December 2017 to April 2018. The regional average consumption of oxycodone continues to be almost double the capital city average. In April 2018, Tasmania had the highest estimated average capital city consumption of oxycodone, with Victoria having the highest estimated average regional consumption.

FENTANYL

When comparing data from April 2017 and April 2018, population-weighted averages for fentanyl consumption in capital city and regional sites increased, with regional consumption in April 2018 more than double that of April 2017.

The population-weighted average consumption of fentanyl increased in both capital city and regional sites from December 2017 to April 2018, with related consumption currently the highest recorded since the program began. The regional average consumption of fentanyl was more than double the capital city average. Tasmania and the Australian Capital Territory had the highest estimated average capital city consumption of fentanyl in April 2018, with New South Wales the highest estimated average regional consumption.

NICOTINE[8]

When comparing data from April 2017 and April 2018, population-weighted averages for nicotine consumption in capital city and regional sites decreased.

Nicotine remains one of the most consumed drugs in Australia. The population-weighted average consumption of nicotine in capital city sites increased from December 2017 to April 2018, with regional average consumption remaining relatively stable. The regional average consumption of nicotine exceeded capital city average consumption. The Northern Territory[9] had the highest estimated average capital city and regional consumption of nicotine in April 2018.

ALCOHOL

When comparing data from April 2017 and April 2018, population-weighted averages for alcohol consumption in capital city sites decreased and increased in regional sites.

Alcohol remains one of the most consumed drugs in Australia. The population-weighted average consumption of alcohol remained relatively stable in regional sites from December 2017 to April 2018, while consumption in capital city sites decreased. The regional average consumption of alcohol was higher than capital city average consumption. The Northern Territory had the highest estimated average capital city and regional consumption in April 2018, with consumption levels well above the national average.

INTERNATIONAL COMPARISONS (SCORE)

There are a number of factors that influence drug consumption, including but not limited to different drug preferences and drug availability. This concept is illustrated in the SCORE data and the notable differences in stimulant drug preferences. Of the 23 countries with comparable reported data for MDMA, cocaine, amphetamine and methylamphetamine, Australia ranks second highest after the USA for total estimated stimulant consumption, although the USA figure is based on testing at one site only. In comparing the individual drug components, Australia ranks highly compared to other reported countries for methylamphetamine consumption, with medium MDMA consumption and relatively low cocaine consumption.

8 For accuracy, estimates have been changed from tobacco in Report 1 and 2 to nicotine from Report 3 due to the inability to distinguish between nicotine intake from tobacco or electric cigarettes and nicotine replacement therapies such as patches and gum.

9 As the Northern Territory only had two participating sites, results may not be representative of the Territory as a whole.

NEXT REPORT

The sixth report of the National Wastewater Drug Monitoring Program is scheduled to be publicly released in December 2018. Cannabis is to be included in the drugs monitored by the National Wastewater Drug Monitoring Program, with related analysis to be incorporated for the first time in Report 6.