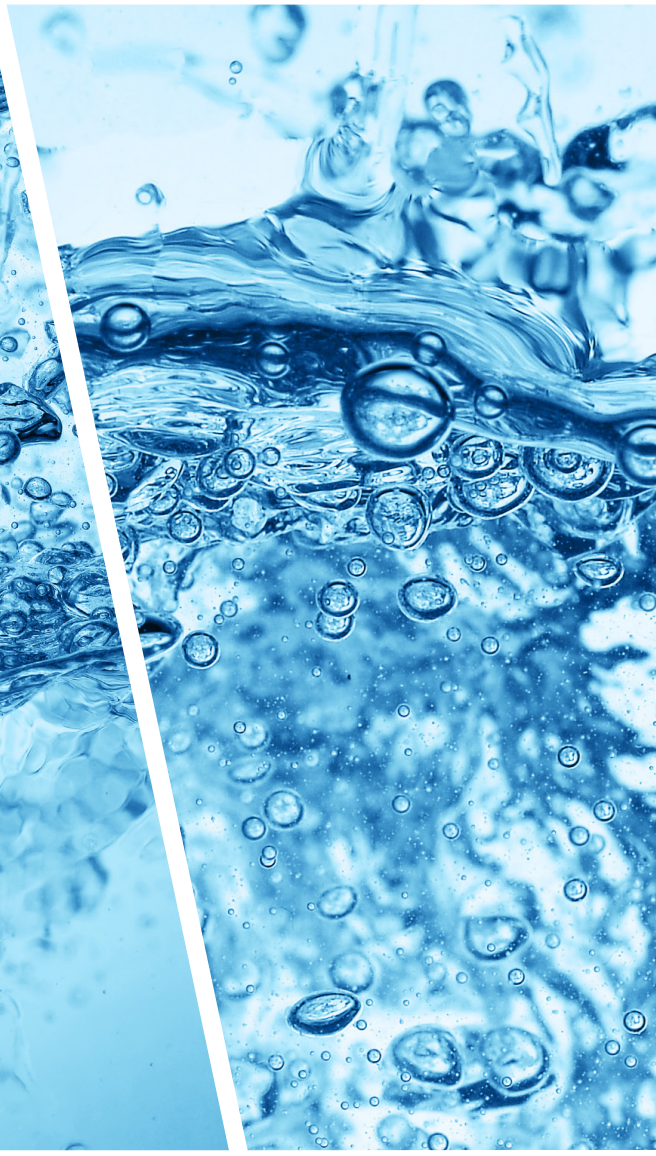
NATIONAL WASTEWATER DRUG MONITORING PROGRAM

REPORT 17



AUSTRALIAN CRIMINAL INTELLIGENCE COMMISSION

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

University of South Australia

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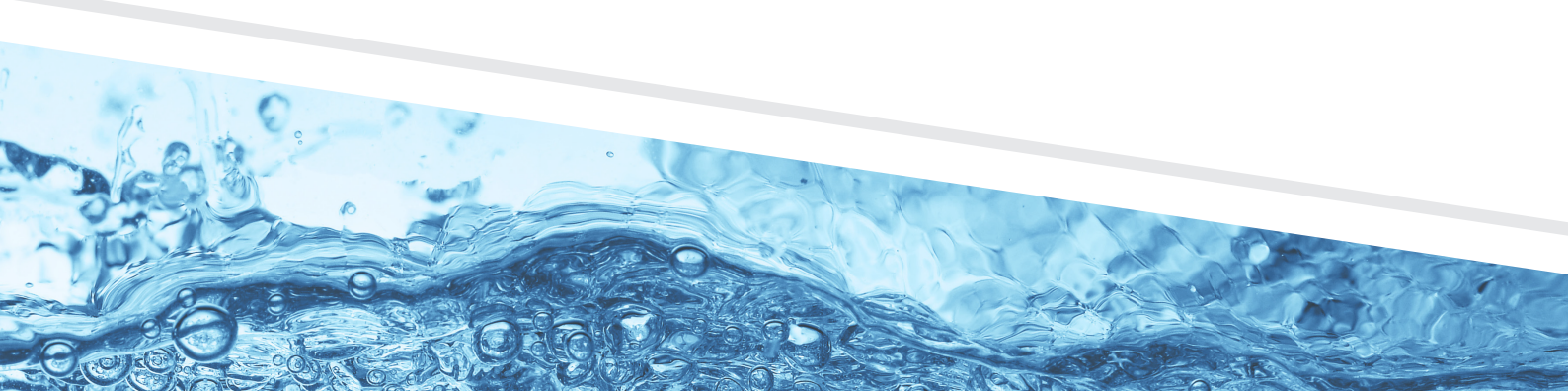


CEO FOREWORD

The Australian Criminal Intelligence Commission (ACIC) provides information and intelligence on serious and organised criminal activity to support government in creating a safer Australia. Much of the harm Australians suffer at the hands of organised crime is due to illicit drugs. In 2020, there were 1,842 drug-induced deaths in Australia—equivalent to 5 drug-induced deaths per day or 7.2 deaths per 100,000 people. Almost 16 tonnes of methylamphetamine, cocaine, 3,4-methylenedioxymethylamphetamine (MDMA) and heroin was consumed at the height of COVID. This shows the resilience of Australia's illicit drug markets and the agility of serious and organised crime groups to overcome significant obstacles to supply major drugs to local markets.

The National Wastewater Drug Monitoring Program (the Program) is an Australian Government-funded initiative that assists in understanding drug use within populations, providing a measure of one important aspect of national health—the demand for a range of drugs. Illicit drugs and licit drugs with abuse potential are inherently harmful. Reliable drug consumption data are a key indicator of the level of harm experienced by the community. This is because the level of community harm is directly related to the quantity of substances consumed. Understanding drug consumption at a population level supports effective allocation of resources to priority areas and assists to inform appropriate demand, supply and harm reduction strategies.

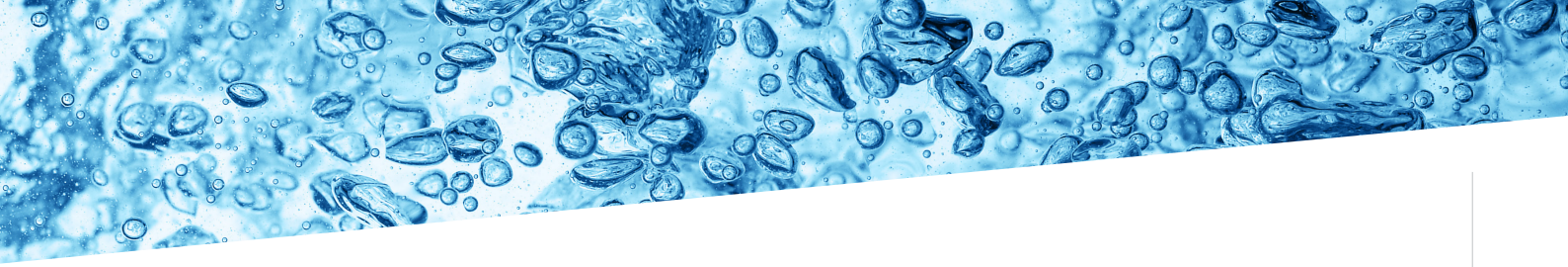
One of the advantages of the Program is the increasing volume of longitudinal data that has now been collected. This enables the ACIC to monitor short and longer-term market trends, key events and law enforcement interventions, and to identify and monitor drug consumption in geographic locations that may benefit from focused responses.

The ACIC has also formed partnerships with academic institutions to develop a more detailed picture of high-risk markets, particularly in regional settings. The data will be further exploited by the ACIC's evolving data analytics capability.

TRENDS IDENTIFIED DURING THIS REPORTING PERIOD

Report 17 covers sampling in April and June 2022. In April 2022 57 wastewater sites were monitored nationally. As part of the ongoing evolution of the Program, this is the first report that incorporated population estimates from the 2021 Census. Based on 2021 Census data, the 57 sites covered approximately 56% of the Australian population.

Between December 2021 and April 2022 national consumption of methylamphetamine increased in both capital city and regional sites, while consumption of heroin remained relatively stable in capital city sites and increased in regional sites. Consumption of all other drugs monitored by the Program decreased in both capital city and regional sites. This was a unique situation that with the exception of heroin, both capital city and regional sites were experiencing the same trend at the same time. National consumption of MDMA, MDA, oxycodone and fentanyl decreased to record low levels in capital city and regional sites in April 2022.



IMPLICATIONS OF THE LATEST DATA

The ACIC judges that these changes in drug markets were brought about by a range of factors. Law enforcement interventions do impact illicit drug markets. Recent analysis by the Australian Criminal Intelligence Commission (ACIC) suggests that law enforcement activities can result in short-term decreases in drug consumption, creating windows of opportunity for law enforcement and health interventions aimed at reducing demand. There are also factors such as normal shifts in supply and demand and of course the responses and adjustments of serious and organised crime groups.

FURTHER APPLICATIONS OF WASTEWATER ANALYSIS

The ACIC's wastewater program continues to expand. New technology developed by our partner universities is being applied to enable sampling to occur at an ever increasing variety of sites in regional and remote areas of Australia, where illicit drug consumption has not traditionally been closely monitored. Work in this area need no longer be confined to the Australian mainland as the Program represents world best practice and can readily be deployed offshore and overseas to determine the level of drug consumption and therefore community harm. Advances in detection techniques is expanding the range of chemicals that can be reliably detected in wastewater, including drugs and chemicals linked to domestic drug manufacture. All of this work is consistent with ACIC and broader government priorities.

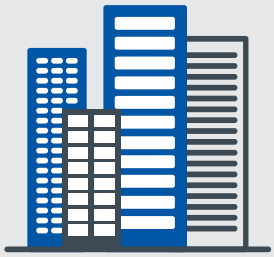
ACKNOWLEDGEMENTS

I would like to acknowledge the valuable support and expertise of The University of Queensland and the University of South Australia, which undertook the data collection and analysis underpinning this report, and the ACIC officers who contributed to the project.

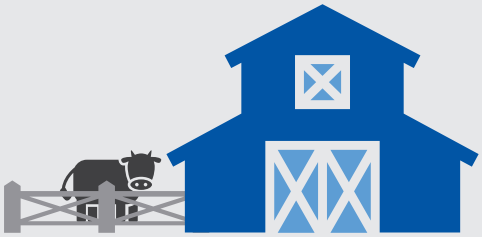
Michael Phelan APM
Chief Executive Officer
Australian Criminal Intelligence Commission

SNAPSHOT

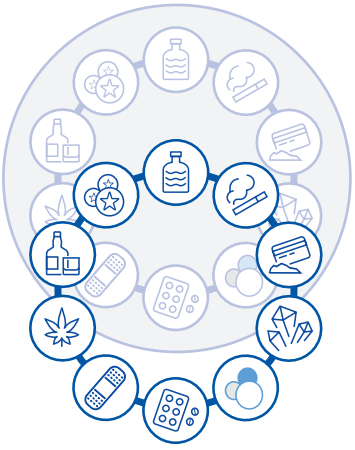
The April 2022 collection covers around **56 per cent** of Australia's population—about **14.1 million Australians.**



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



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



In April 2022, with the exception of heroin, changes in consumption in both capital city and regional sites **mirrored each other** at the national level.

December 2021 to April 2022 highlights:

Methylamphetamine consumption increased in capital cities and regional sites
Heroin consumption increased in regional sites

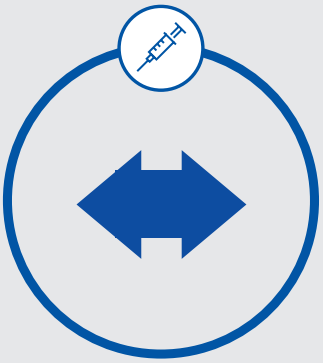
Record lows in capital cities and regional sites

- **MDMA** (April)
- **MDA** (April)
- **Oxycodone** (April)
- **Fentanyl** (April)

Between December 2021 and April 2022, the population-weighted average capital city consumption of:

alcohol, nicotine, cocaine, MDMA, MDA, oxycodone, fentanyl, cannabis and ketamine **decreased**

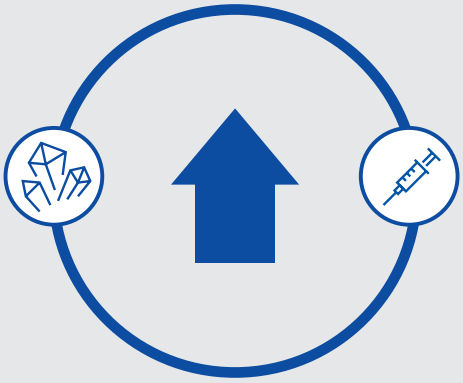
methylamphetamine **increased**



heroin **relatively stable**

Between December 2021 and April 2022, the population-weighted average regional consumption of:

alcohol, nicotine, cocaine, MDMA, MDA, oxycodone, fentanyl, cannabis and ketamine **decreased**



methylamphetamine and heroin **increased**

INTRODUCTION

This is the 17th National Wastewater Drug Monitoring Program (the Program) report to be publicly released by the Australian Criminal Intelligence Commission (ACIC). The 17th report presents data on Australia's drug consumption for 12 substances and includes data for April (capital city and regional sites) and June 2022 (capital city sites). Longitudinal data captured by the Program increases our understanding of drug use nationally, in specific locations and over time. It provides valuable insight into trends and emerging issues in drug consumption across Australia and can identify new sources of risk.

Findings presented in the wastewater reports provide law enforcement, policy, regulatory and health agencies with additional, objective data on the use of drugs. These data create opportunities to shape the response to the demand and supply sides of illicit drug markets, particularly in high-use areas, and inform harm reduction strategies. They permit priorities to be set and modified in a manner that is consistent with constantly evolving drug markets and broader world circumstances.

IMPLEMENTATION

The ACIC 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 Program measured the presence[1] of the following substances:

- methylamphetamine
- amphetamine
- cocaine
- 3,4-methylenedioxymethylamphetamine (MDMA)
- 3,4-methylenedioxyamphetamine (MDA)
- heroin
- cannabis
- oxycodone
- fentanyl
- nicotine
- alcohol
- ketamine.

The ACIC continues to review the appropriateness of monitored substances with its partners, stakeholders and the universities.

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.

Both contracted universities monitored wastewater across Australia, covering all state and territory capital cities and a range of regional cities and towns. In April 2022, 57 wastewater treatment plants participated nationally (see Figure 1).[2] Sites were selected to permit the ACIC to provide data on major population areas, sites of actual or potential concern from a drug use perspective and sites where the treatment plant operators have established relationships with the 2 universities.

Figure 1: The breakdown of sites by jurisdiction for April 2022.

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(s) not to participate in the national program in the future, the ACIC, in consultation with the universities, 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 life of the Program, although the intention is to ensure as much continuity as possible in relation to site participation.

2 Sampling also occurred in June 2022 in capital city sites, with 20 participating wastewater sites nationally, covering approximately 48 per cent of the Australian population.

REPORTING

Program reports are published 3 times a year. 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 sampled are not publicly released by the ACIC. Stakeholders in law enforcement, health and other relevant policy agencies are provided with classified information identifying actual sampling locations to inform appropriate responses.

Reported results reflect per capita use in all locations and, with the exception of MDA, cannabis and ketamine (for which reliable dose figures are not available), are expressed in terms of both the number of doses and the weight or volume consumed per capita of the respective substances, to facilitate comparison between substances.

EXPLOITATION OF PROGRAM DATA

The Program is based on a well-established and internationally recognised methodology. The data provide an important basis for the development of empirically informed government and private sector policy and decision making. The reports provide regular, timely, unambiguous and detailed measures of the level of demand for the listed substances in the Australian population, complementing other drug datasets published in Australia. Report 17 measures the drug use of approximately 56% of the Australian population. Population estimates have been updated with Census 2021 population data and are reflected in the site data from April 2022. The changes to population estimates from 2016 to 2021 are contained in Appendix 4.

Wastewater data are also particularly useful for identifying differences in levels of drug consumption in capital city and regional areas of Australia. The data reinforce the different dynamics that apply to both capital city and regional markets and illustrate drug preference variations that exist both within and between states and territories. Understanding these preferences is important in the development and delivery of national responses and in tailoring responses to suit the specific needs of individual jurisdictions. Wastewater analysis also permits the ACIC to gain insight into the decision-making of serious and organised crime groups that supply illicit drug markets.

Regular and near-real-time wastewater reporting enables the ACIC and partners to detect and respond to increasing drug threats in a timely way. The number and diversity of regional sites that participate in the Program permit confident assessments to be made of drug trends outside of the capital cities and facilitates local responses to the different circumstances that apply in each location. This is important because it allows wastewater data to complement a number of other drug data sources in Australia that have limited regional coverage, or are confined to capital cities. It also permits the ACIC and our partners to speak with greater confidence about local drug threats. Wastewater data are used with other available data sources to develop a comprehensive and accurate understanding of drug markets nationally and in each state and territory.

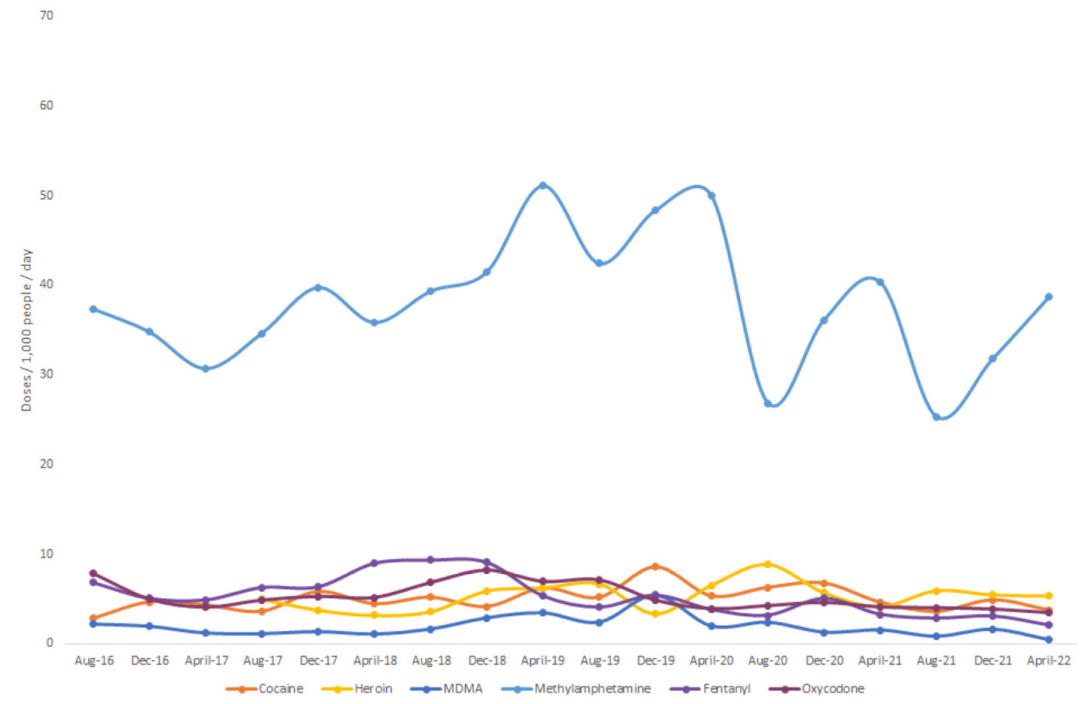
The triangulated data shows that domestic drug markets are complex and vary between jurisdictions, with external influences affecting markets in different ways at different time periods. Other Program data illustrated that consumption of the respective drugs also varied considerably at different sites within jurisdictions. Given that a relatively small proportion of the Australian population consumes illicit drugs, it is important that datasets that purport to measure drug consumption cover a significant proportion of the population on a regular and ongoing basis and a variety of local drug markets. It is also important that Australian drug datasets are interpreted in a complementary manner.

The ACIC engages with academic institutions, industry and public sector agencies to identify further data applications. Identified opportunities included informing responses in high risk areas; measuring drug use in specific local areas; estimating the size of discrete illicit markets; and exploring options for monitoring the effectiveness of existing demand, supply and harm reduction initiatives. The Program is sufficiently flexible to allow for focused collection activity in different geographic locations and at more regular intervals in response to identified need.

TRENDS DURING THE REPORTING PERIOD AND IMPLICATIONS

Most drug markets are close to returning to pre-COVID settings. We judge fluctuations in consumption that have occurred during the current reporting period are explainable by factors that routinely impact on illicit drug markets in particular. For example, as illustrated in Figure 2, illicit drug markets (cannabis excepted) continue to be dominated by methylamphetamine consumption, with that consumption continuing to increase, while there was little change to other major illicit drug markets, or consumption decreased.

Figure 2: National average drug consumption of methylamphetamine, cocaine, MDMA, heroin, oxycodone and fentanyl.



Methylamphetamine consumption increased in both capital city and regional areas in April 2022, which likely reflects a return to more normal supply levels for importations and domestic manufacture. Conversely, MDMA consumption continued to decrease to record low levels in both capital city and regional sites in April 2022, including a tangible decrease during the reporting period. The ACIC judges that this trend is based on decisions by serious and organised crime groups in Europe which are key to the supply of MDMA in Australia. Some of those groups appear to be transitioning from the manufacture of MDMA to methylamphetamine and this appears to be impacting supply of the Australian market.

Cocaine consumption also decreased in both capital city and regional areas. Like MDMA, the ACIC judges that this is not a result of a decrease in demand for the drug but is more likely to be related to supply issues; in this case a series of large detections of cocaine by law enforcement agencies over the past year. With the exception of heroin, changes in consumption in both capital city and regional sites mirrored each other at the national level during the reporting period, which is unique in our experience over the life of the Program. This included record low MDMA, MDA, oxycodone and fentanyl consumption reported in both capital city and regional sites in April 2022. National heroin consumption changed little within the reporting period and remains within historical ranges.

For 3 of the past 4 years, cannabis consumption has peaked in August in regional areas before decreasing. This trend has the appearance of being cyclical, which is perhaps surprising for the cannabis market. It will be interesting to observe if the trend continues in the next report.

BROADER APPLICATIONS FOR WASTEWATER ANALYSIS

Wastewater data are an important part of the suite of datasets available to increase our understanding of drug consumption, demand and supply in Australia. Making data from the Program publicly available assists understanding and informs the national conversation on drug trends and related demand. This 17th report of the Program builds on national drug consumption data contained in the preceding reports to identify temporal trends in drug use 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, continue to build and shape understanding on trends and changes in patterns of use, creating an increasingly detailed picture of drug consumption in Australia.

The ACIC's wastewater work extends far beyond the Program. We are exploiting new technology developed by our university partners to take sampling to an ever increasing variety of sites that are not confined to wastewater treatment plants. There is also innovation in the range of chemicals that can be reliably detected and quantified in wastewater and these advances have application for law enforcement, health and broader community harm reduction purposes. It is also worth noting that wastewater analysis now routinely extends to a far broader range of drugs than are reported in the Program and the ACIC is devoting a portion of its time and focus to these substances, again for law enforcement and broader harm reduction purposes. This is important in the context of drug consumption patterns in Australia which feature poly-drug use and supply.

Whatever the future trajectory of drug consumption, a multi-dimensional approach that targets supply, demand and harm reduction is critical to reducing 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 availability data—provide insight into drug markets, including their resilience and points of vulnerability, and the potential for coordinated supply, demand and harm reduction strategies to reduce harm to the Australian community.

RESEARCH FINDINGS

Prepared by The University of Queensland (B Tscharke, J O'Brien, R Bade, P Prasad, D Barry, G Elisei, T Reeks, K Thomas, J Mueller) and University of South Australia (M Ghetia, E Jaunay, S Paxton, K Paxton, B Simpson, J White, C Gerber)

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
LOQ	Limit of quantification
MDA	3,4-methylenedioxyamphetamine
MDMA	3,4-methylenedioxymethylamphetamine
NSW	New South Wales
NT	Northern Territory
NWDMP	National Wastewater Drug Monitoring Program
Qld	Queensland
SA	South Australia
SPE	Solid phase extraction
Tas	Tasmania
THC	Tetrahydrocannabinol
THC-COOH	11-nor-9-carboxy-tetrahydrocannabinol
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.

THC and THC-COOH: Tetrahydrocannabinol is the main psychoactive compound in cannabis and is referred to as THC throughout this report. Cannabis consumption levels have been calculated from the THC metabolite, 11-nor-9-carboxy-tetrahydrocannabinol (THC-COOH).

1: EXECUTIVE SUMMARY

The Australian Criminal Intelligence Commission (ACIC)'s National Wastewater Drug Monitoring Program (NWDMP) has reported on selected substances of concern in most populated regions of Australia since August 2016. The current version of the NWDMP focuses on 12 licit and illicit drugs: nicotine, alcohol, methylamphetamine, amphetamine, cocaine, MDMA, MDA, oxycodone, fentanyl, heroin, cannabis and ketamine. Estimates of drug consumption in a population are determined from measured concentrations of drug metabolites (excreted into the sewer system after consumption) in wastewater samples and results are used to monitor trends in drug consumption over the life of the NWDMP. Wastewater treatment plants (WWTPs) located across capital cities and regional Australia, covering all states and territories, have been invited to participate in the NWDMP. Each site has been allocated a unique code which is assigned to each WWTP throughout the course of the NWDMP. Site names are not included in this report to maintain treatment plant confidentiality.

For Report 17, wastewater samples were collected for up to 7 consecutive days during weeks in April and June 2022. The April collection involved regional and capital city sites, while June was confined to capital city sites. A total of 57 sites participated in the NWDMP for the April 2022 period, consisting of 20 capital city WWTPs and a further 37 regional WWTPs, covering a population of 14.1 million Australians. Data from this report equates to coverage of approximately 56 per cent of Australia's population for April and 48 per cent for June 2022. From this report the population estimates of the WWTP catchment areas have been revised based on the latest Australian Bureau of Statistics 2021 Census population estimates that were released in June 2022 (see Appendix 4 for the change in population estimate at each site). This is important to note as consumption estimates in this report are expressed as the amount of drug consumed per 1,000 people.

A total of 523 new samples have been added to the 8,014 already reported previously, bringing the total number since the beginning of the Program to 8,537. The collected samples provide comprehensive, Australia-wide baseline data against which subsequent results can be compared to ascertain both spatial and temporal trends. Results from the April 2022 sampling were compared with historical data included in previous reports. The April 2022 dataset was used for the spatial comparison as it is more comprehensive, including both capital city and regional sites. The temporal comparison includes the latest capital city collection data for June 2022.

After normalising the amount of drug measured in wastewater for population size and average dose consumed, alcohol and nicotine remained the highest consumed drugs in all states and territories in April 2022. Cannabis was not included in the comparison but will be once better estimates of a typical dose are available. The average consumption of nicotine was substantially higher in regional areas in April 2022 compared to capital cities. Consumption was quite variable between sites. On a jurisdiction level, the Northern Territory had the highest average consumption in April 2022 and in general over the life of the Program. On a national scale, nicotine consumption has been declining in regional areas since mid-2020, while in capital cities consumption has been relatively steady with small fluctuations.

Alcohol consumption in regional areas was higher than that in the capital cities in April 2022 at approximately 1,200 and 1,050 standard drinks per day per 1,000 people, respectively. On a state or territory level, the Northern Territory had the highest overall consumption of alcohol. The Northern Territory has had some variations in alcohol consumption following the implementation of a minimum unit price on alcohol content from October 2018 (O'Brien 2021). Consumption appears to have increased towards pre-intervention levels. Nationally, alcohol consumption has been relatively steady since the start of the Program, averaging out short-term fluctuations.

Methylamphetamine consumption was similar between the capital cities and regional Australia with the latter being slightly higher. Nevertheless, several regional sites across the country recorded well above average consumption levels in April 2022. At the state and territory level, in April 2022 methylamphetamine consumption was highest at a single regional site in New South Wales. Consumption trends have been varied in many parts of the country over the past two years with no clear direction. If anything, the methylamphetamine landscape has been characterised by deep troughs and temporary spikes. Since August 2021 there has been a general increase in methylamphetamine consumption in most jurisdictions. When considered on a national level, it is apparent that a clear shift occurred in April 2020, when COVID restrictions were introduced nationally. Up to that point, a general upward trend in methylamphetamine consumption was apparent, staring in mid-2017. This was particularly evident in regional Australia. After April 2020, capital city and regional consumption declined and became very similar. Some fluctuation within a relatively narrow band has become the norm, with peaks in early 2021 and 2022.

Cocaine consumption in Australia in April 2022 was higher on average in the capital cities compared to regional parts of the country at approximately 2.5 and 4 doses per day per 1,000 people, respectively. Highest levels were found in New South Wales, although cocaine consumption in the state has almost halved since late 2020. National cocaine consumption has been decreasing since that period in both capital city and regional areas.

MDMA consumption remains relatively low compared to methylamphetamine and cocaine, with capital city and regional averages almost identical in April 2022 and less than half a dose per day per 1,000 people. The temporal trend in MDMA consumption has been a decline across almost all jurisdictions and historically low levels have been reached nationally and in multiple parts of the country. The long-term decline appears to have accelerated from mid-2020 for many jurisdictions. MDA, being a stimulant in its own right as well as a metabolite of MDMA, was excreted at relatively low levels, with no evident consistent spatial patterns. MDA excretion has also been declining similar to MDMA, with no measurable amounts at some sites.

Oxycodone and fentanyl are prescription pharmaceutical opioids with abuse potential. Both oxycodone and fentanyl consumption were considerably higher in regional parts of the country in April 2022. In the case of oxycodone, the difference was almost double. On a national level, consumption of both oxycodone and fentanyl is at record low levels and the gap between regional and capital city consumption of fentanyl has diminished over the past 3 years

Heroin consumption in April 2022 in the capital cities was on average double that in regional Australia, although a few regional sites in New South Wales (and regional New South Wales generally) had well above overall national average consumption. Capital city Victoria had the highest heroin consumption nationally. The trends in heroin consumption are quite variable and generally do not appear to follow common patterns between jurisdictions. The Australian Capital Territory has shown considerable, but variable increases in consumption over the past 12 months.

Regional cannabis consumption was on average much higher than in the capital cities. Sites in several parts of the country all had well above average consumption in April 2022, particularly for some regional sites in New South Wales and South Australia. Nationally, the previous increasing trend in cannabis consumption in many jurisdictions over the last year seems to have reversed in the last 2 reporting periods. On a national level, regional and capital city consumption has shown a decline after the historical high levels in August 2021.

Ketamine is a pharmaceutical compound of growing concern due to its abuse potential. Capital city excretion levels were higher than the regional averages in April 2022. Sites with the highest excretion levels were located in New South Wales, Tasmania and Western Australia . Excreted amounts are relatively low and variable in most jurisdictions, but the capital city of the Northern Territory has large fluctuations between collection periods.

2: INTRODUCTION

2.1 PREAMBLE

Wastewater analysis is a technique for monitoring the population-scale consumption of substances. The University of Queensland and University of South Australia were commissioned to provide drug consumption data to the ACIC for an initial 3-year program from 2016 to 2019, including 9 public reports. The universities have been re-commissioned to provide data for a further 4 years, including 12 public reports. Wastewater treatment sites have been assessed, bimonthly in the case of capital city sites and every 4 months for regional sites. The aim has been 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 build on the baseline data of substance use across Australia to establish trends. The report presents patterns of substance use across Australia, showing differences in levels between capital cities and regional centres, within and between states and territories, and nationally.

Compounds of concern include nicotine from nicotine intake (cigarettes, gum, patches, e-cigarettes, etc.), ethanol from alcohol consumption, pharmaceutical substances with abuse potential such as oxycodone, fentanyl and ketamine, as well as illicit substances including methylamphetamine, MDMA, cocaine, cannabis and heroin.

Some drugs share a common clearance pathway from the body. Methylamphetamine is partially metabolised and excreted as amphetamine, while part of a MDMA dose is converted to MDA. The pharmacokinetics of these 4 compounds have been documented and have been accounted for in this report (Pizarro et al. 2002; Khan & Nicell 2011). MDA is a drug in its own right and a metabolite of MDMA. Since the proportion of MDA eliminated after MDMA consumption is known, the proportion of MDA attributable to MDMA metabolism was subtracted from the total measured amount of MDA for each site and expressed as mg excreted per 1,000 people per day (daily mass load). Due to the lack of information concerning MDA elimination following MDA ingestion, consumption estimates cannot be calculated.

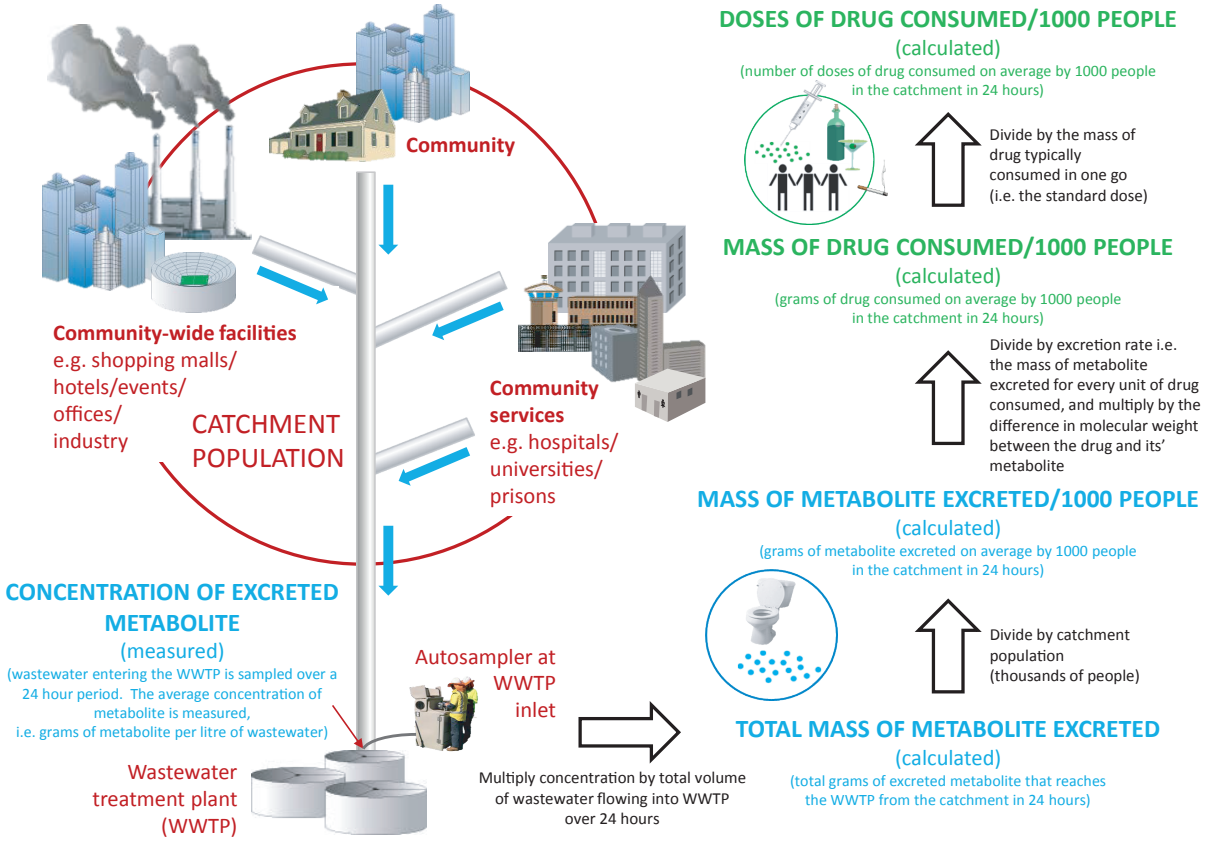
Cannabis results are expressed as amount consumed per day per 1,000 people, while MDA and ketamine results are reported as the amount (mg) of drug excreted per day per 1,000 people due to the absence of clear information available in the scientific literature around suitable factors to estimate consumption of the substances in wastewater.

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. This may be either in the chemical form it was consumed and/or in a chemically modified form that is referred to as a metabolite. Once the excreted compound or metabolite is flushed, it will enter the sewer system, assuming the toilet forms part of a wastewater catchment.

The drugs and their metabolites of interest were included in the first NWDMP report (available at www.acic.gov.au), as well as an in-depth description of the methodologies involved.[3] 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 a 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 3). The method is non-invasive and is done on a population-scale level, so individuals are not targeted, and privacy is respected.

Figure 3: 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.



3 Information in relation to heroin appears in Report 3.

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 aid 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. Apart from a few sites in regional Western Australia, operators have been collecting a second daily influent sample with sodium metabisulphite (0.5% m/v) as preservative from August 2018 to allow for the detection of the cannabis metabolite.

Collected wastewater samples were analysed at the University of South Australia and The University of Queensland laboratories. The steps routinely performed in these 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 table including THC-COOH and dose can be found in Appendix 1. Methods to extract and analyse the cannabis metabolite are outlined in Tscharke et al. (2016). Concentrations of drug metabolites were determined in the wastewater using liquid chromatography-tandem mass spectrometric (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.

3.1 PARTICIPATING WASTEWATER TREATMENT PLANTS (WWTPs)

Fifty-seven WWTPs across Australia participated in the NWDMP for the April 2022 collection period (Figure 4). Of these, 20 sites were located in capital cities and a further 37 in regional areas, covering a wide range of catchment population sizes. Sites were selected in consultation with the ACIC. The number of participating sites for this report and a complete list of participating sites, number of samples and relative catchment sizes are listed in Table 1 and Appendix 2. To maintain the confidentiality of the participating sites, all sites were allocated a unique code to de-identify their results for the course of the Program. Only site codes are presented in the results. From Report 17, the population estimates of each WWTP have been revised using Census 2021 data and the methodology has been refined (see Appendix 4 for the changes in population from 2016 Census estimates).

Figure 4: Participating WWTPs in April 2022 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.

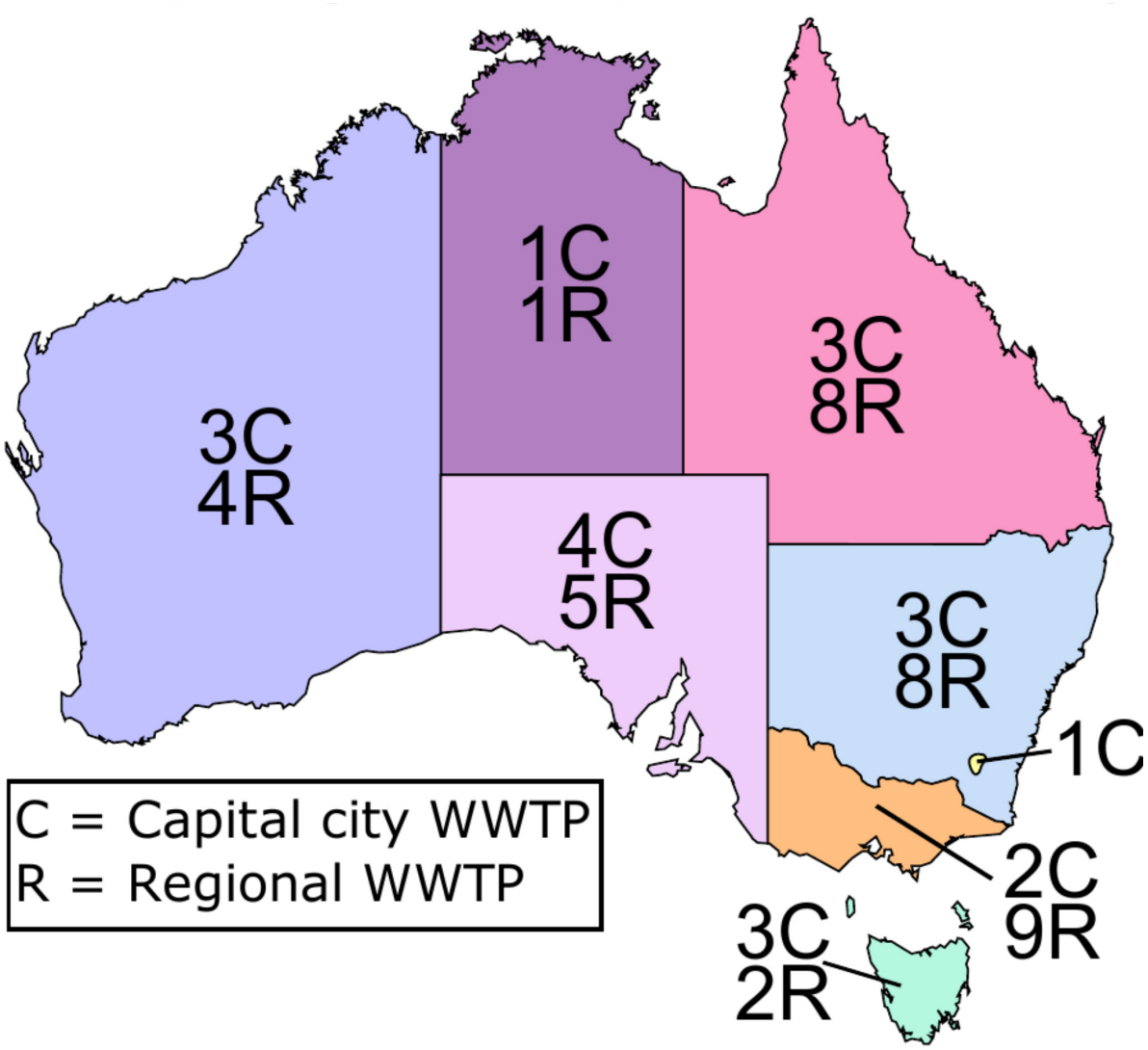


Table 1: Number of participating WWTPs for the periods covered in this report. One collection period aims to collect data from both capital city (C) and regional (R) sites, while the other collection period aims to collect data from capital city sites only.

State or territory	Apr 2022 Capital	Apr 2022 Regional	June 2022 Capital
ACT	1	0	1
NSW	3	8	3
NT	1	1	1
Qld	3	8	3
SA	4	5	4
Tas	3	2	3
Vic	2	9	2
WA	3	4	3
Sites	**20**	**37**	**20**
Population (millions) C & R	**12.1**	**2**	**12.1**
% of Australian population	**47.6**	**7.9**	**47.6**
Total population (millions)		**14.1**	**12.1**
% of Australian population		**55.5**	**47.6**

Estimates have been rounded to the nearest 0.1 million. Census 2021 population used (25,422,788) for population percentage estimates.

3.2 SAMPLE COLLECTION AND PREPARATION

Daily composite samples were collected by treatment plant staff on 7 consecutive days, or where 7 days was not feasible, across as many consecutive days as possible. For example, weekend samples in many of the Tasmanian sites were not available. Small revisions may be made to historical data when more accurate data become available, for example, when updated flow measurements supplied by wastewater treatment authorities or population estimates become available, such as the recently released Census 2021 figures. Samples were stored at 4°C or were frozen prior to transport to South Australia or Queensland. 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), Tscharke et al. (2016) and Bade et al. (2019). All other descriptions of calculations, extractions and analytical methods are outlined in Report 1 (available at www.acic.gov.au). Methods to detect and analyse THC-COOH are outlined in Tscharke et al. (2016).

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 the estimated total population.

Graphical presentation of data: An overview of how the data is presented in the graphs for the individual sites is given in Figure 5. 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 this drug can only be expressed as how much drug was excreted into the sewer network, e.g., the mg excreted per 1,000 people per day. This is also similar for ketamine. For cannabis, the approximate dosage is not well defined and results are expressed as mg consumed per 1,000 people per day.

Bubble charts are included to represent the relative extent of consumption in capital city and regional areas for each jurisdiction. See Figure 6 for a description of how to interpret the bubble charts.

Instrumental method limits of detection and limits of quantification: 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 quantification (LOQ)[4] 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 LOQ 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 practice, for back calculations to estimate per capita consumption, a concentration below the LOD was included as a value of LOD/√2. A concentration above the LOD but below LOQ, is included at the midpoint between the LOD and LOQ (i.e. (LOD + LOQ)/2). The frequency of detection of each analyte of interest is included in Appendix 3.

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. This is because the starting day of the collection week did not always correspond for every plant. We present the maximum, minimum and average (for individual sites as illustrated in Figure 5) and only population-weighted average values for all other graphs. Consistent patterns of drug use in Australia from previous wastewater-based epidemiology studies indicate that some substances such as cocaine, MDMA and alcohol have high variation in weekly consumption rates, with higher consumption on weekends. Other drugs such as methylamphetamine, oxycodone and fentanyl tend to have lower daily variation suggesting that their consumption is consistent throughout the week (Lai et al. 2015, Tscharke et al. 2016).

4 LOQ is the lowest level that can be accurately measured.

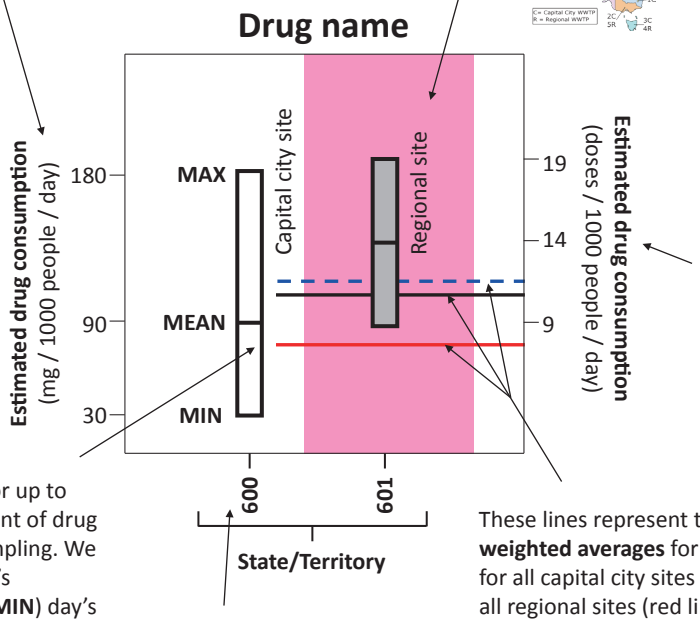
Figure 5: Explanation of the graphical representation of data for individual sites and bubble maps. General concepts relevant to all graphs in the report are also outlined (unique site codes, explanation of vertical axes, colour coding).

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).

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 of Report 4. 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.

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



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

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).

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

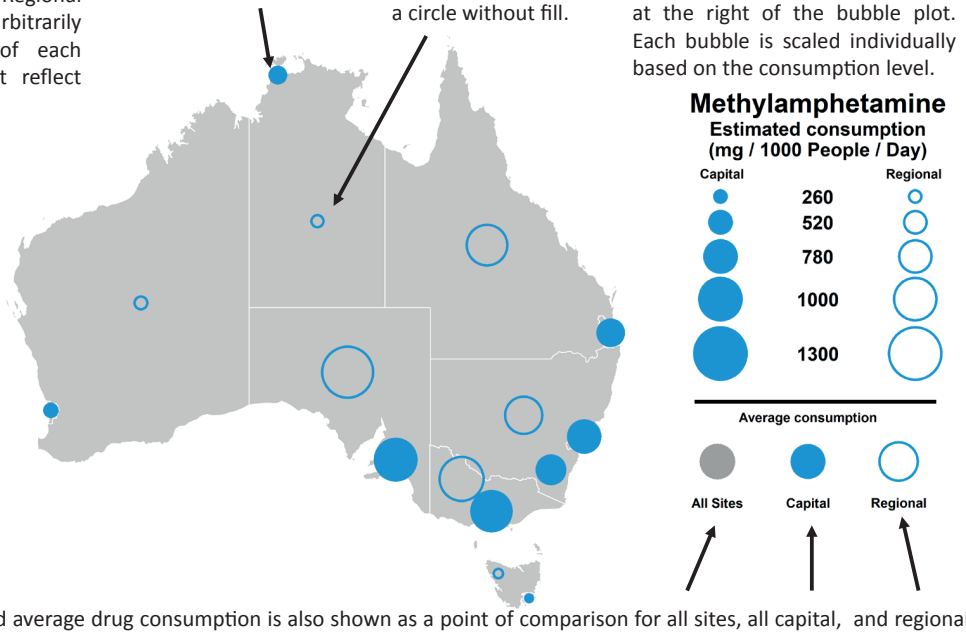
Bubbles:
Capital city site averages are drawn over the capital city of a jurisdiction and the regional site averages are drawn in the middle of the State or Territory. Regional bubbles are drawn arbitrarily close to the centre of each jurisdiction and do not reflect location of sites.

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 over time, and should be used for analysis.

Capital city average:
Population-weighted average of all capital sites tested per jurisdiction. Capital sites are indicated by a filled circle.

Regional city average:
Population-weighted average of all regional sites tested per jurisdiction. Regional sites are indicated by a circle without fill.

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. Each bubble is scaled individually based on the consumption level.



Aggregated data:
The population-weighted average drug consumption is also shown as a point of comparison for all sites, all capital, and regional sites that were tested within the timepoint. This incorporates sites from **all jurisdictions** for the timepoint under investigation. These are also represented with sizes representing the scale of use categories used for the jurisdictional averages.

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 for April 2022 (section 4.1), temporal trends for states and territories for the past two years (section 4.2) and within each state and territory (section 4.3). April 2022 data were used for section 4.1, which compares the individual sites as it included the latest set of results for the full suite of sites included in the Program. We recommend exercising caution when comparing results between sites as some plants provided samples for fewer days than others and the collection week, and the days of the month, may not correspond in all instances. A list of the detection frequency for each drug can be found in Appendix 3. This report updated the population estimates introduced in Report 4 by integrating the specific wastewater catchment areas against the high-resolution population data released from the 2021 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 may be 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 2022

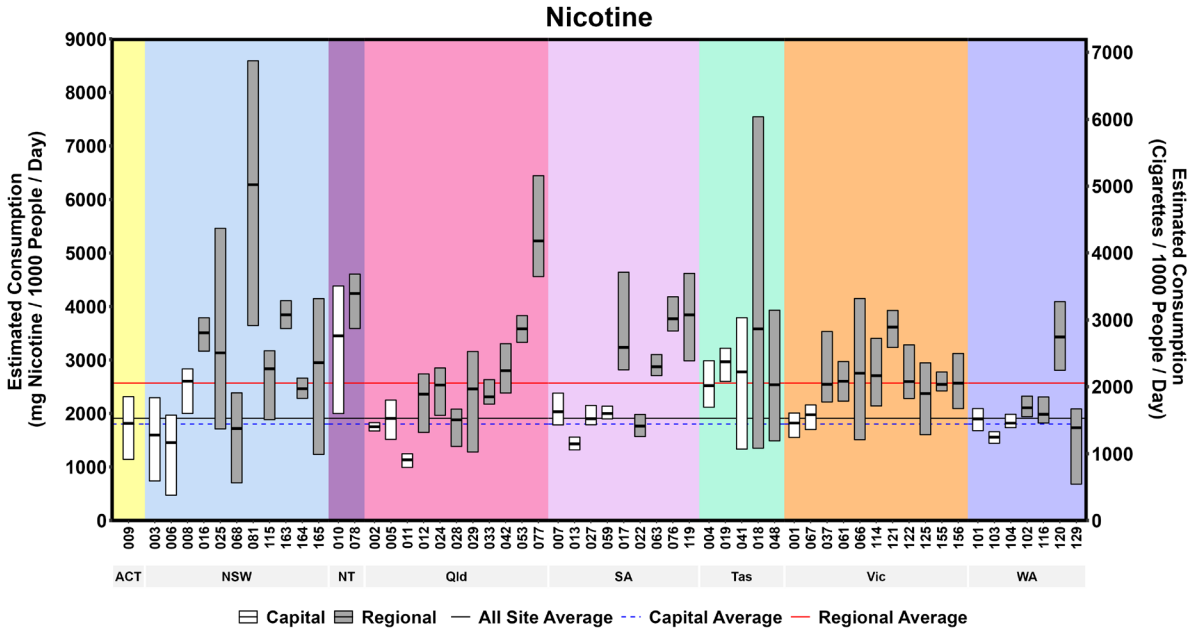
4.1.1 NICOTINE AND ALCOHOL

Nicotine is the main psychoactive substance present in tobacco products. Two nicotine metabolites, cotinine and hydroxycotinine, were used to represent the consumption of tobacco. The estimate is expressed as nicotine in this report as the method cannot distinguish between nicotine intake from tobacco, electronic cigarettes and nicotine replacement therapies such as patches and gums. The April 2022 results show that nicotine consumption varied widely between sites across the country, particularly regional areas (Figure 7). Average consumption in regional Australia was higher than in the capital cities (red horizontal and dotted blue lines, respectively). The Northern Territory and Tasmania generally had the highest capital city nicotine consumption in April 2022. Some regional sites in several states had well above average nicotine consumption, particularly New South Wales and Queensland. Nicotine consumption showed large fluctuations over the sampling week at some sites, indicated by longer bars.

Alcohol consumption was measured using a specific metabolite of ethanol, ethyl sulphate. In April 2022 the average alcohol consumption was higher in regional areas than in capital cities (Figure 8). Parts of New South Wales, the Northern Territory and Tasmania had the highest average capital city alcohol consumption in April 2022, while use in regional Australia was high in several jurisdictions. Sites in Victoria and Western Australia generally had average or below average alcohol consumption compared to the national regional and capital city averages, with Victoria more consistent in consumption between locations.

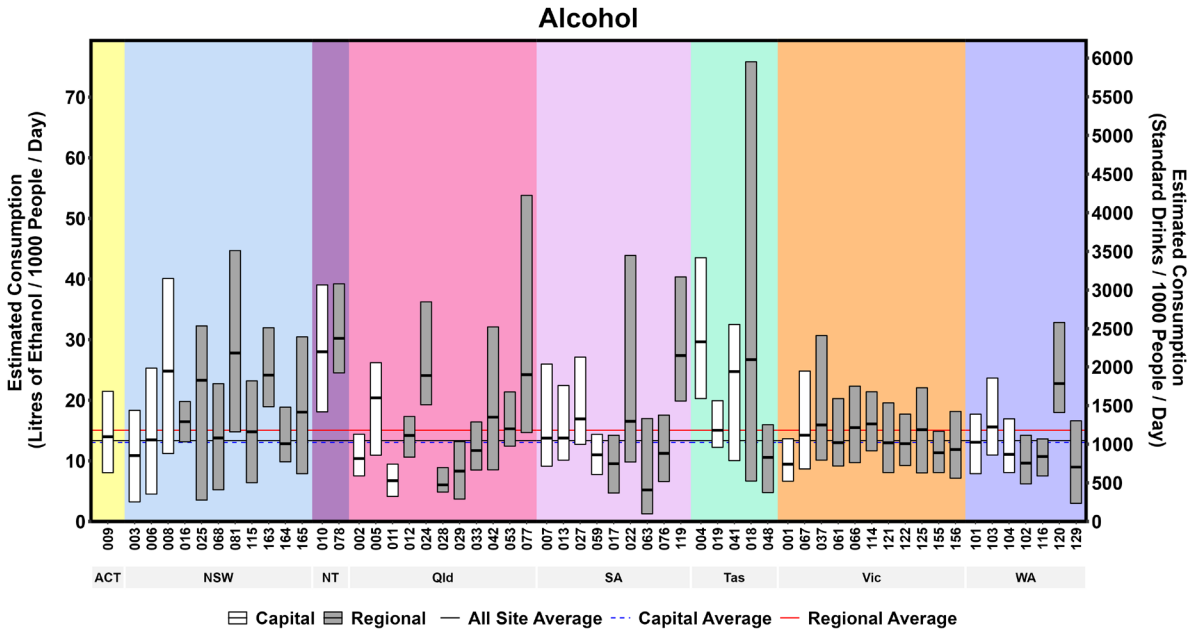
Relative consumption levels can be represented by showing the scale of use of nicotine (Figure 9) and alcohol (Figure 10) as capital city or regional ‘bubbles’ for each state and territory. The above average consumption of nicotine and alcohol in the Northern Territory is evident from the size of the bubbles in that region. These findings need to be understood with the context that there is only one capital city site and one regional site included for this jurisdiction. However, approximately 25 per cent of the Northern Territory’s population is covered by those 2 sites.

Figure 7: Estimated nicotine consumption for April 2022 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.



- Higher regional average
- Variable across Australia

Figure 8: Estimated alcohol consumption for April 2022 in litres consumed per day (left axis) and standard drinks per day (right axis) per thousand people. The number of collection days varied from 5-7.



- Higher regional average
- Victoria more consistent between sites

Figure 9: Estimated average nicotine consumption per jurisdiction for April 2022 in number of cigarettes per day per thousand people The number of collection days varied from 5-7.

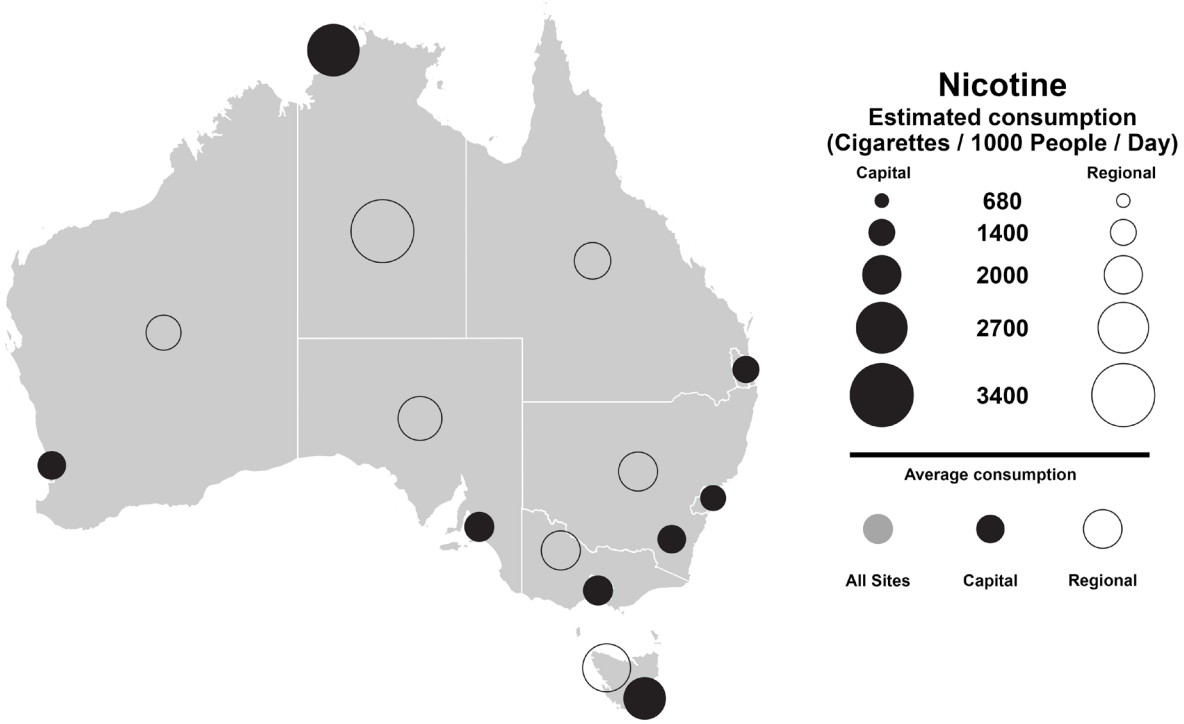
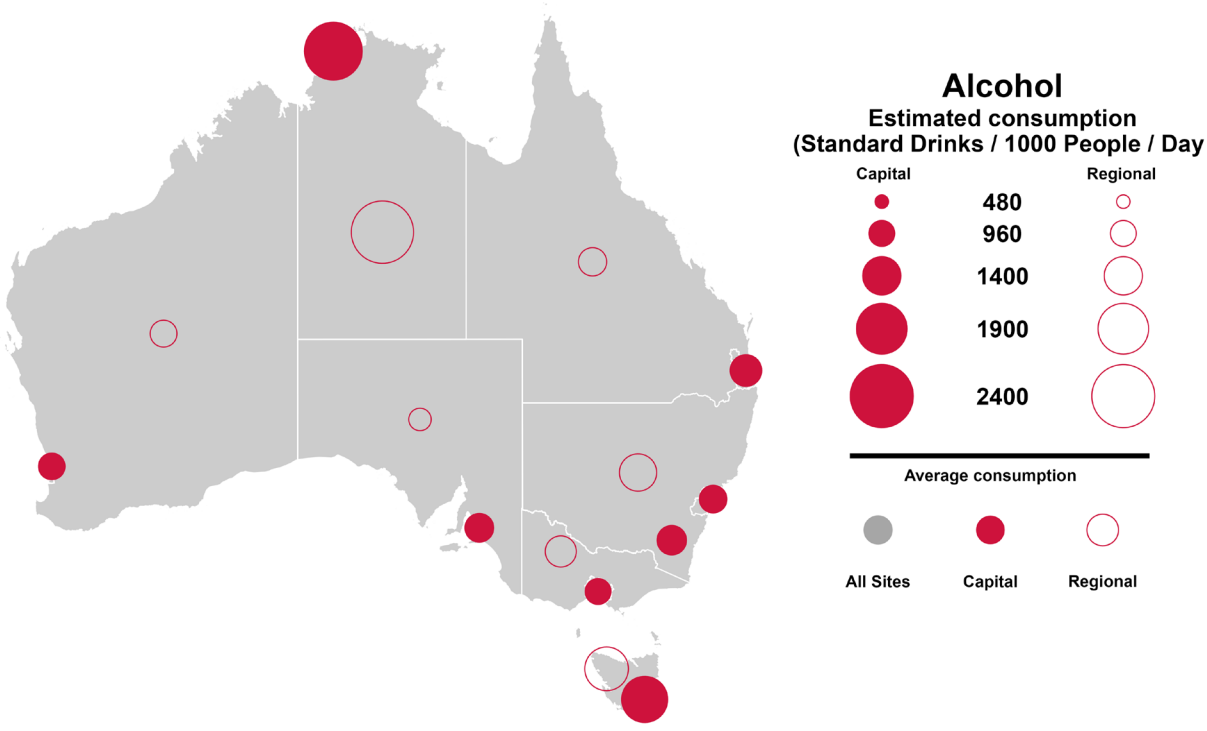


Figure 10: Estimated average alcohol consumption per jurisdiction for April 2022 in number of standard drinks per day per thousand people. The number of collection days varied from 5-7.



4.1.2 STIMULANTS

4.1.2.1METHYLAMPHETAMINE

Methylamphetamine consumption varied considerably across the country (Figure 11). Average consumption levels in regional Australia were similar to the levels in capital cities in April 2022. Three sites in South Australia and a site in Victoria had the highest average capital city consumption levels of the drug in April 2022. While most regional sites in Queensland had above average consumption, a regional site in New South Wales and another in South Australia also recorded well above average consumption levels.

4.1.2.2AMPHETAMINE

The measured concentration of amphetamine in the April 2022 samples mostly fell within a range which is consistent with the reported excretion rates following methylamphetamine consumption (Gracia-Lor et al. 2016). The results were largely in agreement with our previous findings (see Appendix 4 of Report 1). The levels of amphetamine in wastewater samples can be largely attributed to the metabolism of methylamphetamine. However, the drug is also prescribed for some behavioural disorders and the method cannot differentiate between medical and illicit use.

4.1.2.3COCAINE

Benzoylecgonine, the specific metabolite of cocaine, was used to estimate the consumption of the stimulant. Capital city cocaine consumption per capita was almost twice that of regional areas in April 2022 (Figure 12). The all site average number of daily doses per 1,000 people of cocaine in April 2022, was one tenth that of methylamphetamine (around 4 vs 40 doses per day per 1,000 people). Site 8 in New South Wales had the highest overall consumption levels in the nation, while one site in New South Wales, and Queensland had well above average regional consumption. Cocaine consumption was generally low in most other regional parts of Australia.

4.1.2.4MDMA (3,4-METHYLENEDIOXYMETHYLAMPHETAMINE)

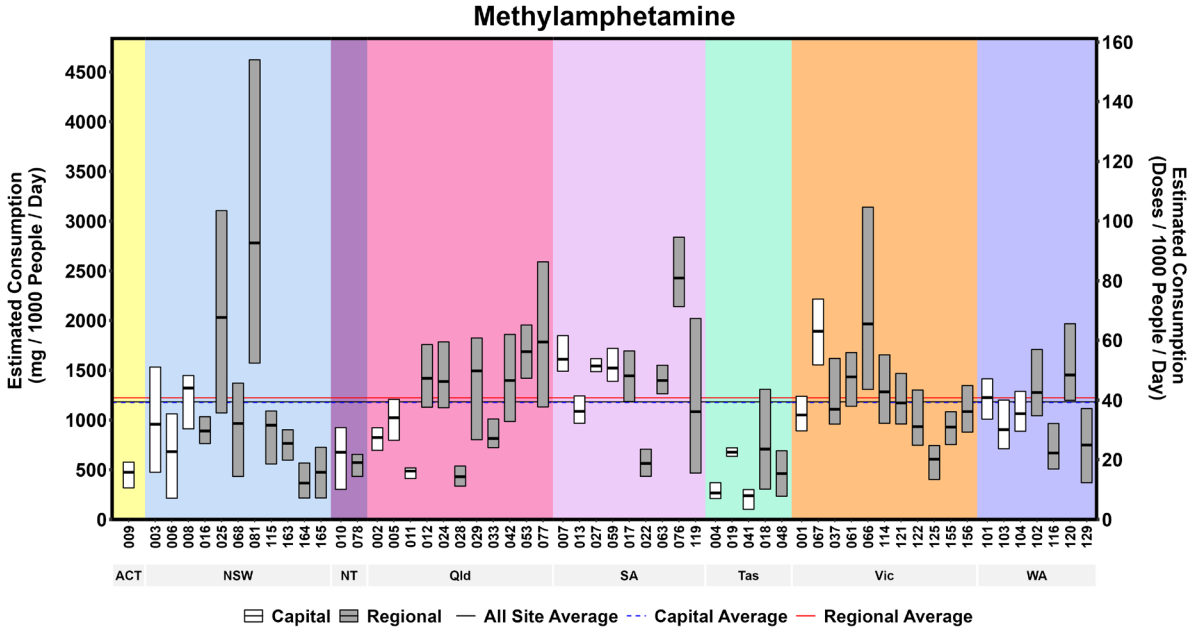
The average consumption of MDMA in April 2022 (around 0.4 doses per day per 1,000 people) was far lower than the previous two stimulants (Figure 13). With a few exceptions, consumption of the drug was relatively consistent across the country. Two sites in New South Wales had very high MDMA consumption levels. The regional average was similar to the capital city average in April 2022.

4.1.2.5MDA (3,4-METHYLENEDIOXYAMPHETAMINE)

MDA excretion levels were mostly low across Australia (Figure 14). The capital city average was slightly lower than the regional average. A few sites gave consumption levels substantially above the rest of the country. These were in New South Wales, Queensland, Victoria and Western Australia.

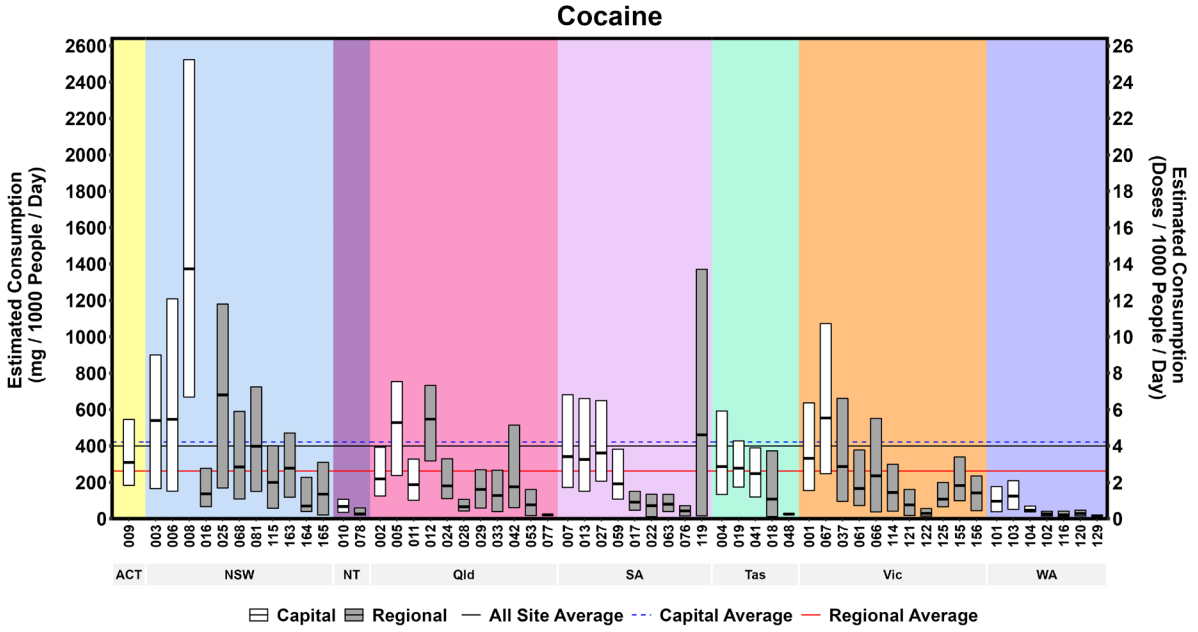
The scale of use of each stimulant is expressed as a bubble graph to compare regional and capital city use of methylamphetamine (Figure 15), cocaine (Figure 16), MDMA (Figure 17) and MDA (Figure 18) across the country. Higher consumption of methylamphetamine in southern parts of the mainland and cocaine on the south-eastern seaboard remains apparent.

Figure 11: Estimated methylamphetamine consumption for April 2022 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.



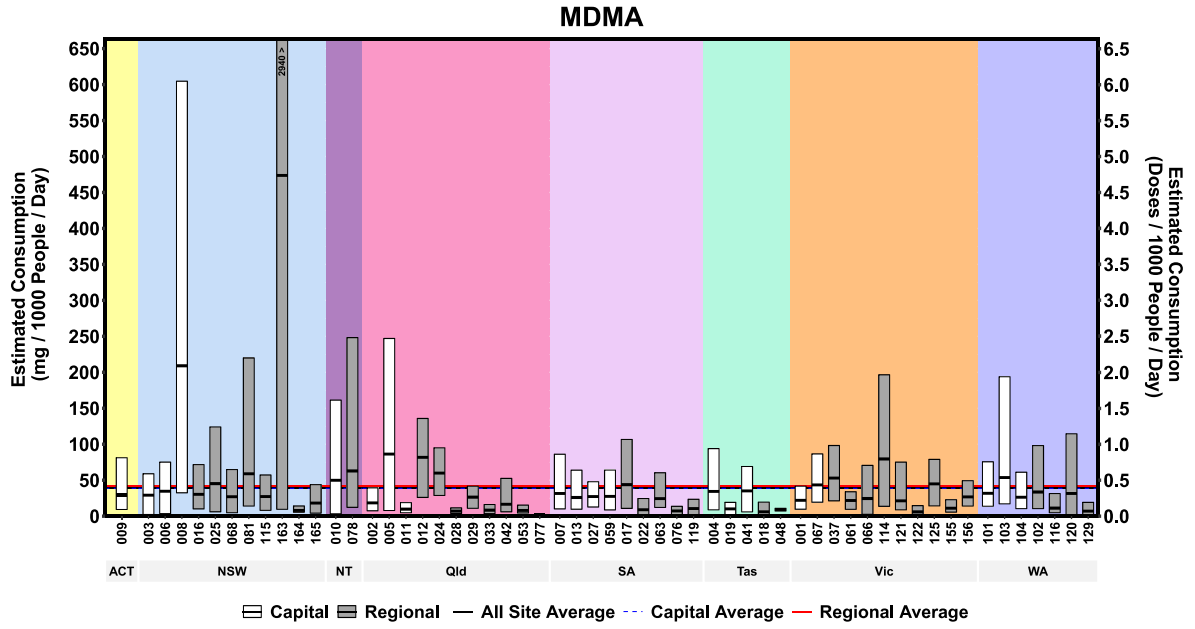
- Similar regional and capital city averages
- High variability in the regions

Figure 12: Estimated cocaine consumption for April 2022 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.



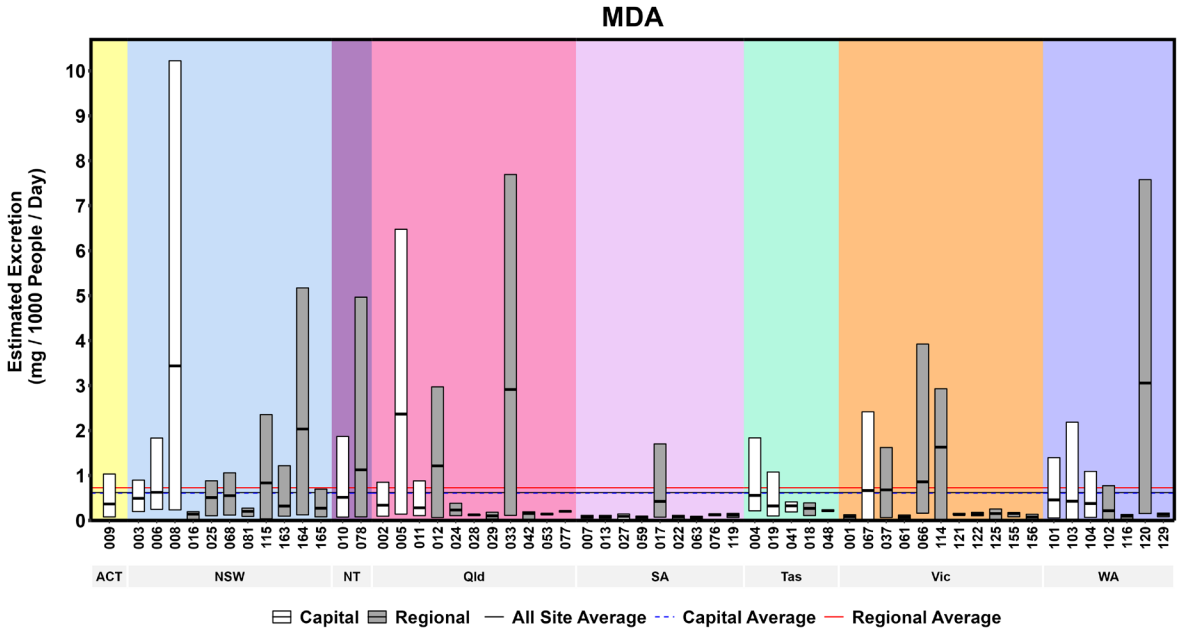
- Higher capital city consumption
- High overall consumption in New South Wales

Figure 13: Estimated MDMA consumption for April 2022 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.



- Mostly low consumption nationally
- High consumption at some sites

Figure 14: Estimated MDA excretion for April 2022 in mass excreted per day per thousand people. The number of collection days varied from 5-7.



- Relatively low consumption
- Slightly higher regional average

Figure 15: Estimated average methylamphetamine consumption per jurisdiction for April 2022 in mg consumed per day per thousand people. The number of collection days varied from 5-7.

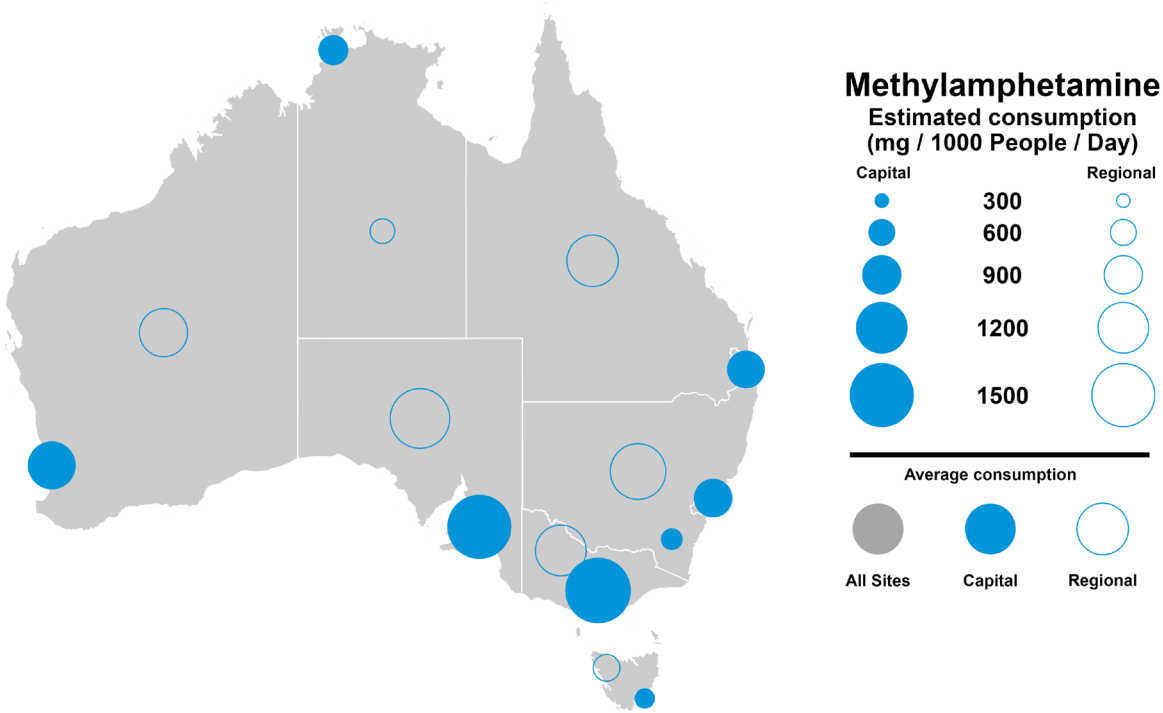


Figure 16: Estimated average cocaine consumption per jurisdiction for April 2022 in mg consumed per day per thousand people. The number of collection days varied from 5-7.

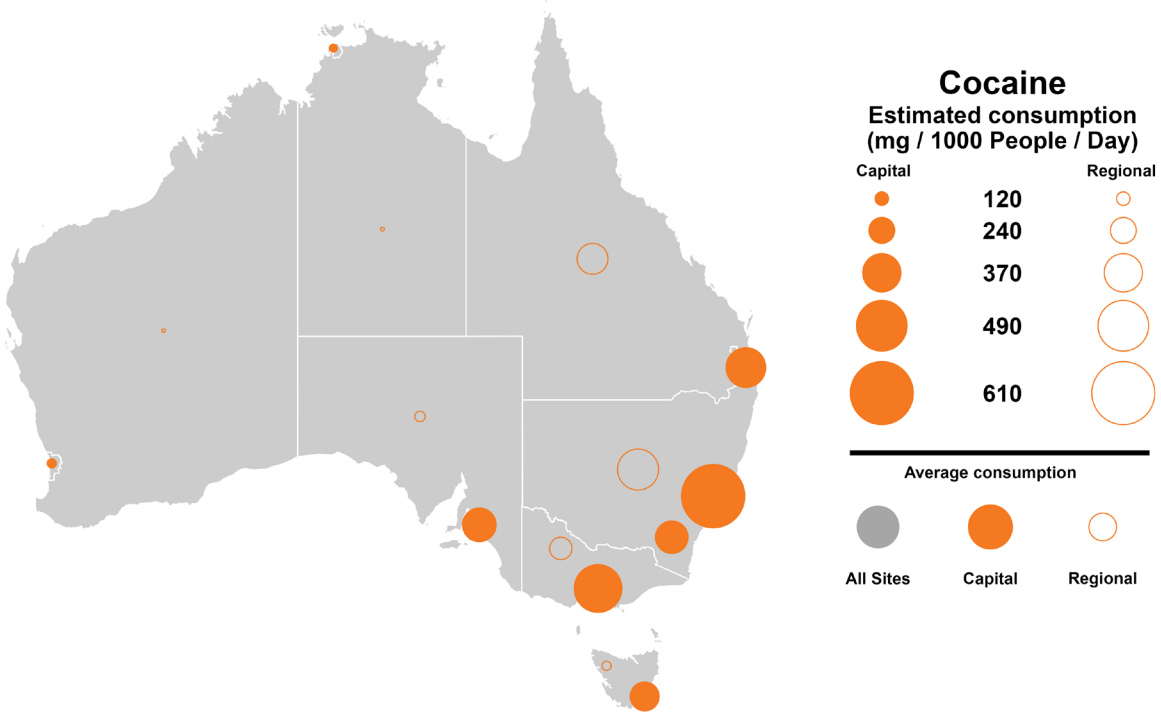


Figure 17: Estimated average MDMA consumption per jurisdiction for April 2022 in mg consumed per day per thousand people. The number of collection days varied from 5-7.

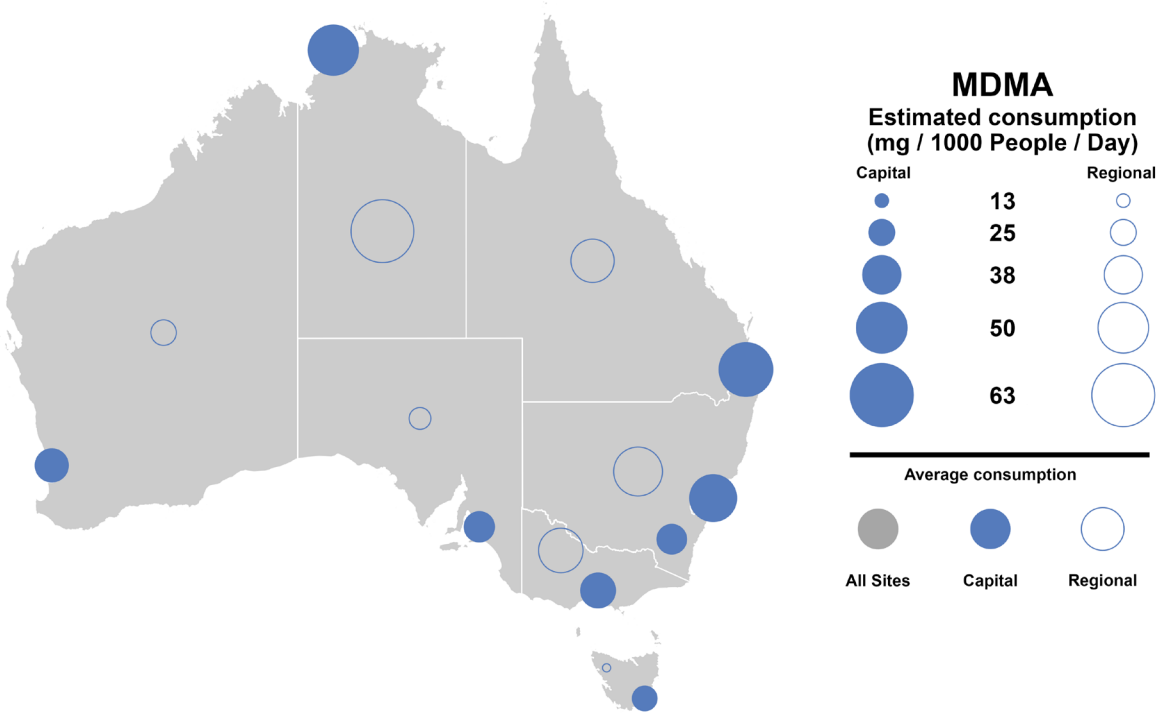
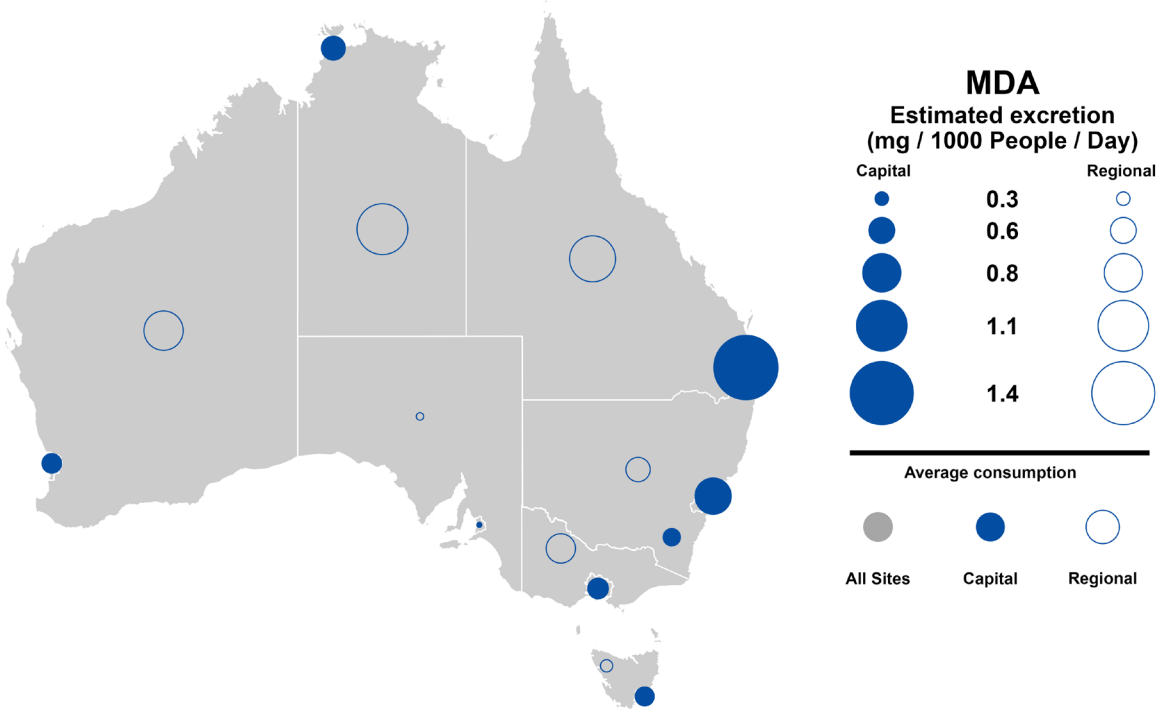


Figure 18: Estimated average MDA excretion per jurisdiction for April 2022 in mg excreted per day per thousand people. The number of collection days varied from 5-7.



4.1.3 OPIOIDS

Two prescription opioids were measured, as well as heroin, an illicit drug. Oxycodone and fentanyl are legally prescribed pharmaceuticals with abuse potential. Although wastewater analysis cannot differentiate between prescribed use and use for non-medical purposes, the relative scale of use of these substances remains of interest as they have the potential for misuse.

4.1.3.1PHARMACEUTICAL OPIOIDS

The metabolism and excretion profiles of oxycodone and fentanyl are well established. The main metabolite of each compound was measured to estimate drug consumption.

Oxycodone consumption across Australia in April 2022 was highly variable. A feature of the national use of oxycodone was the substantially higher average consumption in regional areas, compared with capital cities (Figure 19). Tasmania capital city sites, the Australian Capital Territory and a capital city site in South Australia had well above average oxycodone consumption in April 2022. In contrast, regional sites with relatively high consumption were spread across several states. Western Australia had relatively low overall oxycodone levels compared to the national averages.

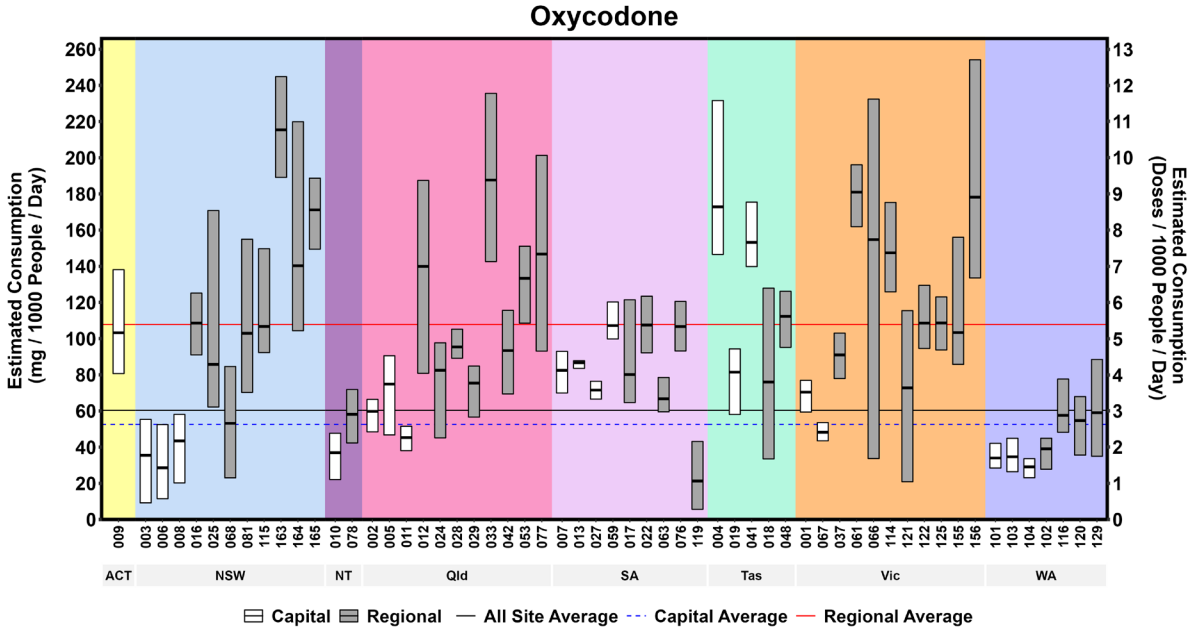
Fentanyl use was also characterised by higher average regional consumption, at almost twice capital city levels (Figure 20). Regional New South Wales included sites with the highest fentanyl consumption in the country.

The relative scale of oxycodone and fentanyl use was apparent when results were aggregated by jurisdiction and capital or regional area and presented in bubble graph form. Generally higher oxycodone consumption rates in regional areas and in capital city Tasmania were apparent (Figure 21). With the exception of Tasmania, average fentanyl consumption was relatively low in most capital cities compared to regional areas (Figure 22).

4.1.3.2HEROIN

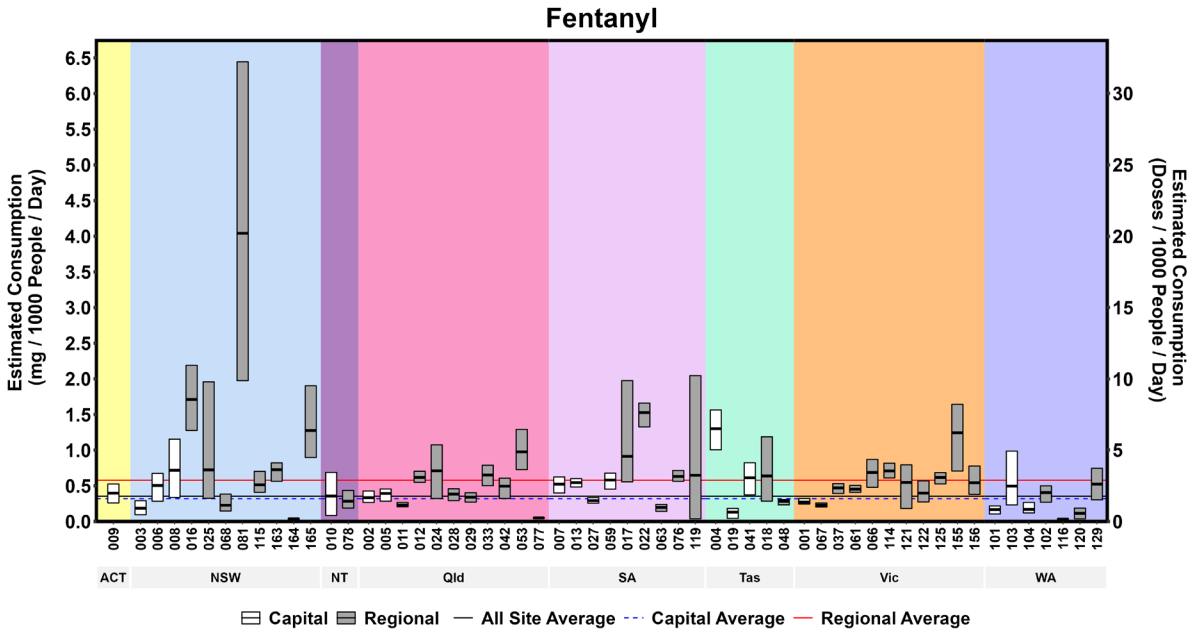
Heroin is metabolised in the body and excreted in low amounts as the unique metabolite, 6-monoacetylmorphine (6-MAM). Since the compound is characteristic of heroin metabolism, it can be used to distinguish heroin from other opioids such as morphine and codeine. Heroin consumption in regional areas was generally much less than in the capital cities, the average being less than half (Figure 23). Capital city sites in New South Wales, Queensland and Victoria had the highest consumption levels in April 2022, well above most other sites. Two regional sites in New South Wales also had high consumption levels. Levels of the drug tended to be low in many other parts of the country, with regional Queensland and South Australia having levels at or below the quantification limits of the method in many places. Only one site in regional Western Australia was able to provide a sample suitable for heroin reporting. The elevated heroin consumption in regional New South Wales and capital city Victoria is clearly evident from the bubble graph (Figure 24).

Figure 19: Estimated oxycodone consumption for April 2022 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 regional average
- Tasmania highest of the capitals

Figure 20: Estimated fentanyl consumption for April 2022 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 regional average
- Highest consumption in regional New South Wales

Figure 21: Estimated average oxycodone consumption per jurisdiction for April 2022 in mg consumed per day per thousand people. The number of collection days varied from 5-7.

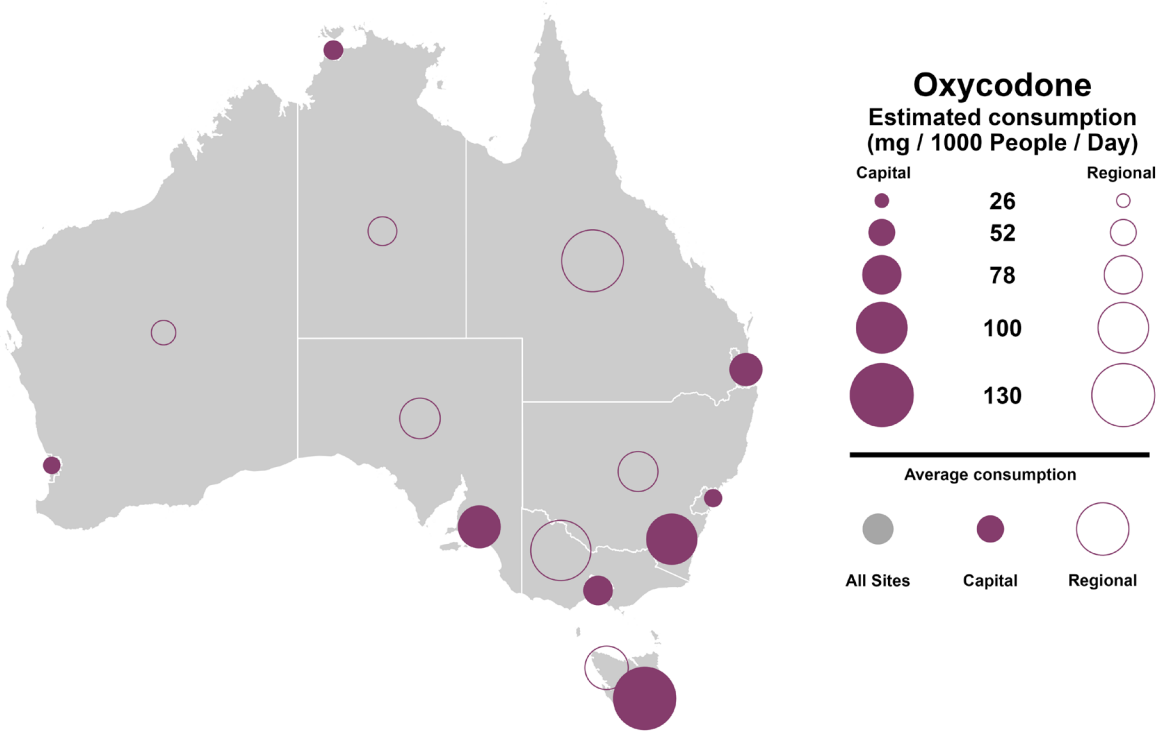


Figure 22: Estimated average fentanyl consumption per jurisdiction for April 2022 in mg consumed per day per thousand people. The number of collection days varied from 5-7.

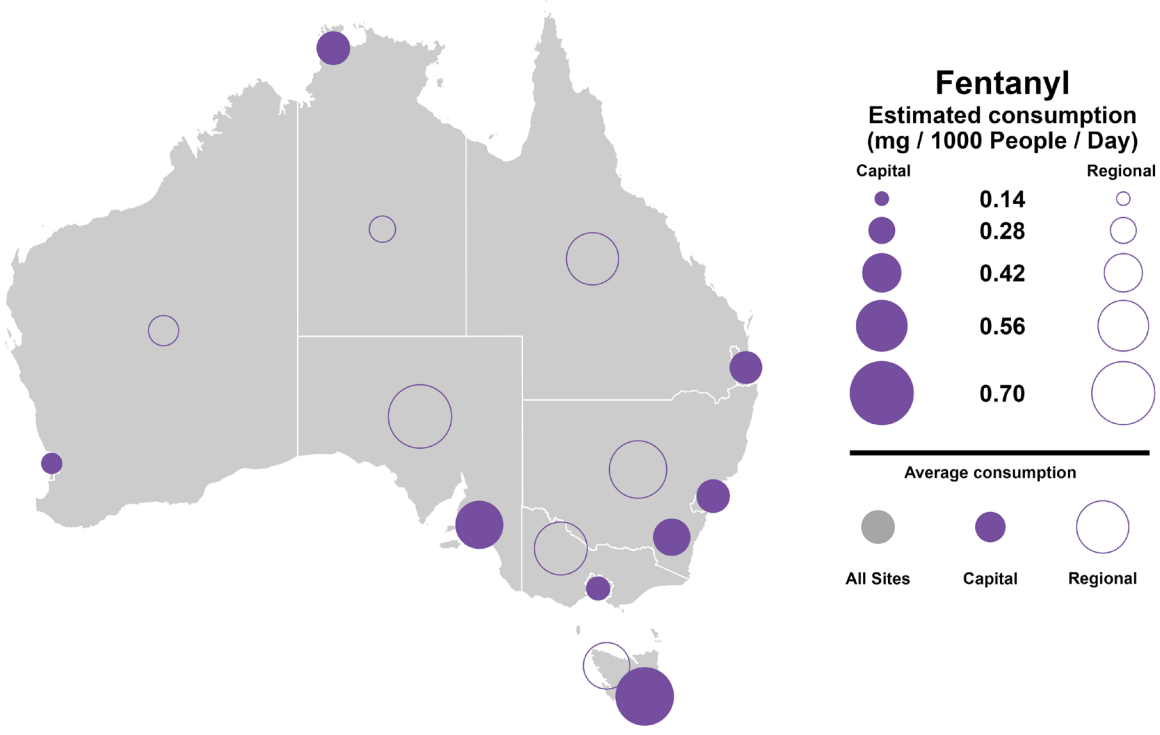
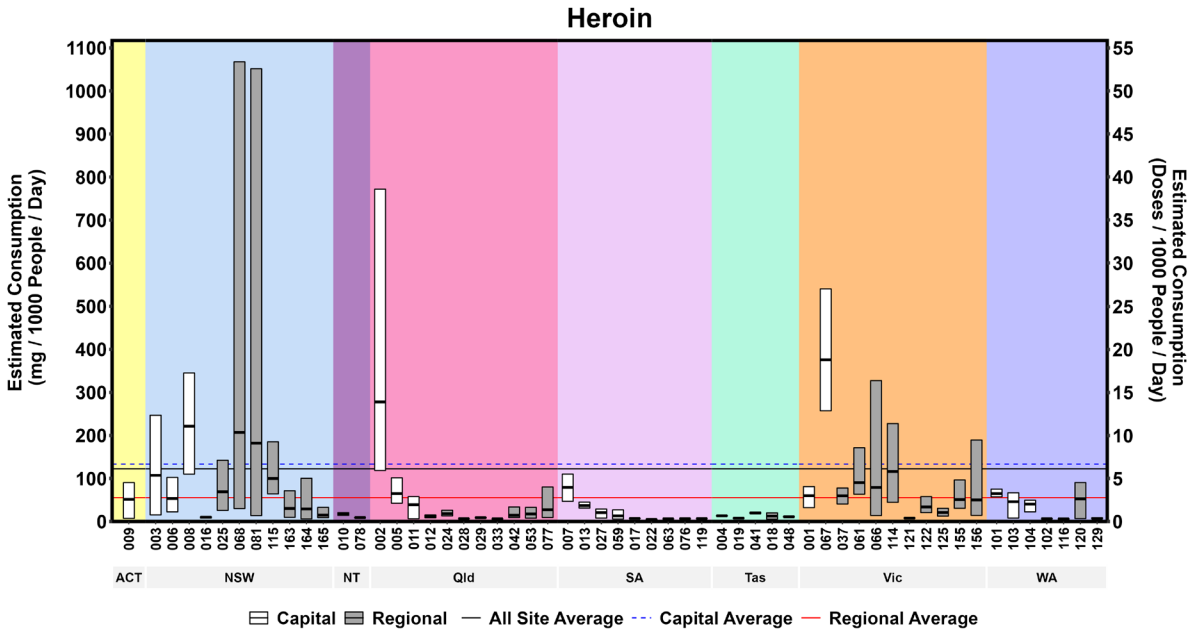
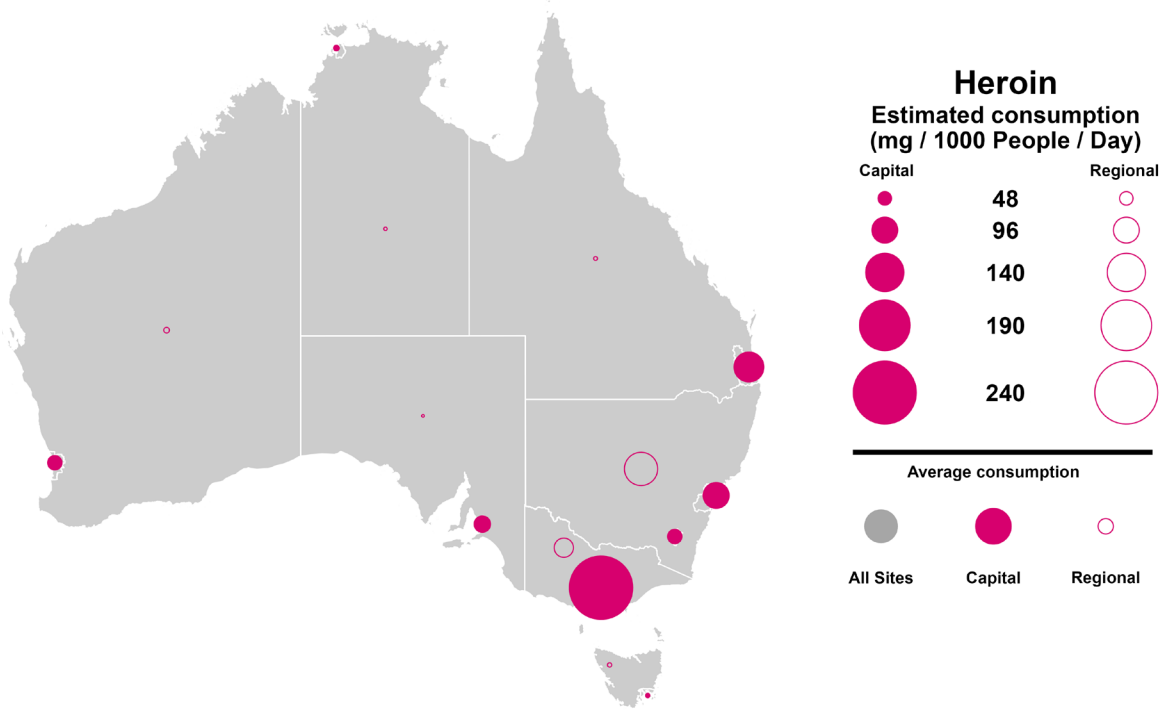


Figure 23: Estimated heroin consumption for April 2022 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5-7.



- Lower regional consumption, often not quantifiable
- Highest consumption generally in the southeast

Figure 24: Estimated average heroin consumption per jurisdiction for April 2022 in mg consumed per day per thousand people. The number of collection days varied from 5-7.



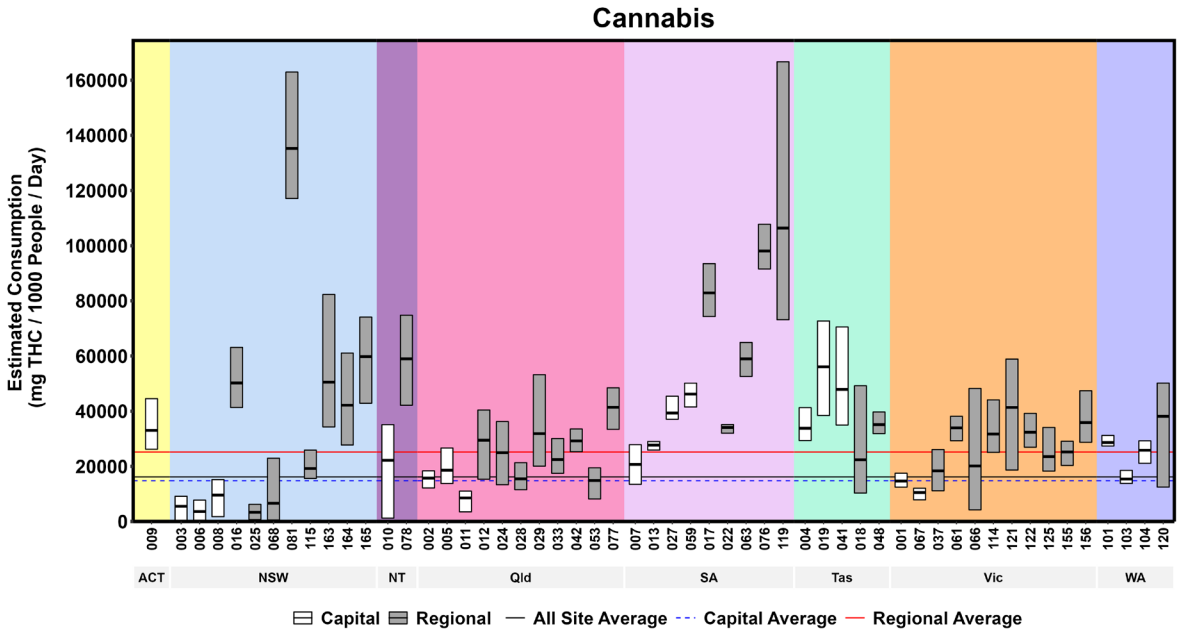
4.1.4 CANNABIS

Tetrahydrocannabinol (THC) is the main psychoactive compound found in cannabis. The compound is metabolised and largely cleared through the intestine. A small proportion (0.6 per cent) is excreted through the kidneys as 11-nor-9-carboxy-tetrahydrocannabinol (THC-COOH). The latter is known to adsorb to various surfaces, including sewer infrastructure. Therefore, in terms of wastewater analysis, the sewer design and collection method may play a part in the reportable levels of the target metabolite used for the purposes of the NWDMP. Upon collection, samples require preservation to avoid degradation of THC-COOH, without using acidification (McCall et al. 2016). This is one reason why cannabis consumption is not reported on a regular basis in other countries where wastewater analysis is routinely conducted, as acidification is a common preservation technique. For the NWDMP, separate samples are collected each day and preserved specifically for THC-COOH analysis, except in some sites in regional Western Australia where this is not possible.

Cannabis consumption is expressed as the daily mass load (mg) of active ingredient (THC) consumed per 1,000 people. An average dose was not defined as for other drugs in the report. The dose of cannabis depends on several factors, such as the part of the plant and the strain that was consumed, or whether an extract was used. This will be included in graphical representations of the data when an appropriate dose becomes available.

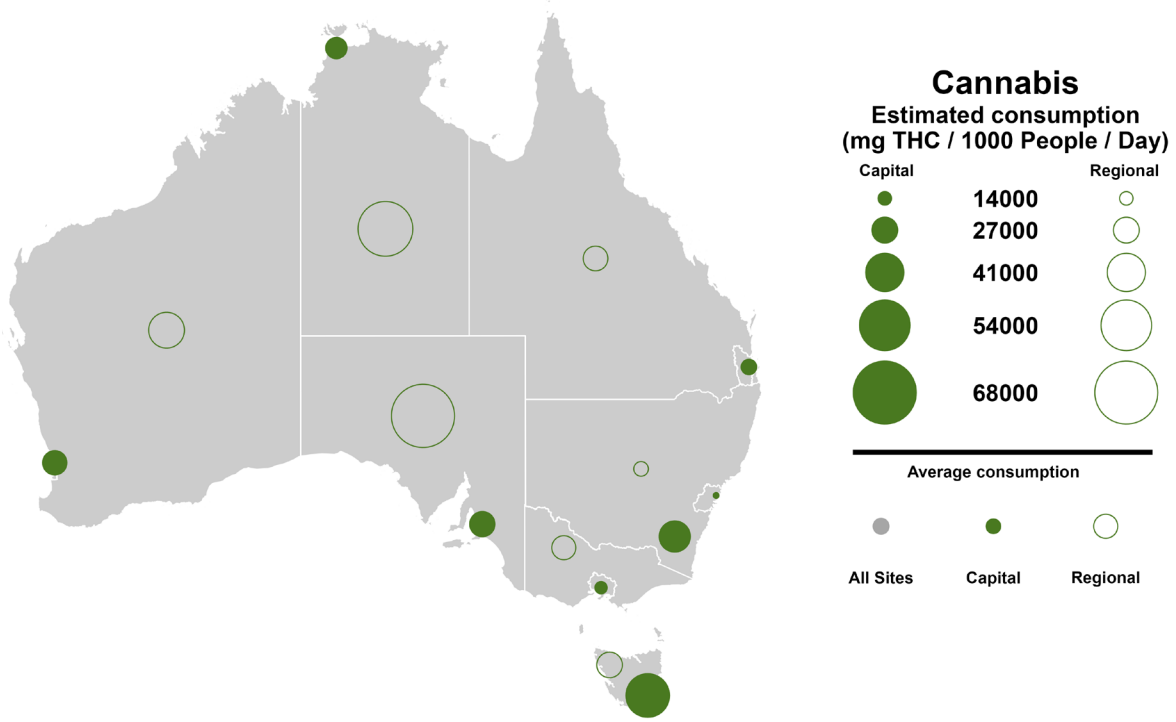
Very large spatial differences were evident across Australia (Figure 25). Average regional consumption in April 2022 exceeded capital city consumption. The highest average values were mostly observed in parts of regional New South Wales, the Northern Territory and South Australia. The Australian Capital Territory, and sites in South Australia and Tasmania had the highest consumption of the capital cities. In contrast, capital city New South Wales had very low cannabis consumption levels. The bubble plot and jurisdictional differences of cannabis use across Australia show the generally higher consumption in regional areas (Figure 26).

Figure 25: Estimated cannabis consumption for April 2022 in mass consumed per day (left axis). The number of collection days varied from 5-7.



- High regional consumption
- Variable consumption across the country

Figure 26: Estimated average cannabis consumption per jurisdiction for April 2022 in mg consumed per day per thousand people. The number of collection days varied from 5-7.

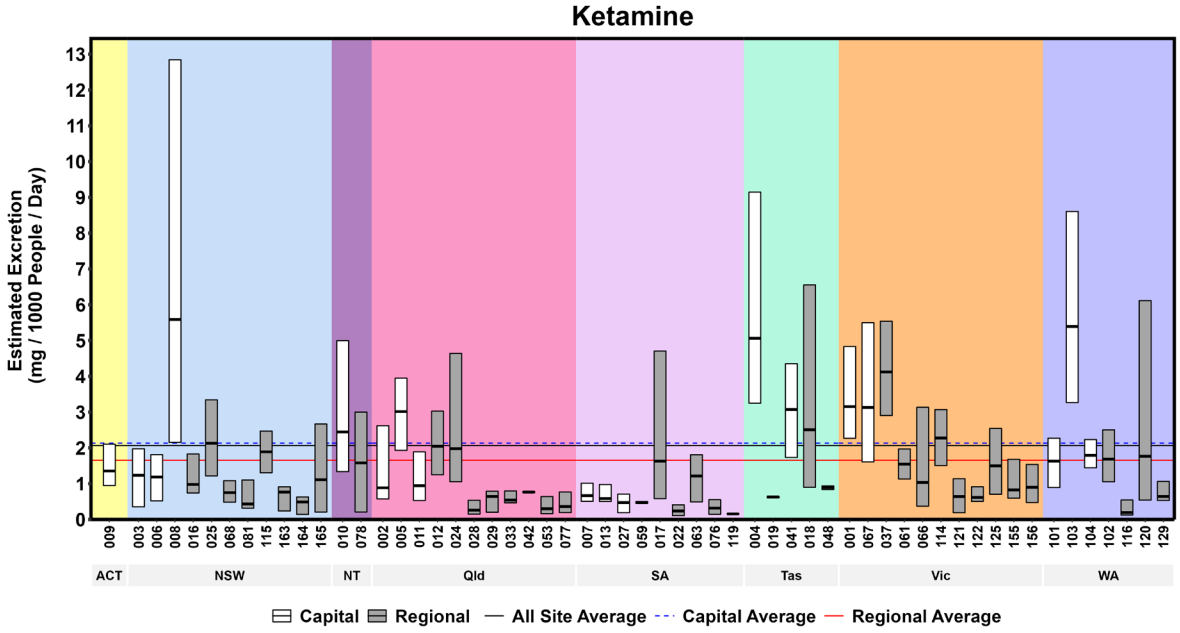


4.1.5 KETAMINE

Ketamine, measured as its metabolite, norketamine, is used medically for the management of acute pain often associated with surgery or trauma. It has veterinary applications as well, although this may have less relevance in terms of wastewater monitoring due to the separation of stormwater and agricultural run-off from the sewer network in most Australian catchments. Due to its sedative and hallucinogenic effects, the drug has been associated with illicit substance abuse and is listed as a new psychoactive substance by the UNODC. The reported proportions of ketamine and its metabolites in wastewater leave some doubt as to an appropriate factor to convert excreted amounts to consumed amounts. Therefore, measured levels are being shown here as excreted daily mass loads, similar to the case of the stimulant, MDA.

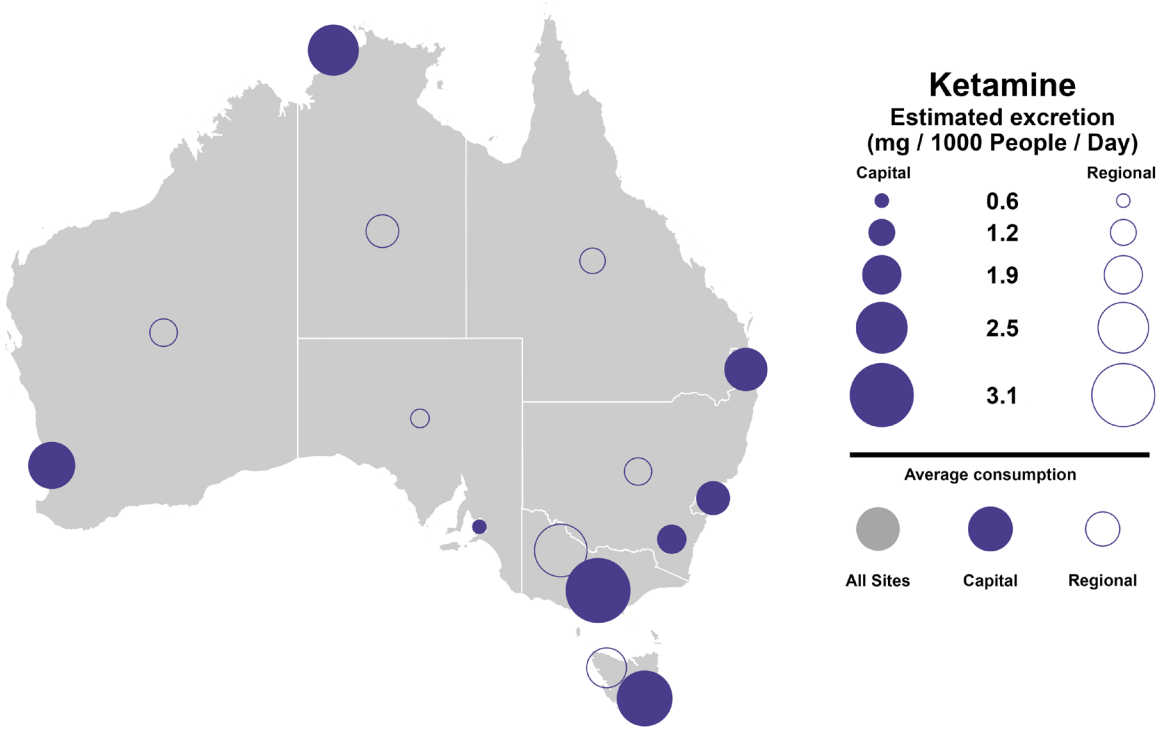
The regional average was lower than the capital cities (Figure 27). Capital city sites in New South Wales, Tasmania and Western Australia had comparatively high levels. A bubble plot shows the relative scale of ketamine excretion across Australia, with Victoria being the most prominent when ketamine excretion was averaged across sites in the respective states and territories (Figure 28).

Figure 27: Estimated ketamine excretion for April 2022 in mass excreted per day (left axis) per thousand people. The number of collection days varied from 5-7.



- Lower regional average
- Higher excretion in specific catchments

Figure 28: Estimated average ketamine excretion per jurisdiction for April 2022 in mg excreted per day per thousand people. The number of collection days varied from 5-7.



4.2 TEMPORAL CHANGES IN DRUG CONSUMPTION ESTIMATES BY JURISDICTION

The per capita consumption of each drug outlined in the following figures compares data acquired in this report to data from previous collection periods on a state or territory basis. The data relating to capital cities in this section have been updated to include both the April and June 2022 collections, while regional areas were updated for April 2022. This needs to be considered when comparing results between sections 4.1 and 4.2. Ketamine was included in the Program for the first time in Report 13 and so has fewer data points than the other substances.

Although every effort has been made to assess the same sites for each period, the individual sites and the number of sites used to generate the population-weighted averages may have changed between periods. Comparing between time points should be done with caution. This would be most evident for the regional averages, which had more variation in participation between each period (see Appendix 2 and Appendix 3, Report 6 and Appendix 2 in this report). Due to the larger number of data points collected by the Program, the current Report presents the last 2 years of data. Prior data dating back to 2016 for each substance of interest is available on the ACIC website by jurisdiction.

Note: The horizontal red, blue and black lines on each temporal graph which represent the averages are the cumulative average across all sampling time points and all samples analysed for each substance. Updated changes to the graphs relating to this report are the 2 most recent bars consisting of capital cities (April and June 2022) and the single most recent bar for regional areas (April 2022). Some temporal changes reflected in these bars may be a consequence of updated populations used in the calculations, see Appendix 4 for the difference in populations for the 2016 and 2021 Census for each catchment.

4.2.1 NICOTINE AND ALCOHOL

Trends in nicotine consumption tend to be state-specific (Figure 29). Thus far in 2022, nicotine consumption has been declining in the Australian Capital Territory, Queensland and capital city Tasmania. In contrast, consumption has been increasing in regional South Australia and Tasmania. Elsewhere, changes have been variable with no clear patterns emerging. Nicotine consumption in the Northern Territory is the highest in the country in the current reporting period. Regional average nicotine consumption (red line) is well above capital city levels (blue dashed line), reflecting greater per capita consumption of the substance in regional areas over the life of the Program (Aug 2016 to June 2022). Capital cities in South Australia and Western Australia have consistently used nicotine at levels below the national average, but several other cities are starting to show the same pattern, including the Australian Capital Territory and Queensland.

Overall alcohol consumption in the current collection period reflects localised changes. Alcohol consumption declined in the Australian Capital Territory, Queensland and capital city Tasmania and Western Australia, while it increased in South Australia (Figure 30). No consistent or uniform patterns in alcohol consumption are evident across the country. The Northern Territory continues to have the highest overall consumption of alcohol, while South Australia and Western Australia have the lowest alcohol consumption in the country. The difference in alcohol consumption in regional areas compared to the cities was less pronounced than for nicotine, but overall consumption of both substances has been higher in regional areas since the start of the Program.

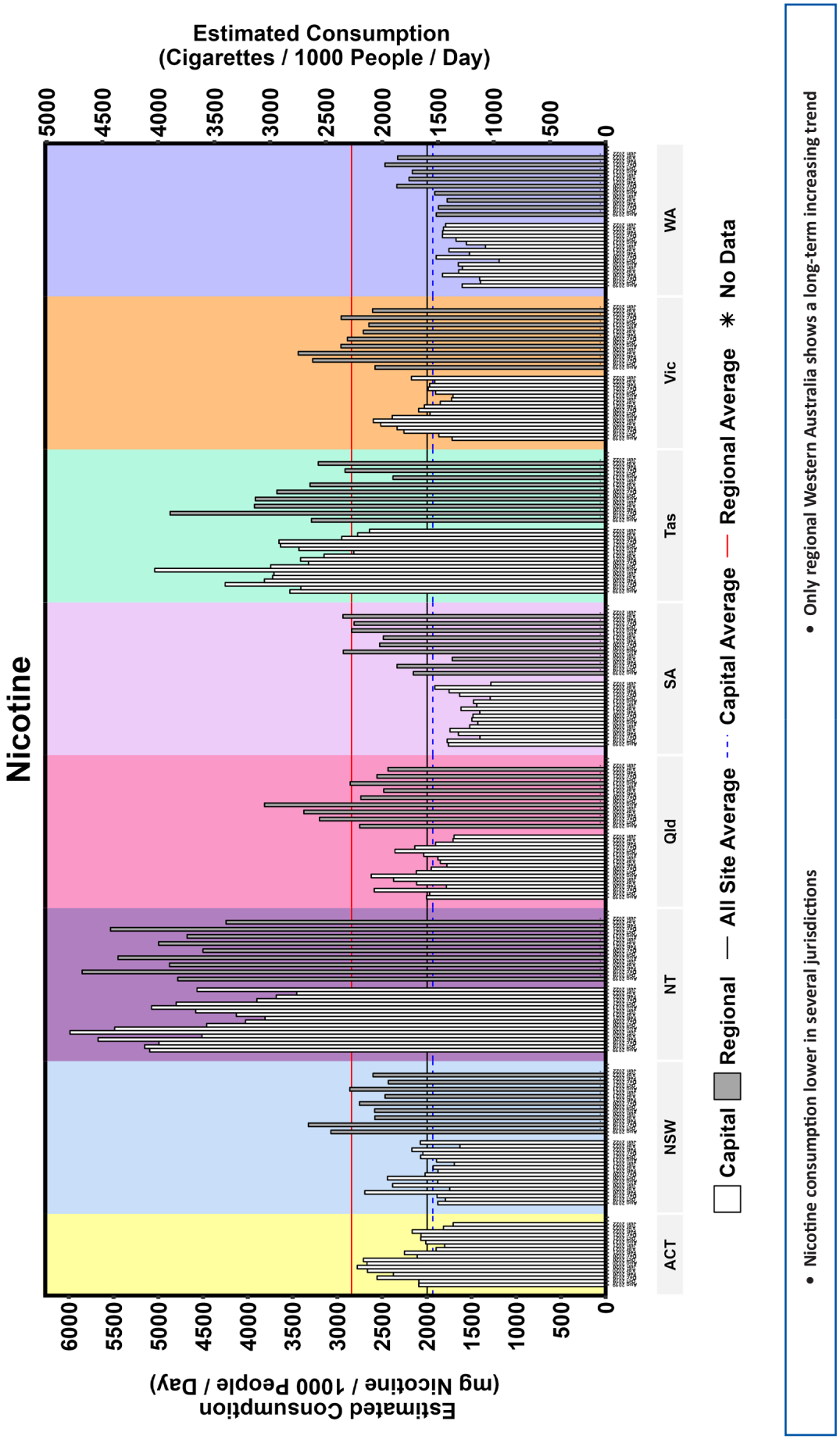


Figure 29: Estimated average consumption of nicotine by state/territory, August 2019 to June 2022, where 1 cigarette provides 1.25 mg of nicotine.

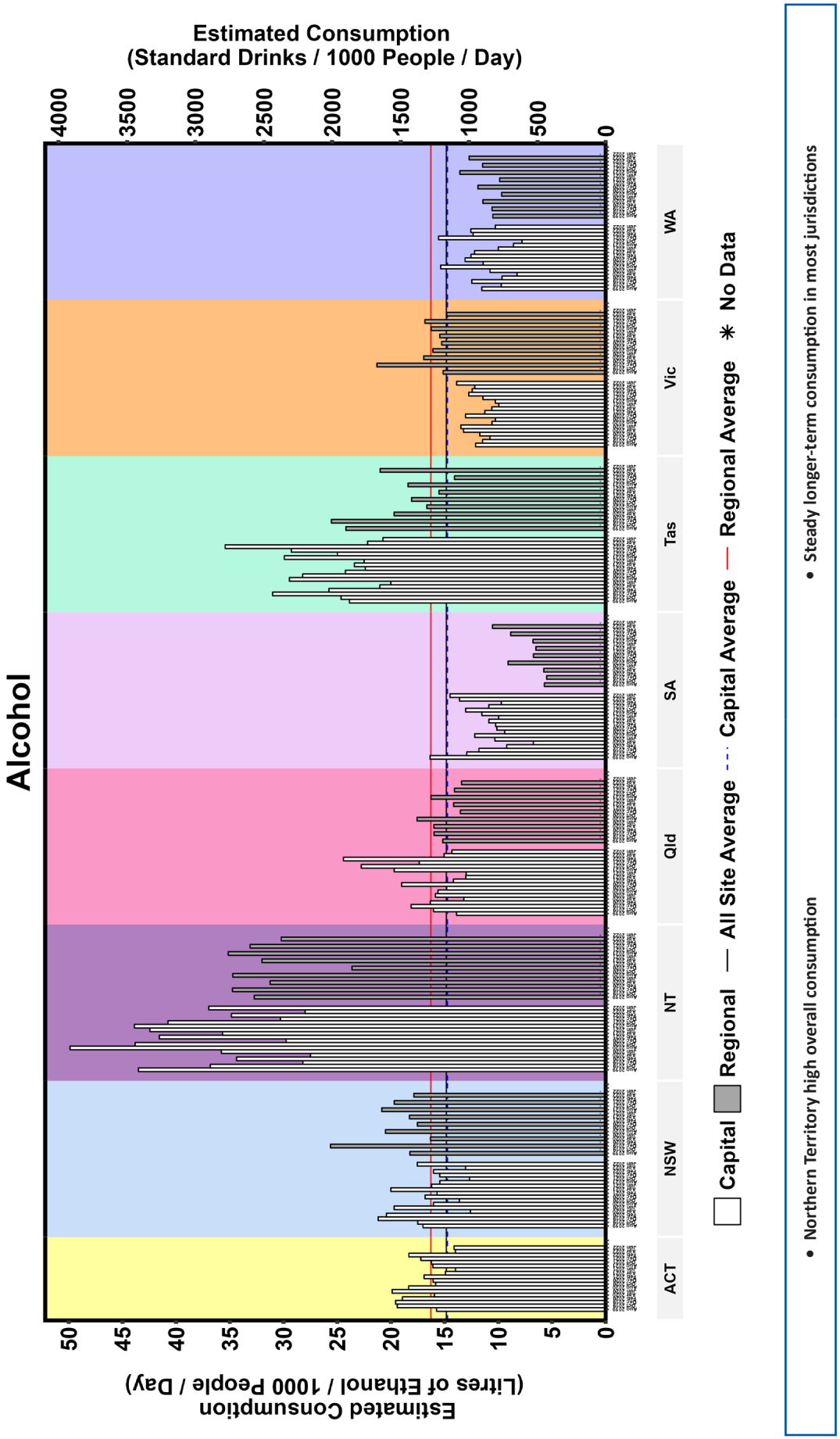


Figure 30: Estimated average consumption of alcohol by state/territory, August 2019 to June 2022. A standard drink is 10.0 g, or 12.6 mL.

4.2.2 STIMULANTS

Methylamphetamine consumption has been highly variable since the start of the pandemic in 2020. Since the decrease in consumption levels in mid-2020 in most parts of the country, consumption of the drug has recovered to a different degree in most jurisdictions (Figure 31). In the Australian Capital Territory and Tasmania methylamphetamine consumption has remained at the lower end of the scale. Substantial increases in use have been evident in many parts of the country since the start of the year, most notably in New South Wales, South Australia and Western Australia. Rolling averages show that regional use tends to be higher than in the capital cities.

Sites where data have been available from before the start of the NWDMP (back in some cases to 2009) show that methylamphetamine consumption has mostly increased over the long-term (Figure 32 and Figure 33). Methylamphetamine levels at the 2 sites in Queensland in June 2022 were almost back to where they were in 2017, while in South Australia, capital city consumption is similar to levels in 2018. Monitoring in Victoria and Western Australia does not go quite as far back. Methylamphetamine in Western Australia is currently at 2017 levels, but an upswing in use has occurred since August 2021. In contrast, the capital city sites in Victoria appear to have been less impacted, with much less variation over time. Current consumption levels are largely consistent with historical values.

A feature of cocaine consumption over the past 2 years is a gradual decline in almost every jurisdiction (Figure 34). New South Wales remains the jurisdiction with the highest cocaine consumption, both in the capital city and regional areas. Cocaine consumption in Western Australia and the Northern Territory was the lowest in the nation.

MDMA consumption across Australia has also been declining over the past 2 years and is at the lowest levels since the Program commenced in August 2016 (Figure 35). Long term trends in MDMA consumption over the life of the Program show that MDMA consumption was increasing from August 2016 to mid to late-2019 in most places before declining. The Northern Territory and Tasmania capital cities have historically been the 2 cities where MDMA consumption tended to be the highest in the nation. However, thus far in 2022, consumption is now more evenly spread across the country. Average regional MDMA consumption continues to exceed capital city consumption.

MDA use, corrected for the proportion derived from MDMA (Khan & Nicell 2011), has shown a general but not consistent decrease over the last few years (Figure 36). Parts of regional Queensland have shown sporadic spikes in use. Spikes in consumption in regional areas have driven the cumulative regional average higher than the capital average. Consumption of the drug in this reporting period was generally at the lowest levels since the beginning of the Program in most jurisdictions.

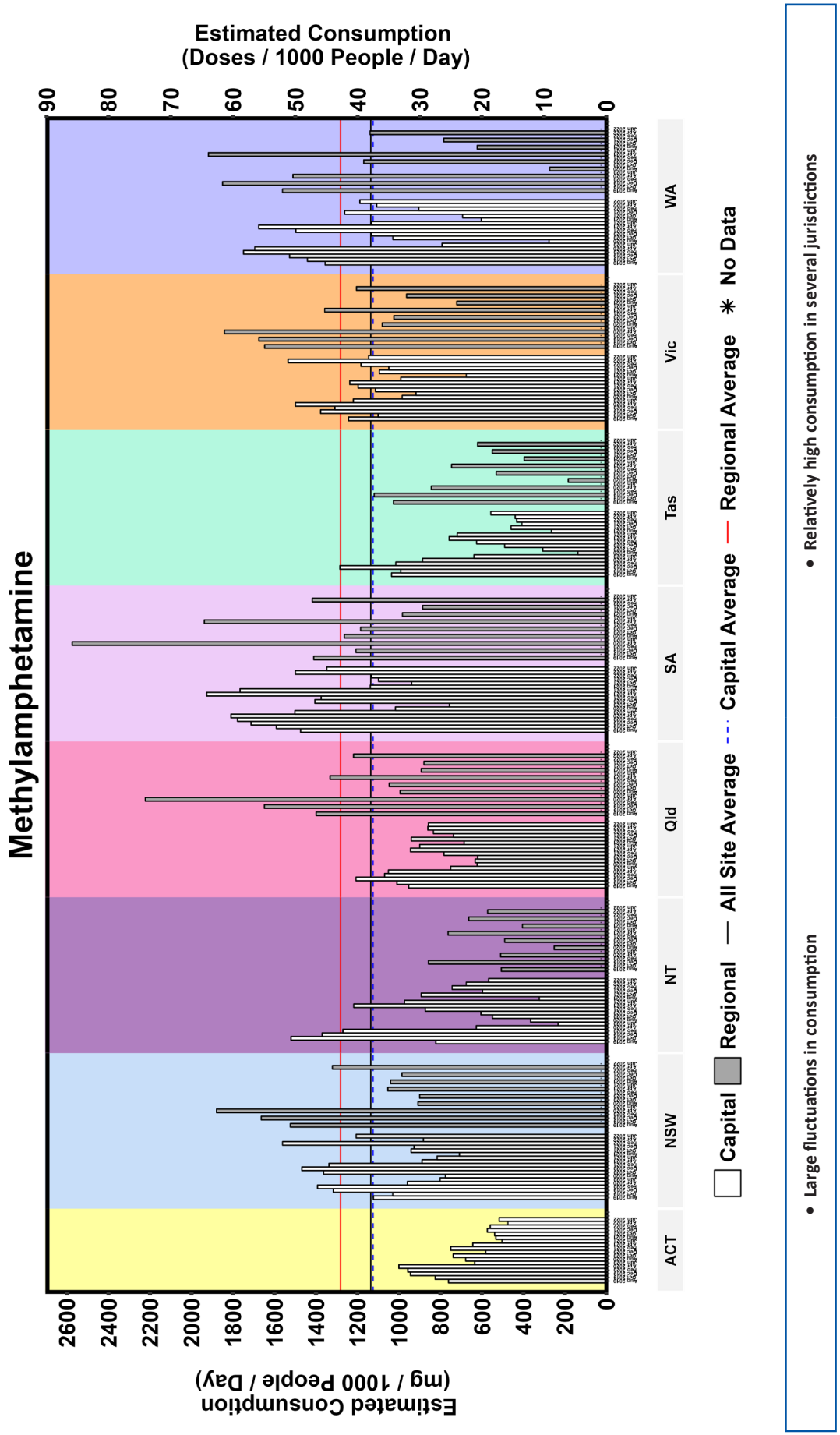


Figure 31: Estimated average consumption of methylamphetamine by state/territory, August 2019 to June 2022.

Figure 32: Change in methylamphetamine consumption for sites in Queensland and South Australia with historical data.

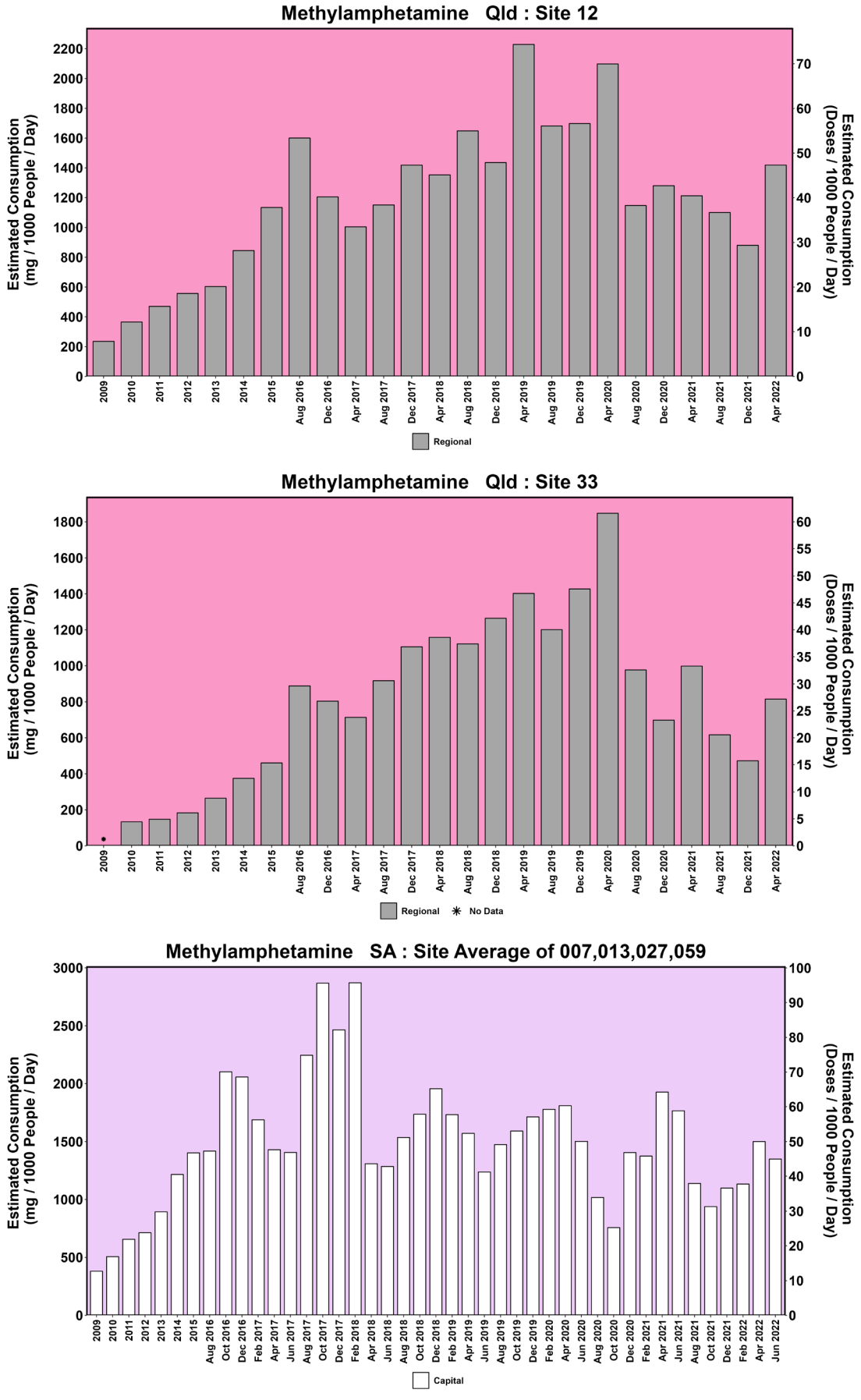
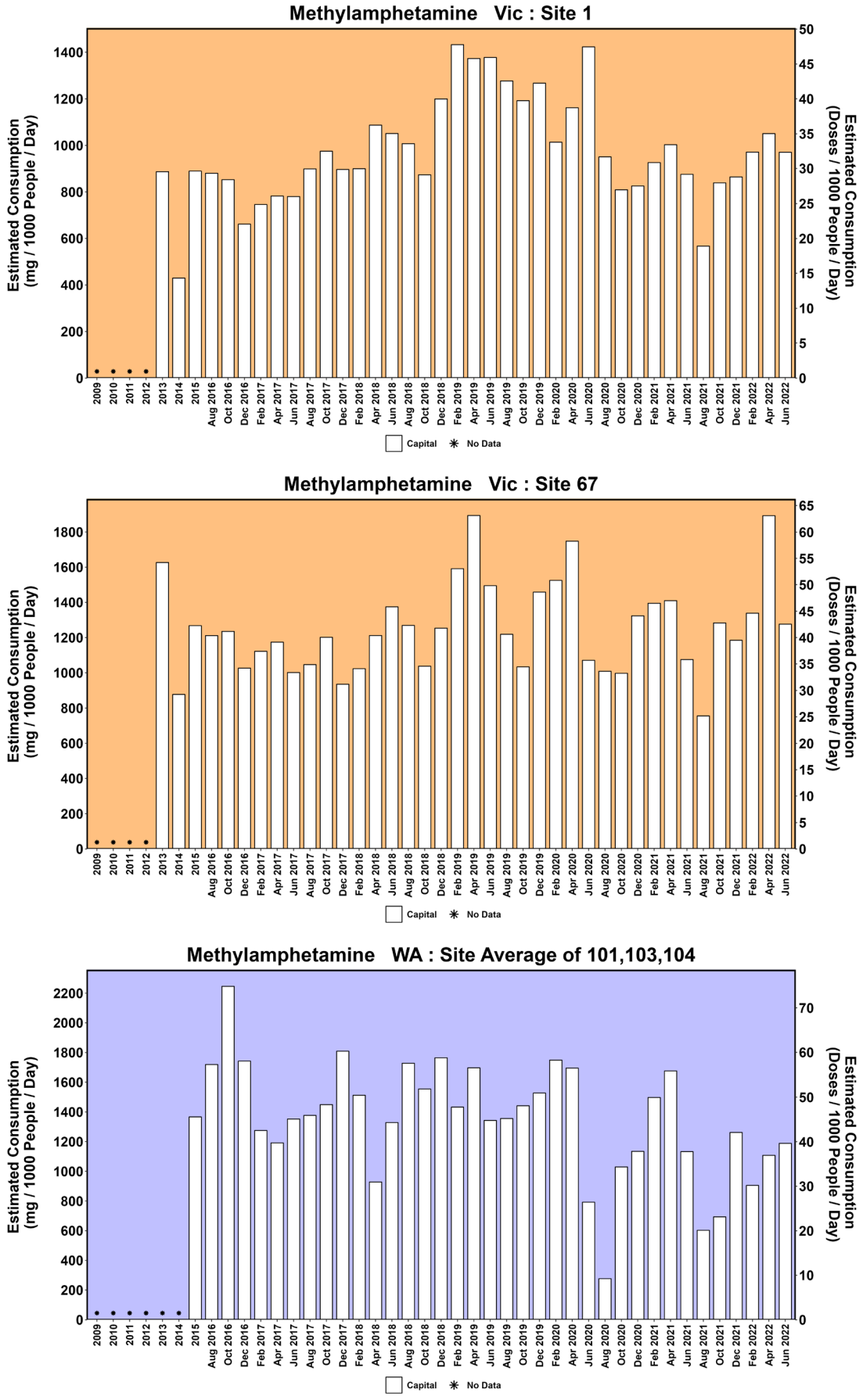


Figure 33: Change in methylamphetamine consumption for sites in Victoria and Western Australia with historical data. Both Victorian sites were the average of one week per year in 2013, 2014 and 2015.



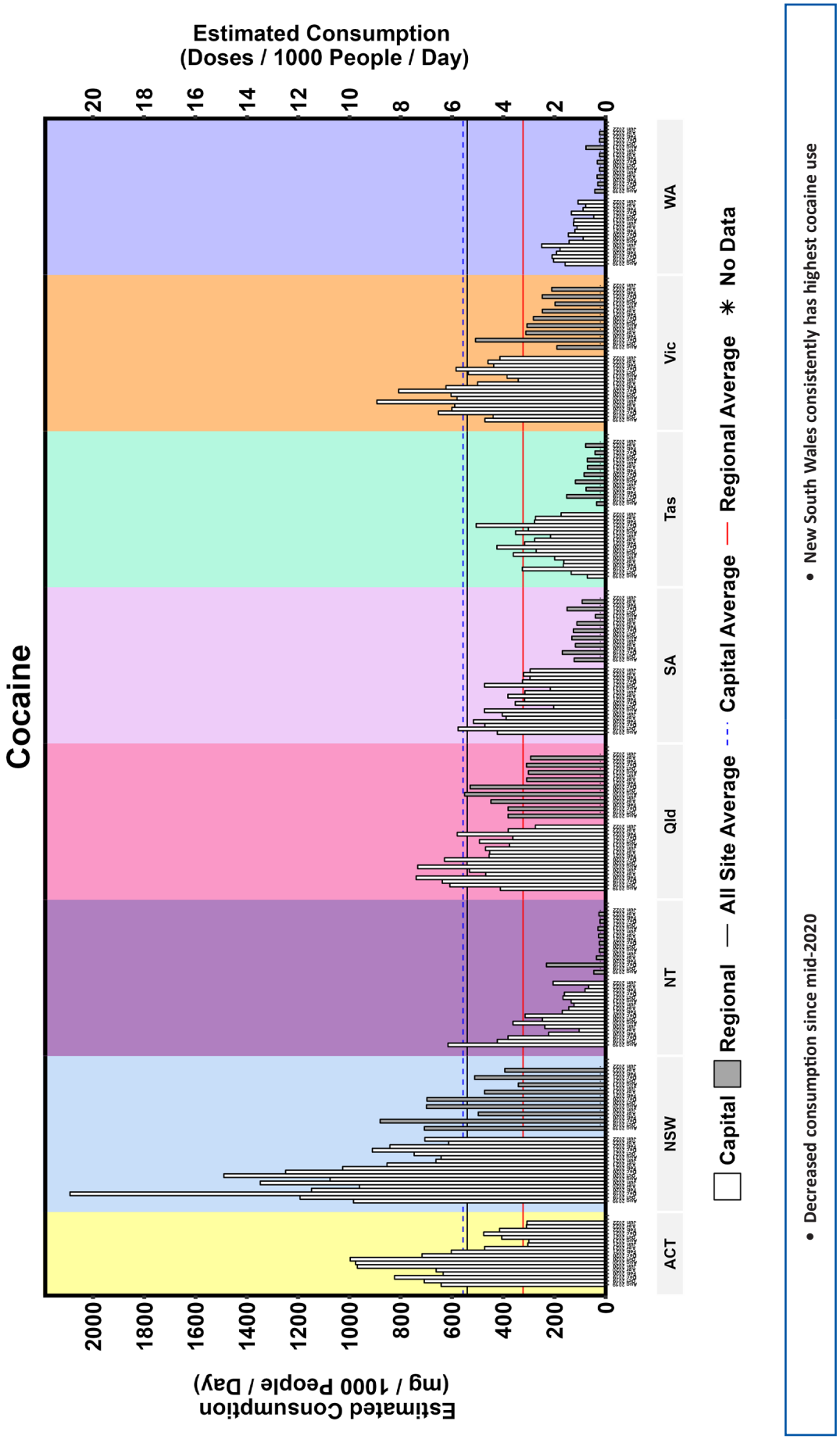


Figure 34: Estimated average consumption of cocaine by state/territory, August 2019 to June 2022.

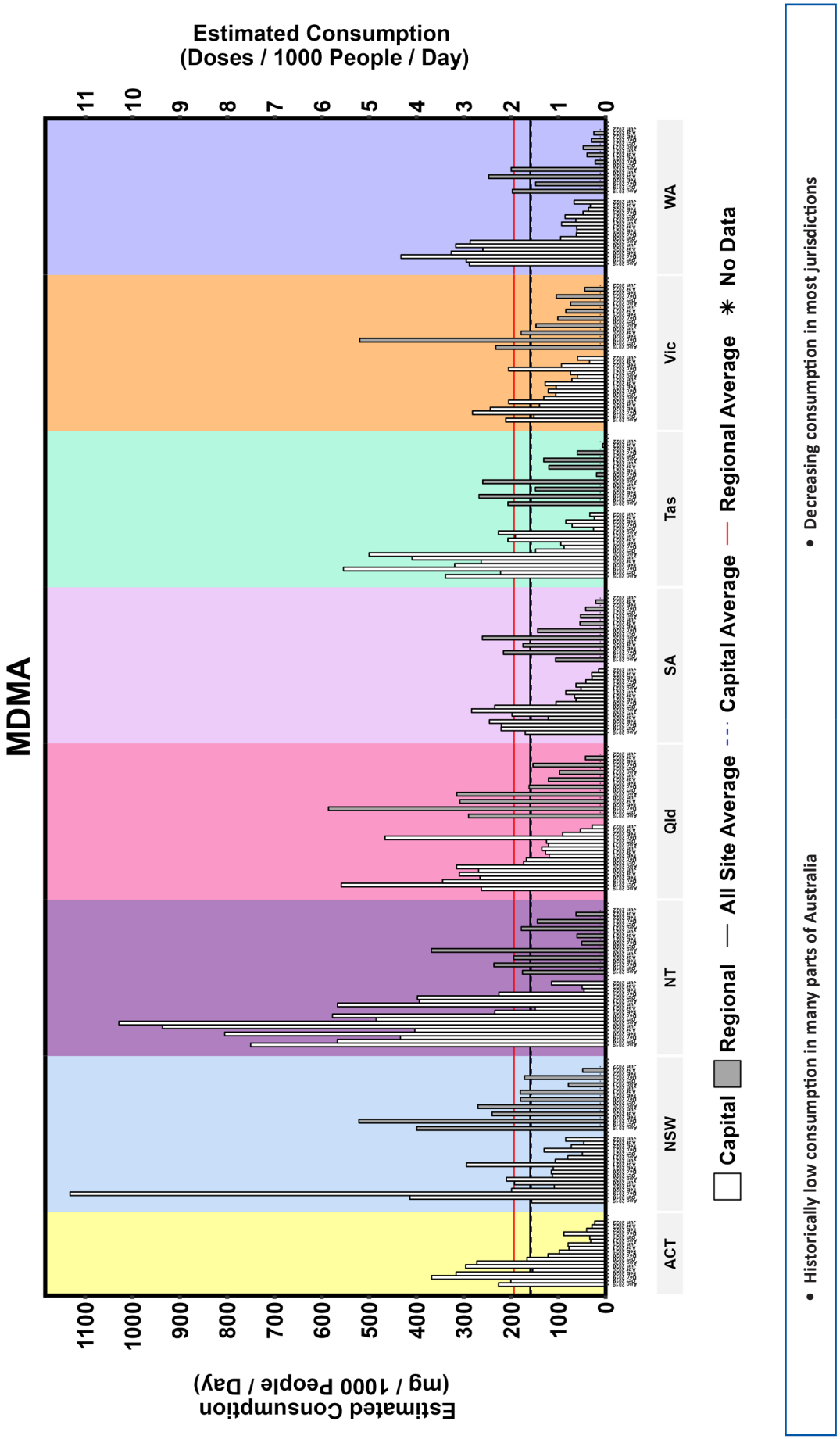


Figure 35: Estimated average consumption of MDMA by state/territory, August 2019 to June 2022.

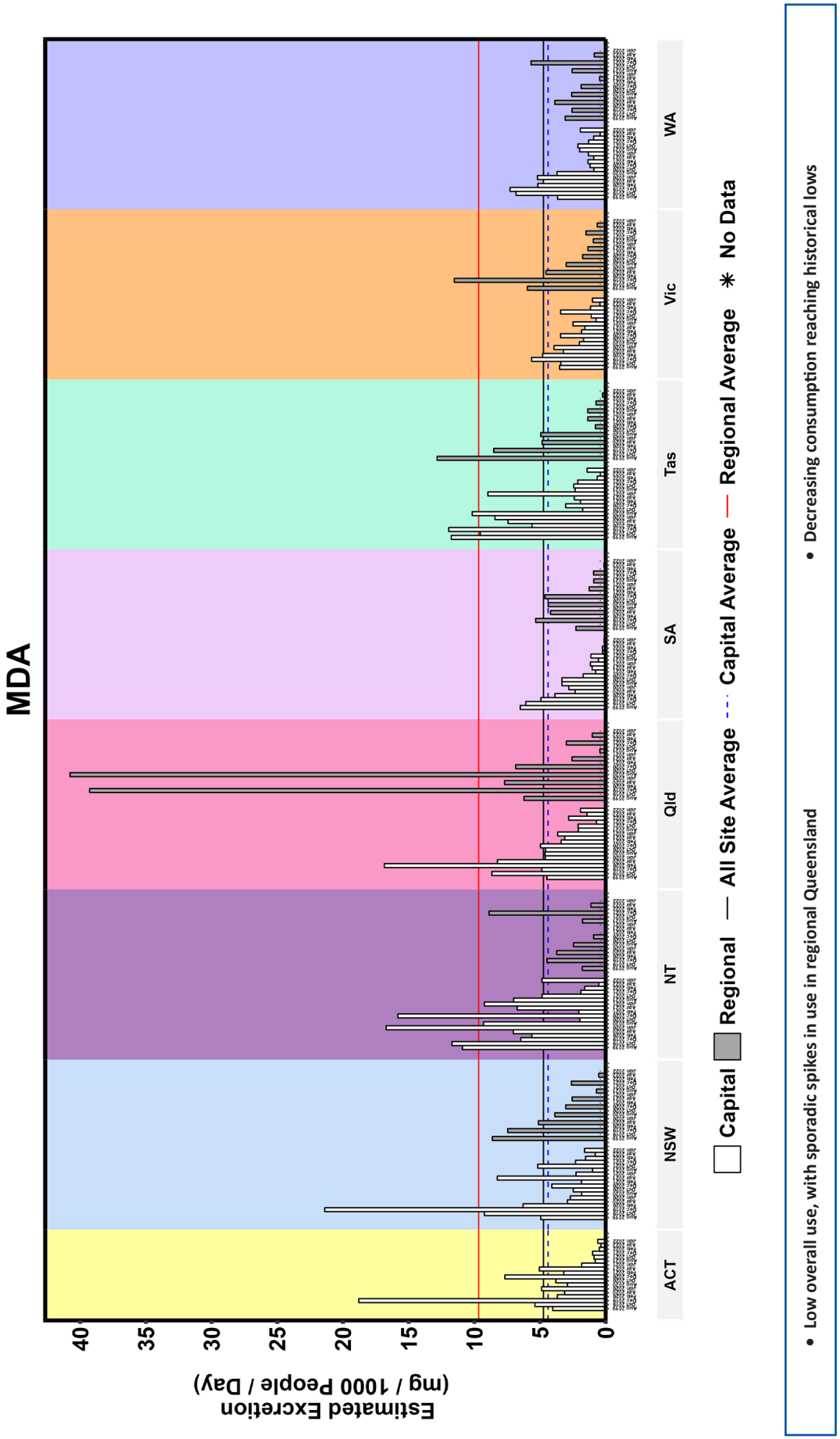


Figure 36: Estimated average excretion of MDA by state/territory, August 2019 to June 2022.

4.2.3 OPIOIDS

Oxycodone consumption in Australia has been declining over the past 2 years (Figure 37). Prior to that, the national trend was an increase between 2016 and 2018, followed by a gradual decline to late 2019 and then a period of relative stability. Fluctuations during the pandemic are possibly a consequence of restrictions causing the postponement of elective surgery and medical treatment. Oxycodone is a strong pain reliever which is commonly prescribed for post-surgery pain treatment. Average per capita regional oxycodone consumption is nearly double that of capital cities. Capital city Tasmania, the Australian Capital Territory and regional parts of Queensland and Victoria tend to be among the highest per capita consumers of oxycodone.

The trend relating to fentanyl consumption has similarly been downward over the past few years, with the exception of regional Tasmania where use was relatively low to start with (Figure 38). This is most obvious when comparing the current reporting period with long-term cumulative averages. The long-term fentanyl trend was a general increase to a peak in mid to late-2018, followed by a decrease to the present time. On a national scale, average regional consumption of fentanyl remains higher than in the capital cities.

In contrast to the pharmaceutical opioids, heroin is mostly consumed in the capital cities (Figure 39). Trends in heroin consumption are different across the country. Capital city Victoria is consistently the location with the highest levels of consumption, but in June 2022 there was above average consumption in the Australian Capital Territory and capital city New South Wales. Outside of New South Wales and Victoria, regional use of heroin is low compared to the capital cities.

Heroin consumption has been measured in capital city South Australia since 2013 (Figure 40). A gradual, long-term decrease in heroin consumption was evident from 2013 to early 2019, followed by an increase since that time. However, since the start of the pandemic in Australia, heroin use has fluctuated in the capital city. Thus far in 2022, heroin use has stabilised.

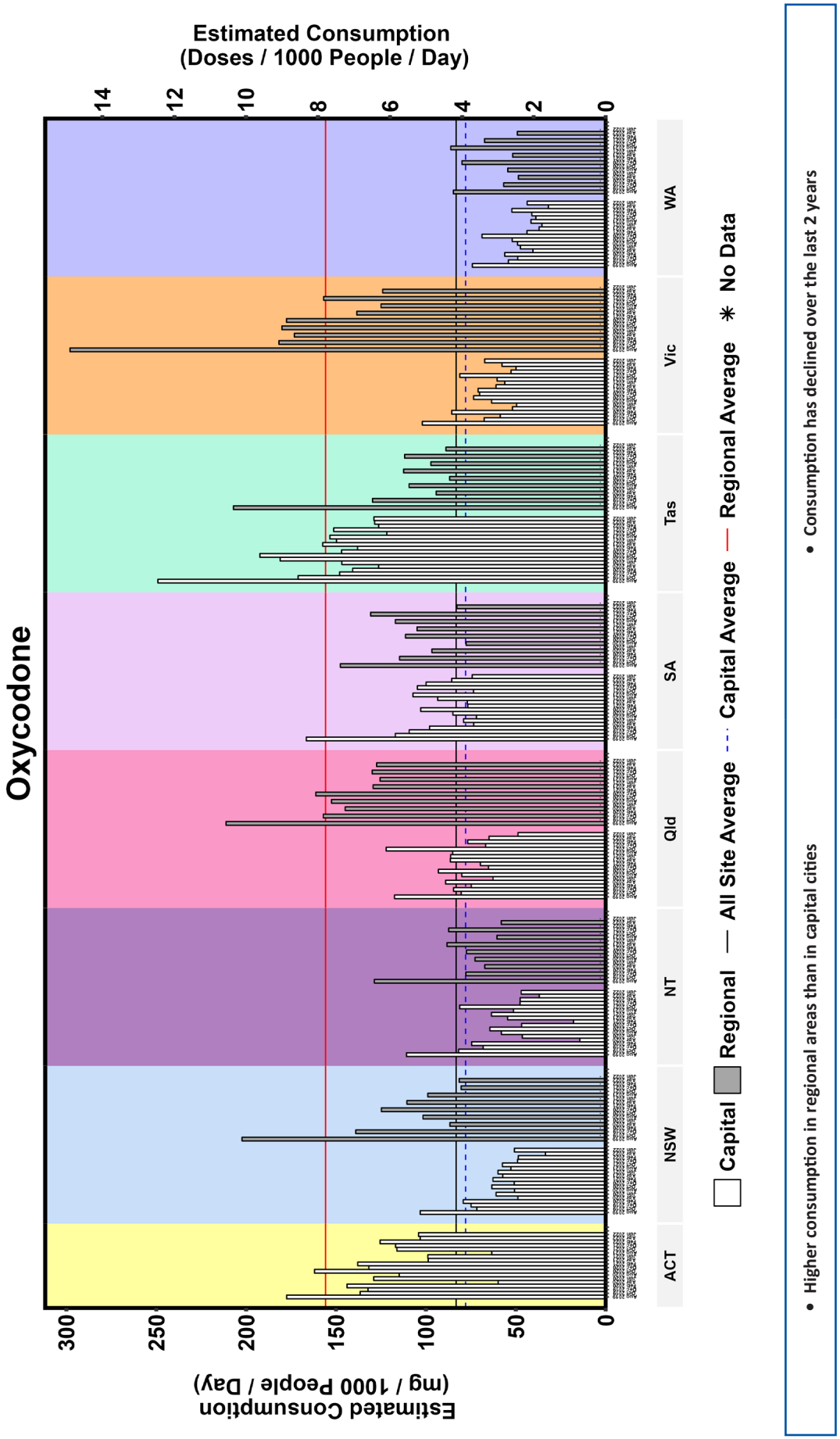


Figure 37: Estimated average consumption of oxycodone by state/territory, August 2019 to June 2022.

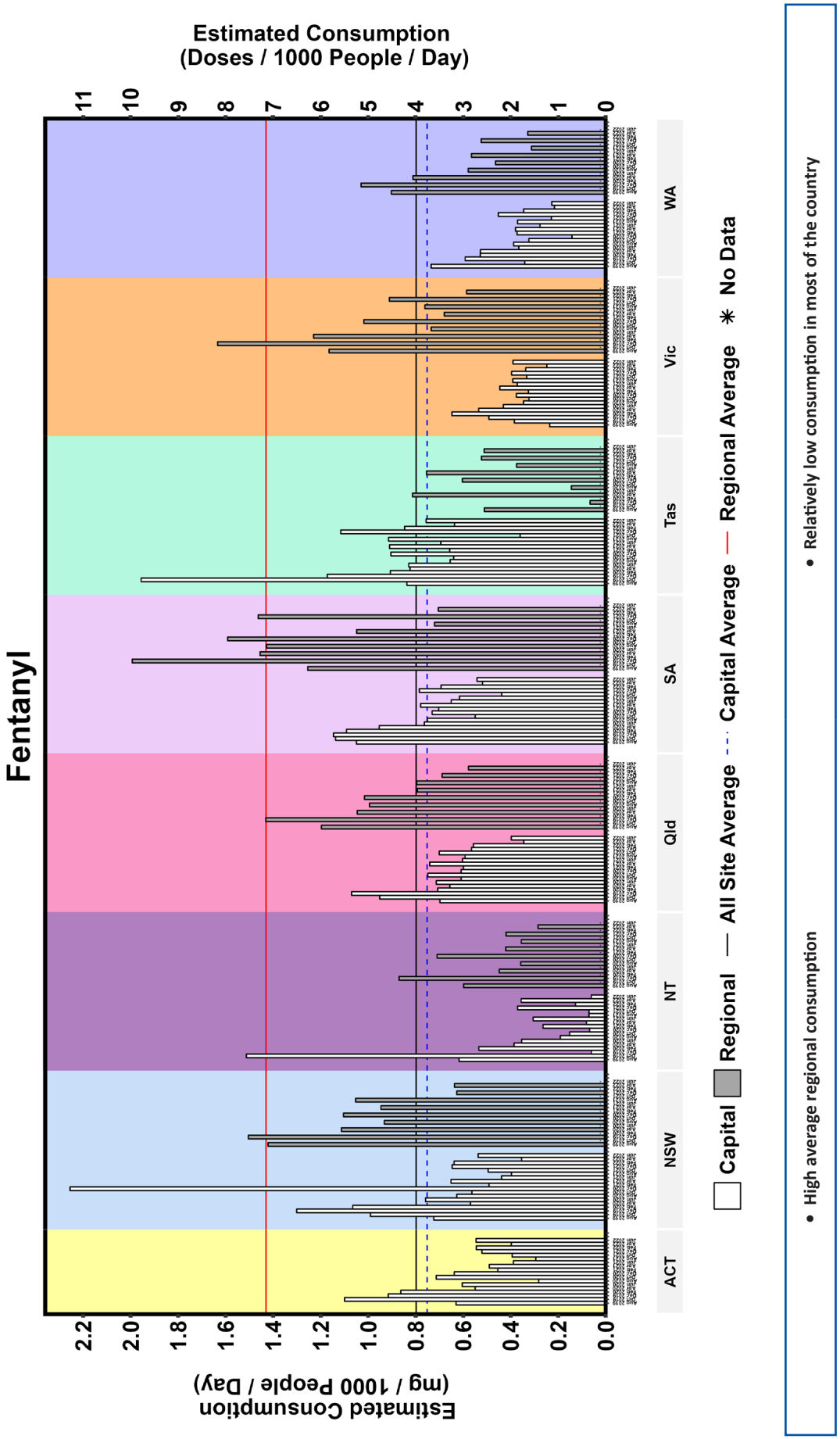


Figure 38: Estimated average consumption of fentanyl by state/territory, August 2019 to June 2022.

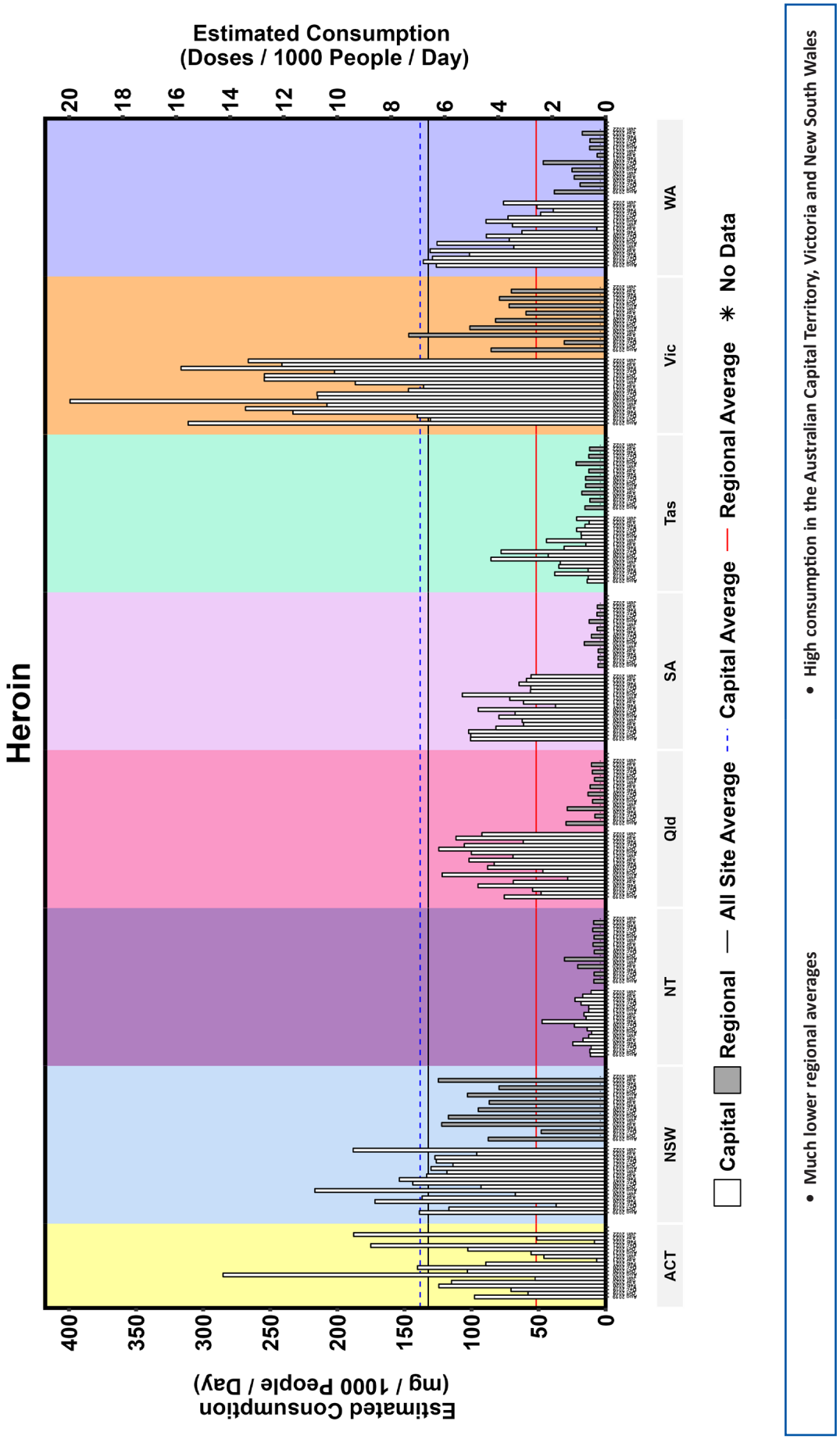
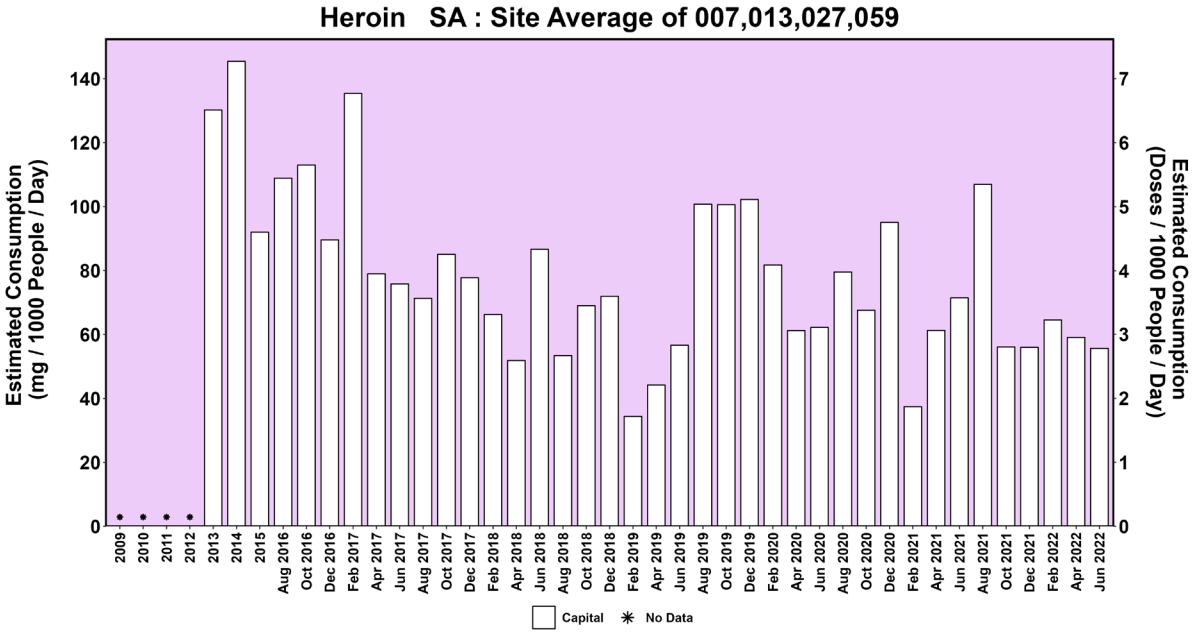


Figure 39: Estimated average consumption of heroin by state/territory, August 2019 to June 2022.

Figure 40: Change in heroin consumption for capital city sites in South Australia with historical data.



4.2.4 CANNABIS

Cannabis consumption has varied considerably over the past 2 years (Figure 41). Regional consumption has been substantially higher than in the capital cities, apart from in Tasmania. Per capita cannabis consumption in capital city New South Wales, Victoria and Queensland is consistently lower than in the smaller capital cities.

Consumption of cannabis has been measured in capital city South Australia since 2011. An overall increasing trend in consumption was observed until early 2019, followed by a short-term decline to February 2020 (Figure 42) since when there has been a steady increase.

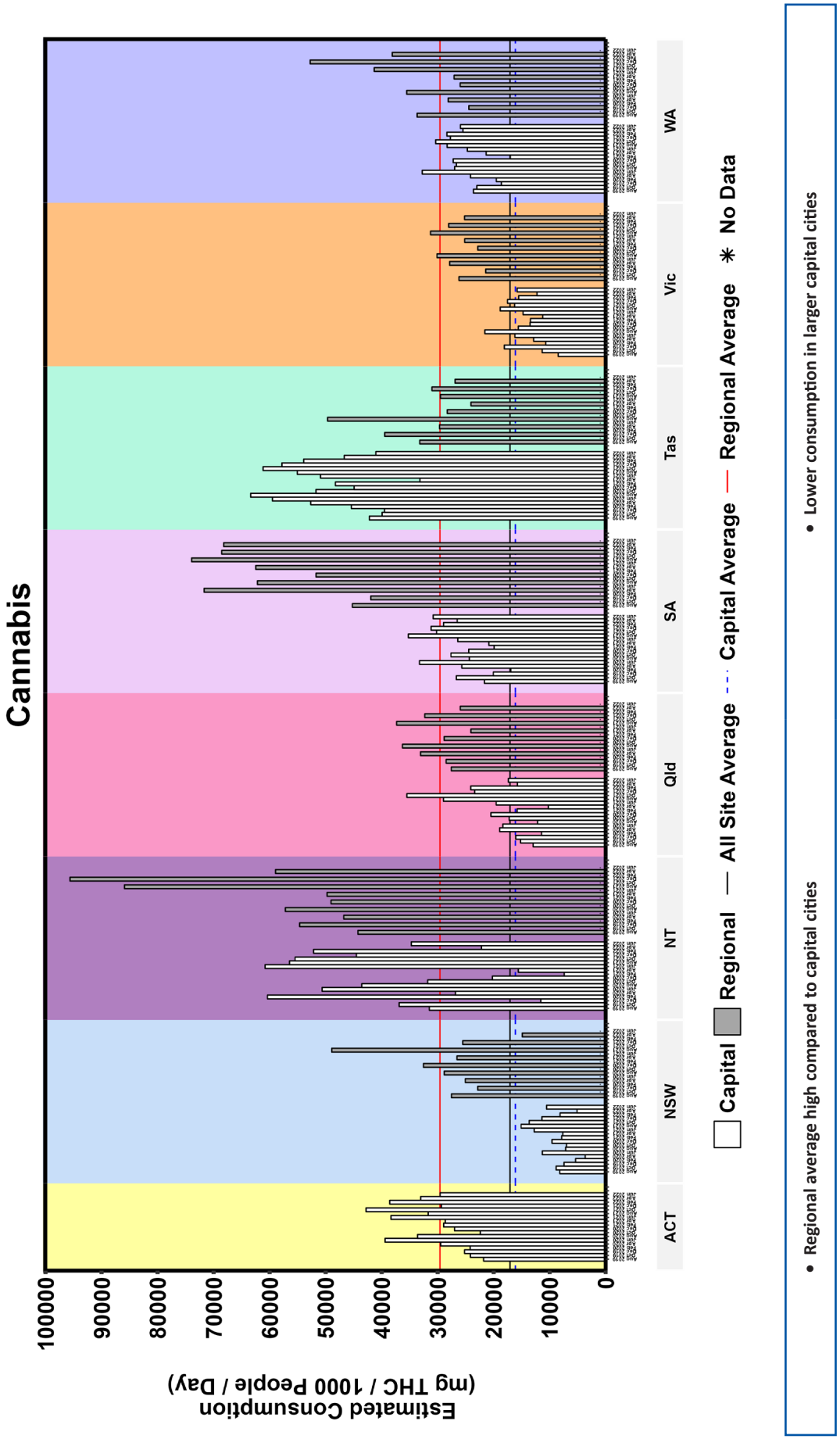
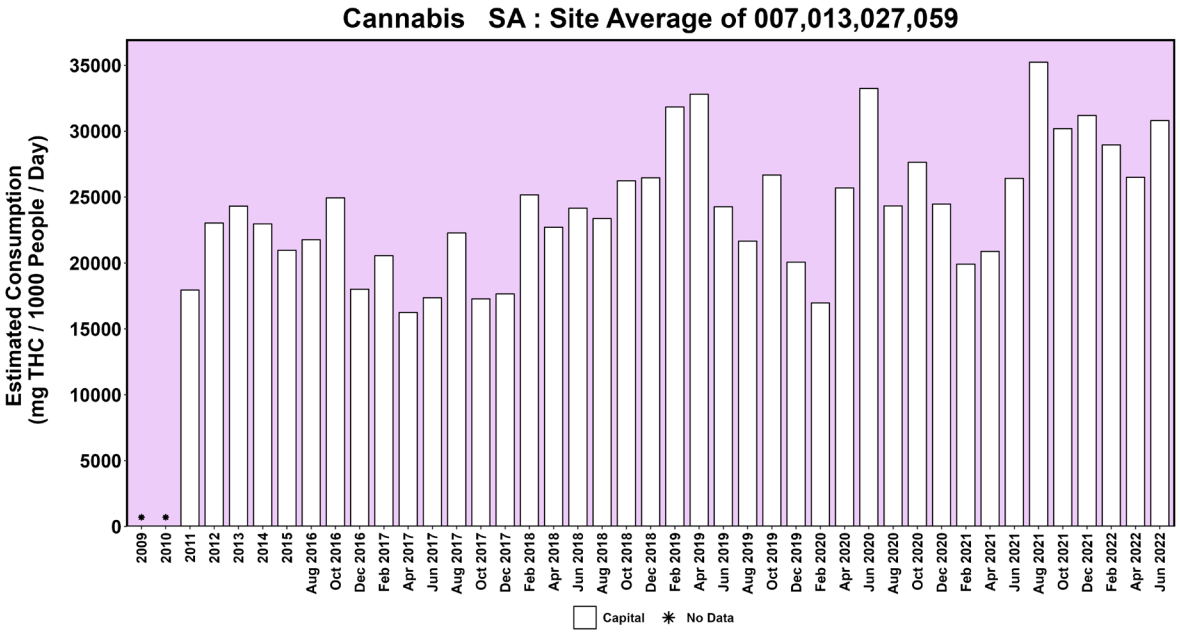


Figure 41: Estimated average consumption of cannabis by state/territory, August 2019 to June 2022.

Figure 42: Change in cannabis consumption for capital city sites in South Australia with historical data. Cannabis is detected via the THC metabolite, THC-COOH.



4.2.5 KETAMINE

Ketamine has been part of the Program for less than 2 years and is reported as amounts excreted until an appropriate urinary elimination rate is selected to calculate back to consumption. Average capital city excretion levels exceed those in regional areas (Figure 43). The Northern Territory capital city site shows large variability between collection periods compared to other jurisdictions. Ketamine excretion levels in the capital city of the Northern Territory have tended to be the highest in the country, followed by capital city and regional Victoria. South Australia has had the lowest ketamine excretion levels, though it increased tangibly in the current reporting period in regional parts of the state.

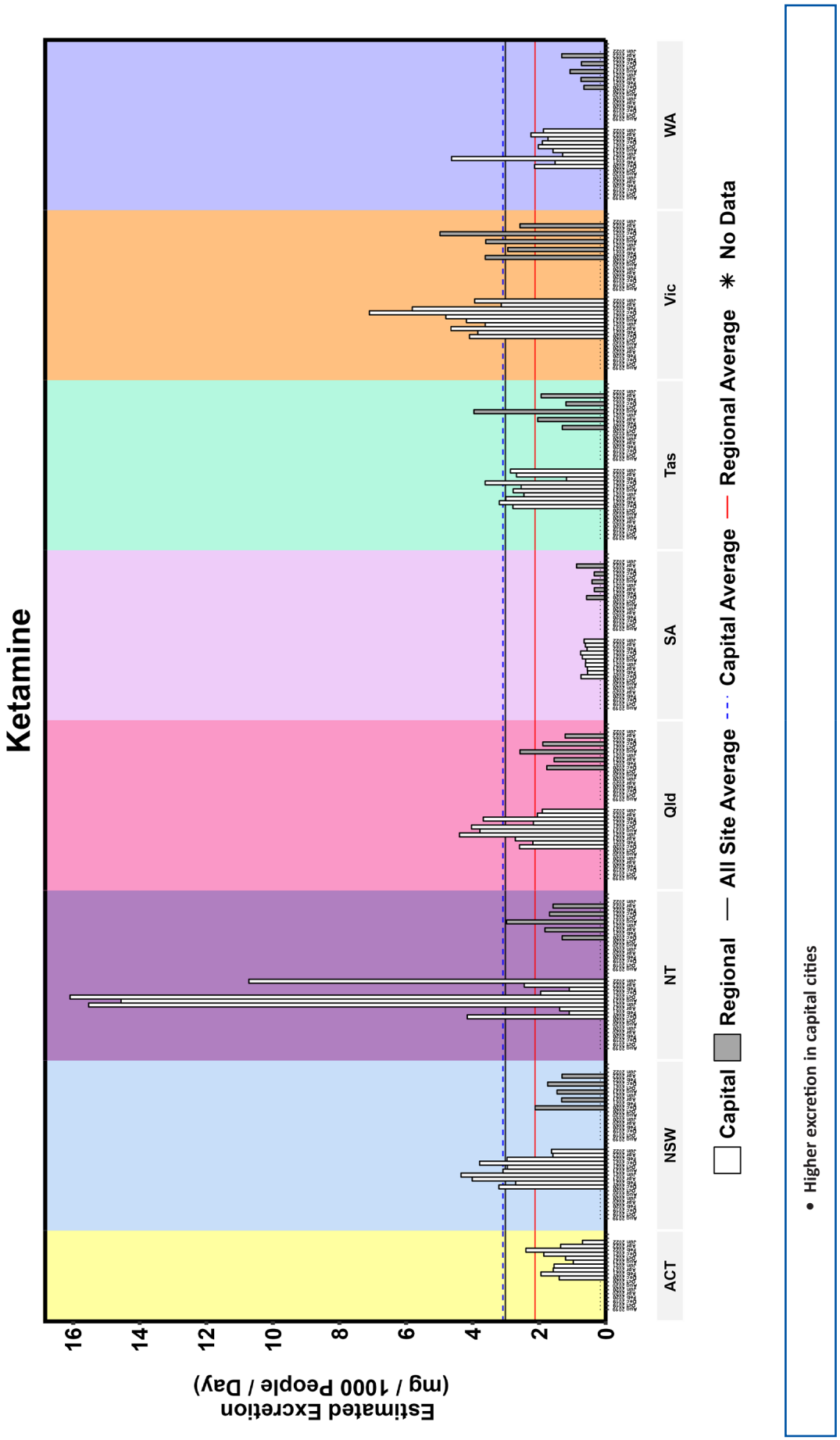


Figure 43: Estimated average consumption of ketamine by state/territory, August 2019 to June 2022.

4.3 NATIONAL CAPITAL CITY AND REGIONAL AVERAGES

In order to show the national trends of the individual substances, all capital city and regional sites were combined for each substance (Figures 44 to 49). Fewer sites were able to be sampled in October 2016 and this is highlighted as such in the respective figures.

In terms of legal substances with abuse potential, nicotine consumption has remained relatively unchanged from the start of the Program (Figure 44). Results from June 2021 to date suggest that nicotine consumption in capital cities is in a modest upward trend, while the reverse applies to regional areas. Alcohol consumption also appears relatively steady over time, with some short-term peaks and troughs. One of these troughs in 2020 coincided with restrictions implemented in response to COVID-19.

Overall methylamphetamine consumption in regional Australia increased more than in the capital cities from early 2017 to the start of the pandemic in early 2020 (Figure 45). From that point, methylamphetamine consumption decreased substantially to August 2020. Consumption in the capital cities made a gradual recovery over the six months to early 2021, to near pre-pandemic levels. A trough in August 2021 appears to have been a short-term decline, as methylamphetamine use has since almost returned to April 2021 levels, both in capital cities and regional Australia. From December 2017 to April 2020 methylamphetamine consumption was much higher in regional parts of the country than in the capital cities. Since then, this pattern has diminished, with a less clear distinction between regional and capital city consumption.

MDMA consumption rates declined over the first year of the Program, followed by a gradual increase to the end of 2019 (Figure 45). The rates of change are more pronounced in regional areas. MDMA consumption reached a peak in both regional and capital cities in December 2019, but has since decreased sharply to historical lows.

Cocaine use in capital cities increased to a record high in June 2020. Since then, consumption has decreased in capital city sites to the present and decreased also (although not uniformly) in regional sites (Figure 46). Long-term trends relating to cocaine clearly show much higher consumption in capital cities compared to regional consumption.

MDA excretion has shown sporadic spikes, particularly in regional areas (Figure 46). Average MDA excretion in regional areas generally exceeds average capital city excretion, although this pattern has been less evident since late 2020. In general, trends in MDA use have been declining since 2017, with the lowest MDA excretion levels in both capital city and regional areas recorded by the Program in April 2022.

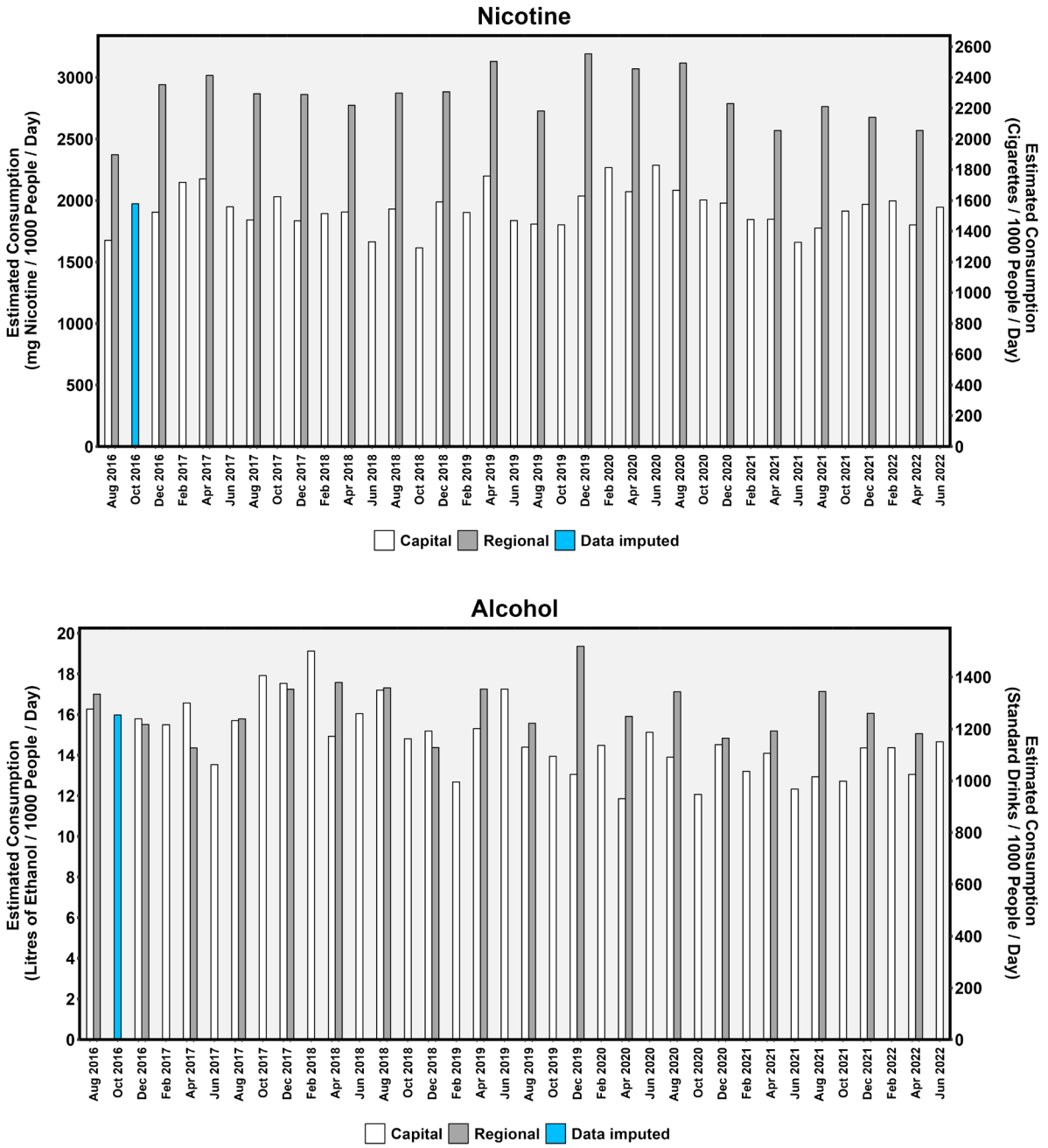
Very large differences between capital cities and regional Australia have been evident for the 2 pharmaceutical opioids, fentanyl and oxycodone for almost all reporting periods (Figure 47). Average capital city consumption of both drugs has been substantially lower than regional areas, although the gap in fentanyl consumption has narrowed since December 2020. Oxycodone consumption increased steadily after early 2017 to a peak in December 2018 and has since decreased. This was more apparent in regional areas than in the capital cities. Fentanyl consumption has followed a similar trend. Consumption of both substances remains low and relatively stable.

The remaining substances, heroin, ketamine and cannabis had mixed patterns in a national context (Figures 48 and 49 respectively). Heroin consumption has been quite variable, partly attributable to low dose numbers and driven largely by one capital city Victorian site which is the highest in the nation for heroin consumption. Variations in heroin consumption in the capital cities have occurred within a relatively narrow range since 2019, and use of the drug remains relatively low in regional areas.

Analysis of ketamine commenced in December 2020. Use of the pharmaceutical compound has been consistently lower in regional Australia compared to the capital cities. A peak in use in December 2021 has been followed by a decrease in consumption to the present time. Changes to date have occurred within a relatively narrow range.

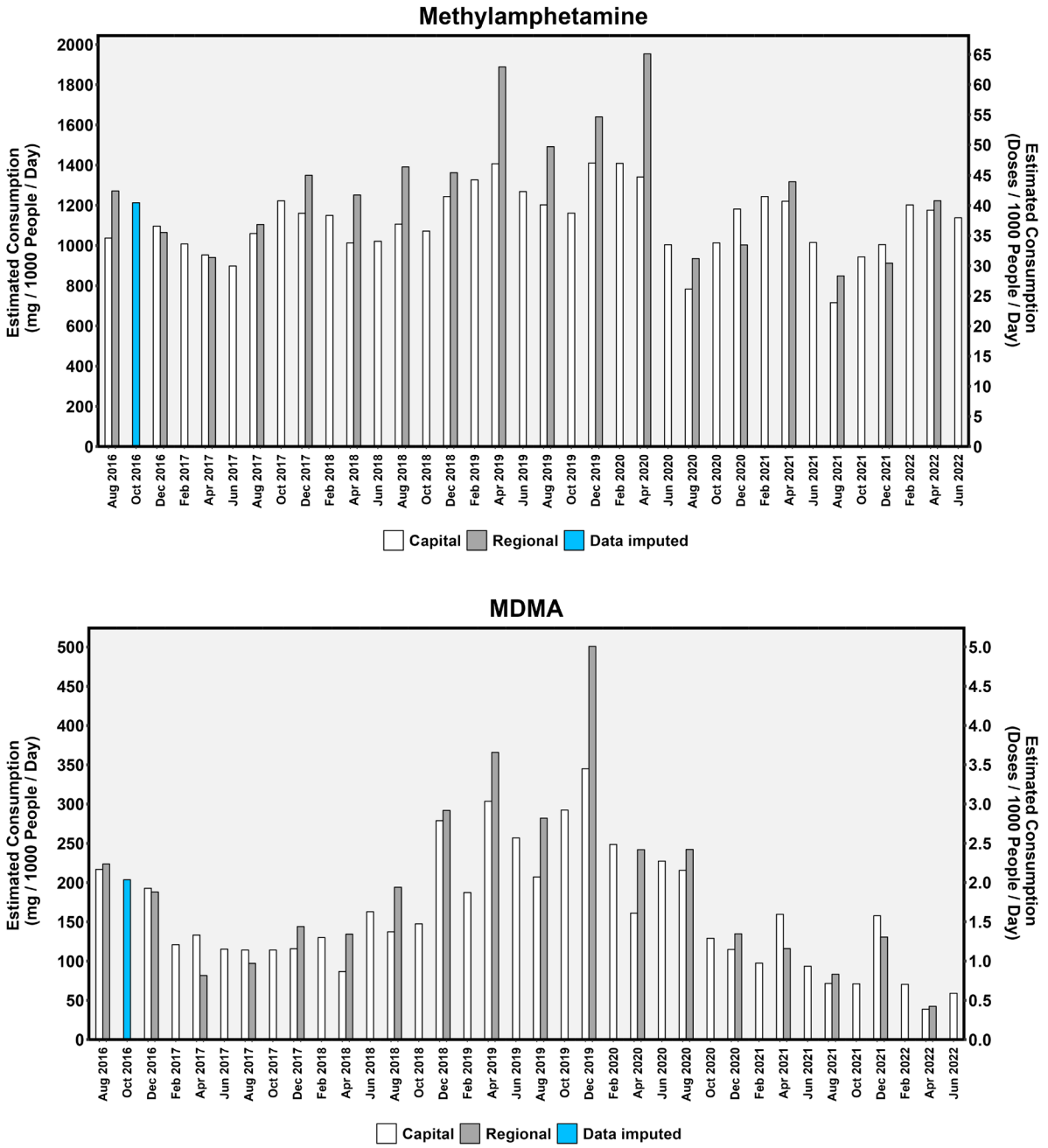
Cannabis consumption is variable, with broader fluctuations in regional consumption (Figure 49). Regional consumption far exceeds that in the capital cities.

Figure 44: The population-weighted average of all sites for nicotine and alcohol.



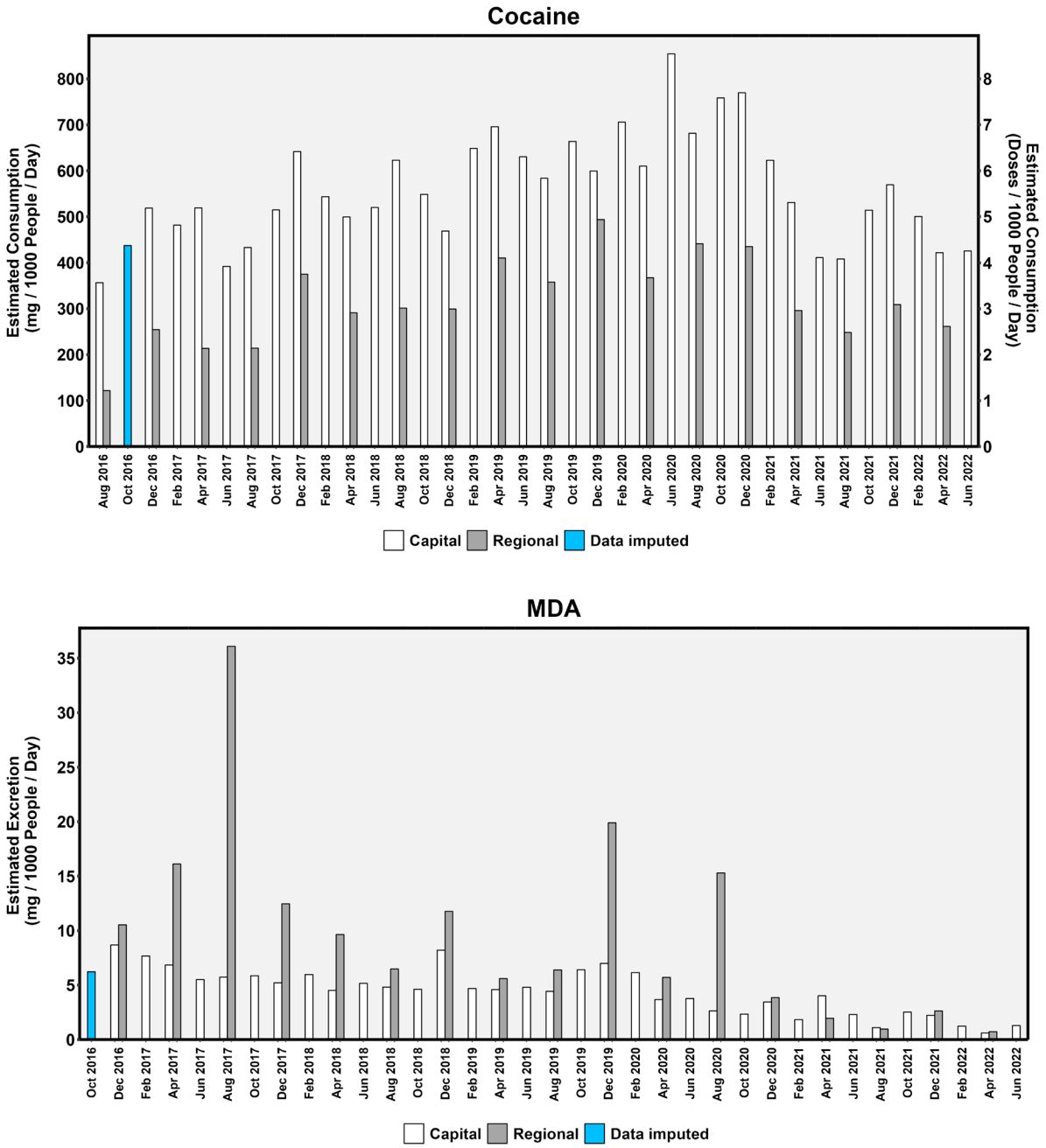
Regional areas are only sampled every second collection period. As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and December 2016 was used to provide the overall October estimate.

Figure 45: The population-weighted average of all sites for methylamphetamine and MDMA.



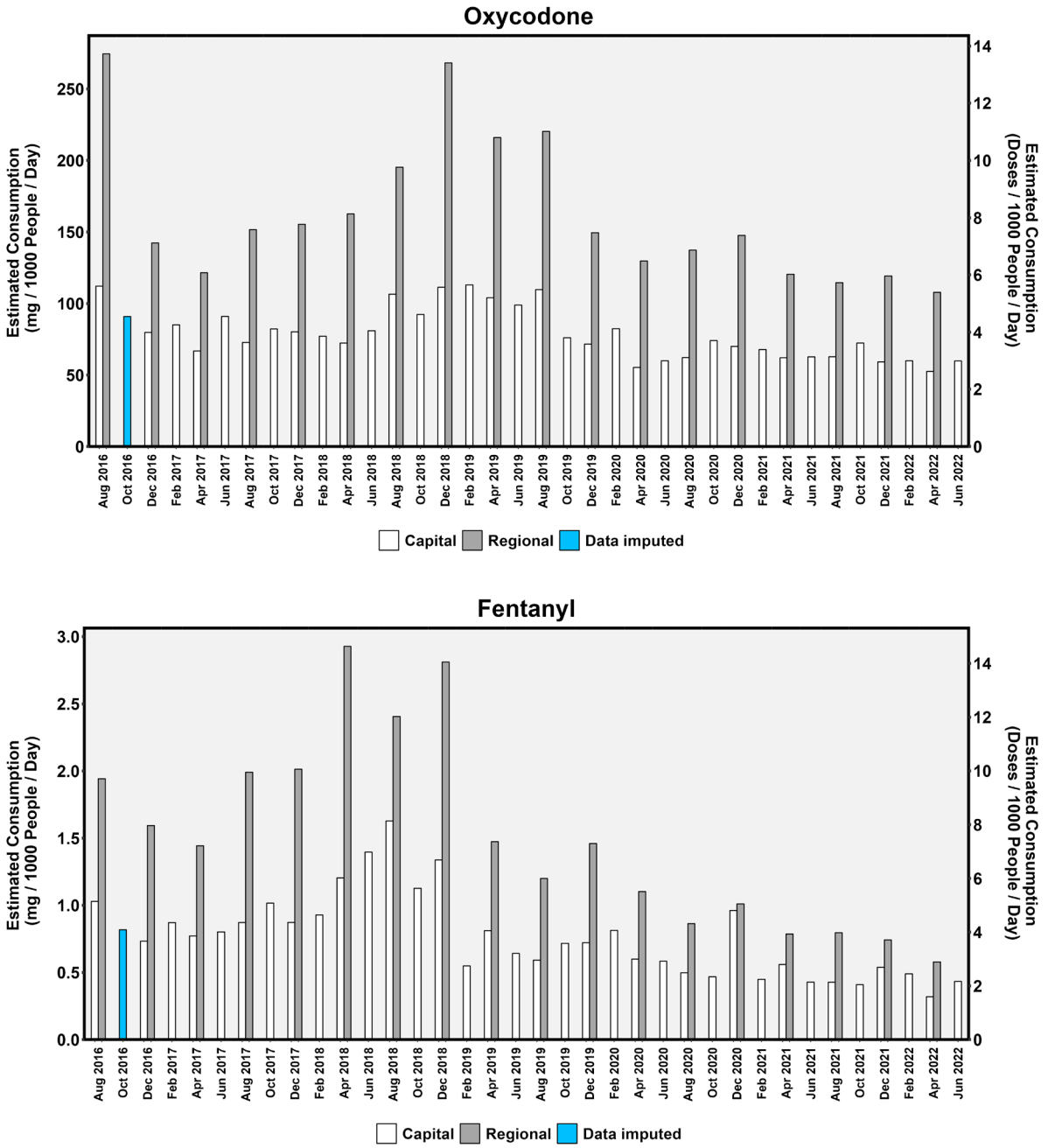
Regional areas are only sampled every second collection period. As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and December 2016 was used to provide the overall October estimate.

Figure 46: The population-weighted average of all sites for cocaine and MDA.



Regional areas are only sampled every second collection period. 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.

Figure 47: The population-weighted average of all sites for oxycodone and fentanyl.



Regional areas are only sampled every second collection period. 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.

Figure 48: The population-weighted average of all sites for heroin and ketamine.

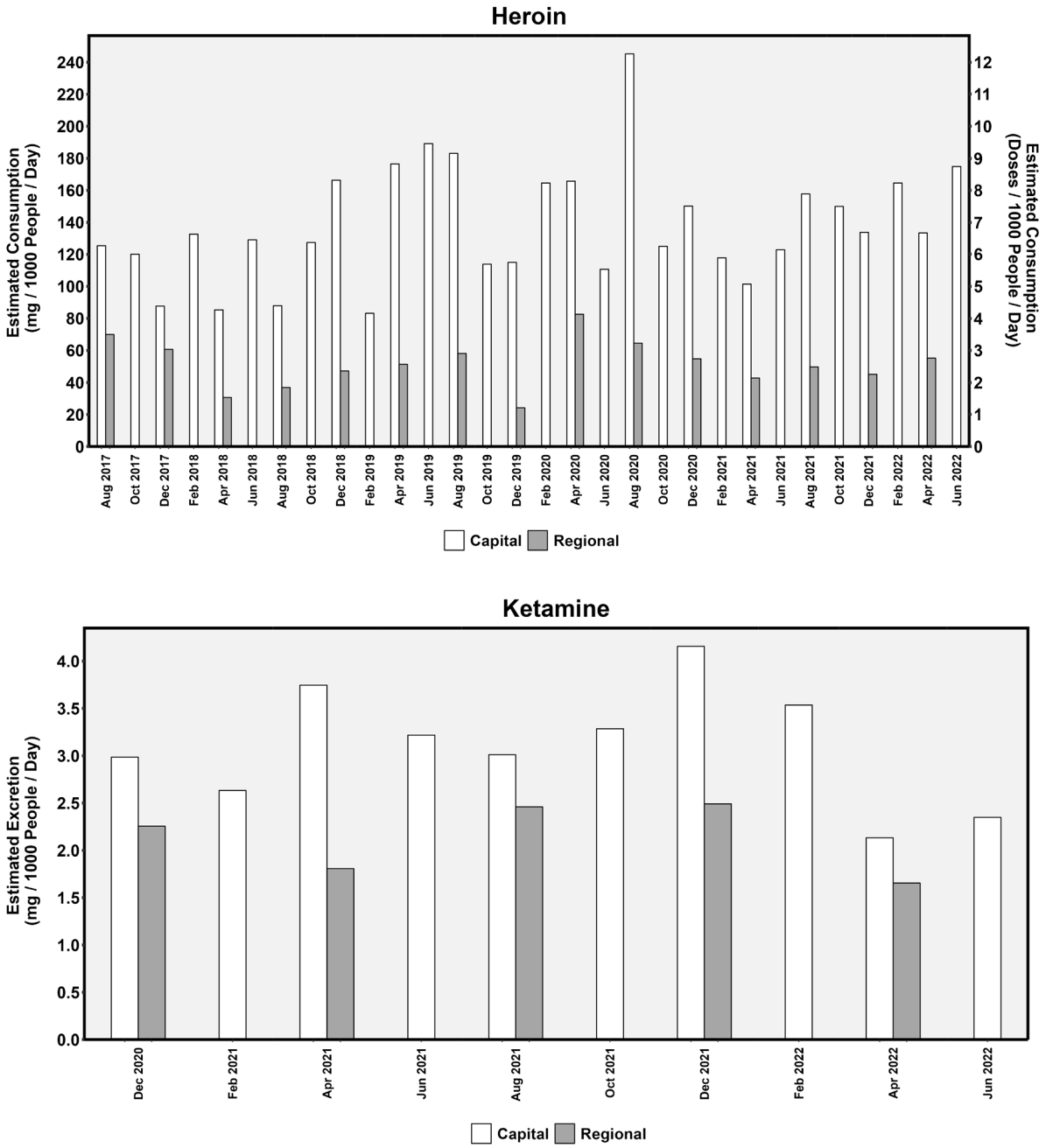
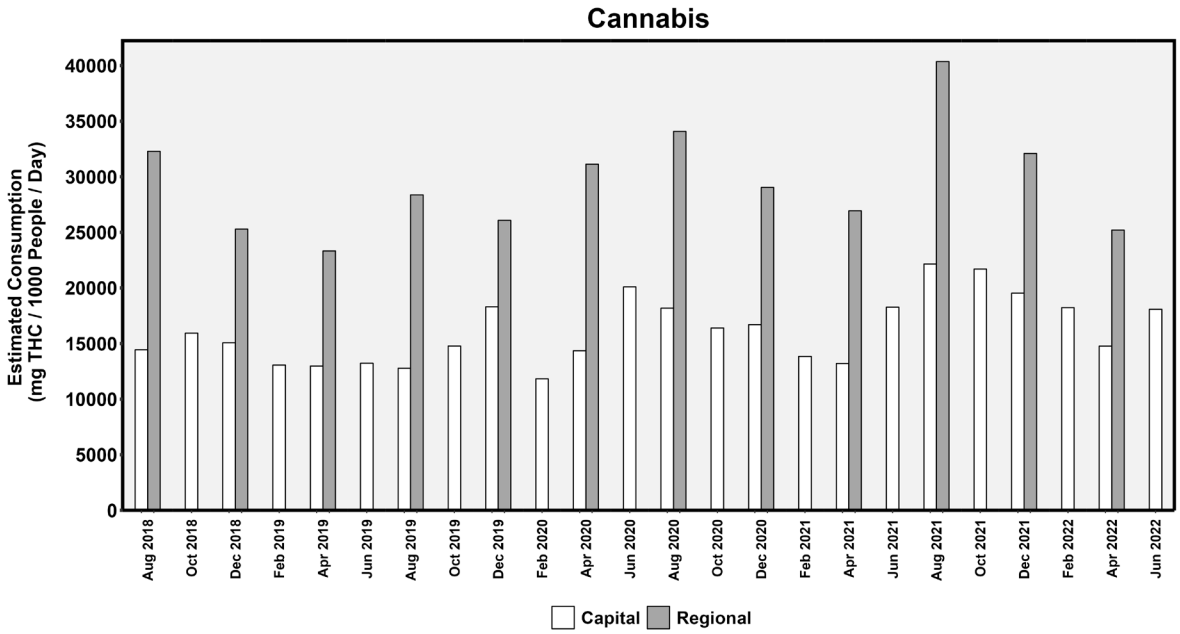


Figure 49: The population-weighted average of all sites for cannabis.



4.4 DRUG PROFILE FOR EACH STATE AND TERRITORY

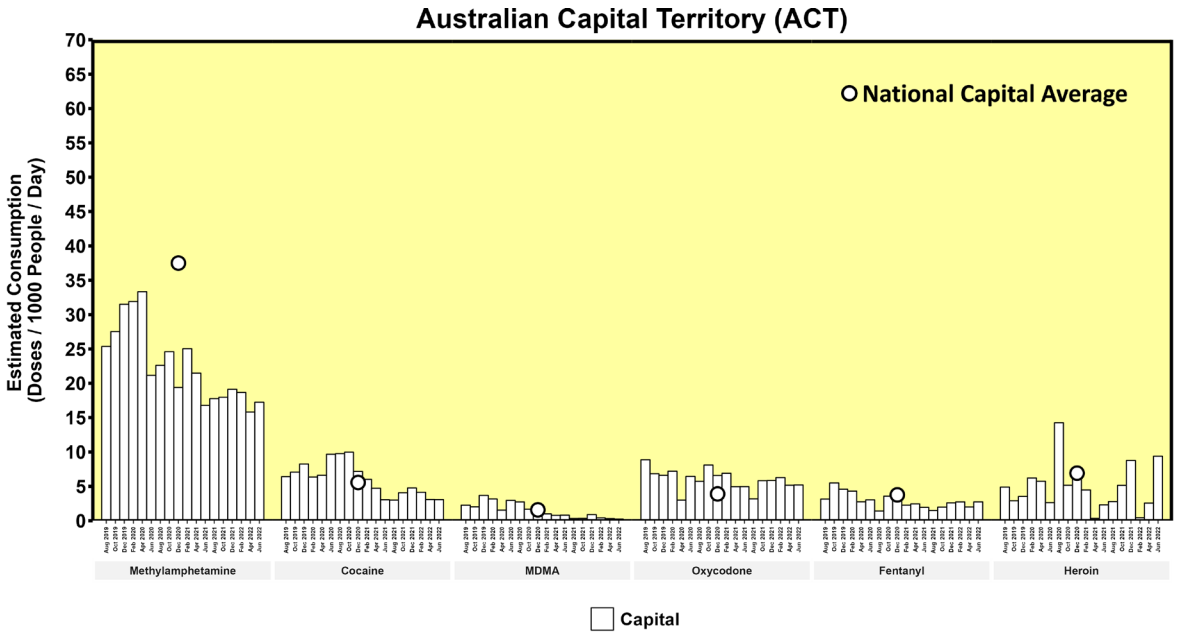
To compare the scale of use of different types of drugs within the same region (for example, within a state or territory), drug consumption was reported as the number of doses consumed and plotted on the same figure. Cannabis has been omitted from this section in this and previous reports since the definition of a typical dose of cannabis is not well defined. This will be included in comparisons when an appropriate dose for cannabis becomes available. In the absence of clear pharmacokinetic excretion data for MDA and ketamine, these compounds are also excluded from the section.

When the amount of drug measured in wastewater was normalised for population size and average dose consumed (excretion factors listed 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 was approximately 1,500 cigarettes (Figure 7) and 1,050 standard drinks (Figure 8), whereas for methylamphetamine, the national average consumption was approximately 40 doses per 1,000 people per day (Figure 11).

Aside from nicotine and alcohol, of the illicit stimulants with available dose information, methylamphetamine remained the highest (Figures 50 to 53). This was the case across all jurisdictions, with methylamphetamine consumption consistently high for both capital cities and regional areas. Even with the decrease in methylamphetamine consumption in some jurisdictions such as Western Australia during the period when COVID restrictions were in place, the drug was still present at higher levels than any other illicit substance (Figure 53). More recently, average consumption has become more similar in regional and capital city areas.

In terms of the profiles of other drugs monitored by the NWDMP (cocaine, MDMA, oxycodone and fentanyl), the patterns were less consistent. Cocaine consumption in most jurisdictions has been declining over the longer term, with some variability. Use in Tasmania has defied the trend, although cocaine consumption tended to be low in that state. MDMA use has similarly declined in most jurisdictions. In terms of the pharmaceutical opioids, both oxycodone and fentanyl use are trending downward at different rates, depending on the jurisdiction. Oxycodone, and to a lesser extent fentanyl, consumption tends to exceed that of some illicit substances in most jurisdictions. The relative scale of heroin consumption in capital city Victoria is a notable contrast to the rest of the country (Figure 53).

Figure 50: Profile of average drug consumption by state or territory, August 2019 to June 2022 for capital sites and to April 2022 for regional sites. 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). The circles represent the cumulative national average of all time points for respective drugs.



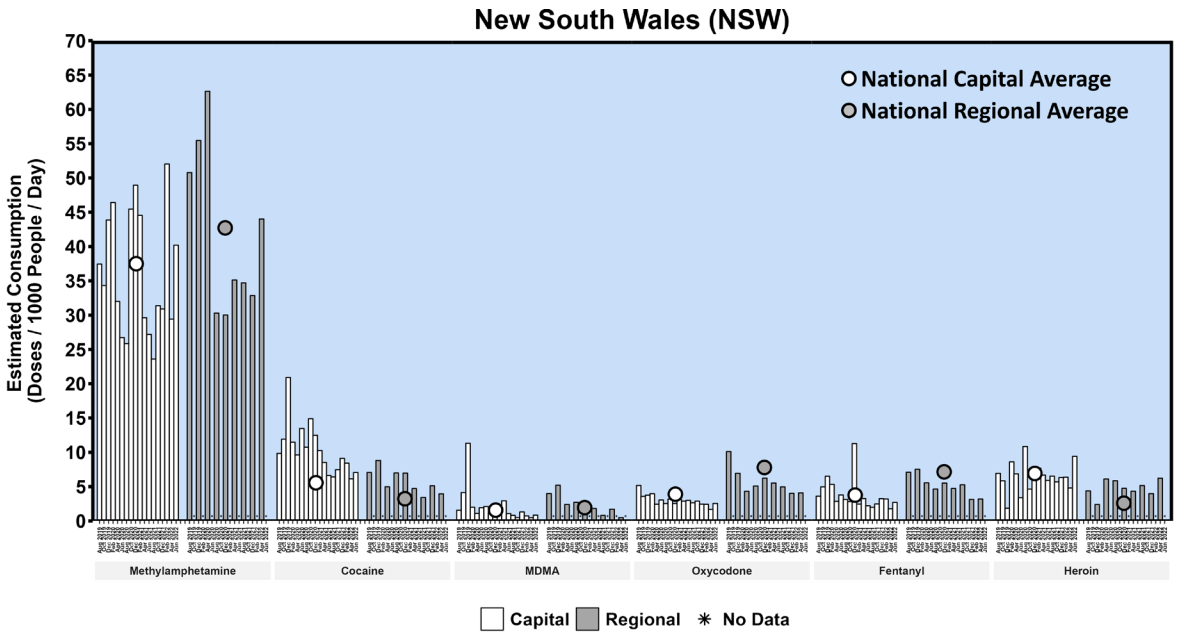


Figure 51: Profile of average drug consumption by state or territory, August 2019 to June 2022 for capital sites and to April 2022 for regional sites.

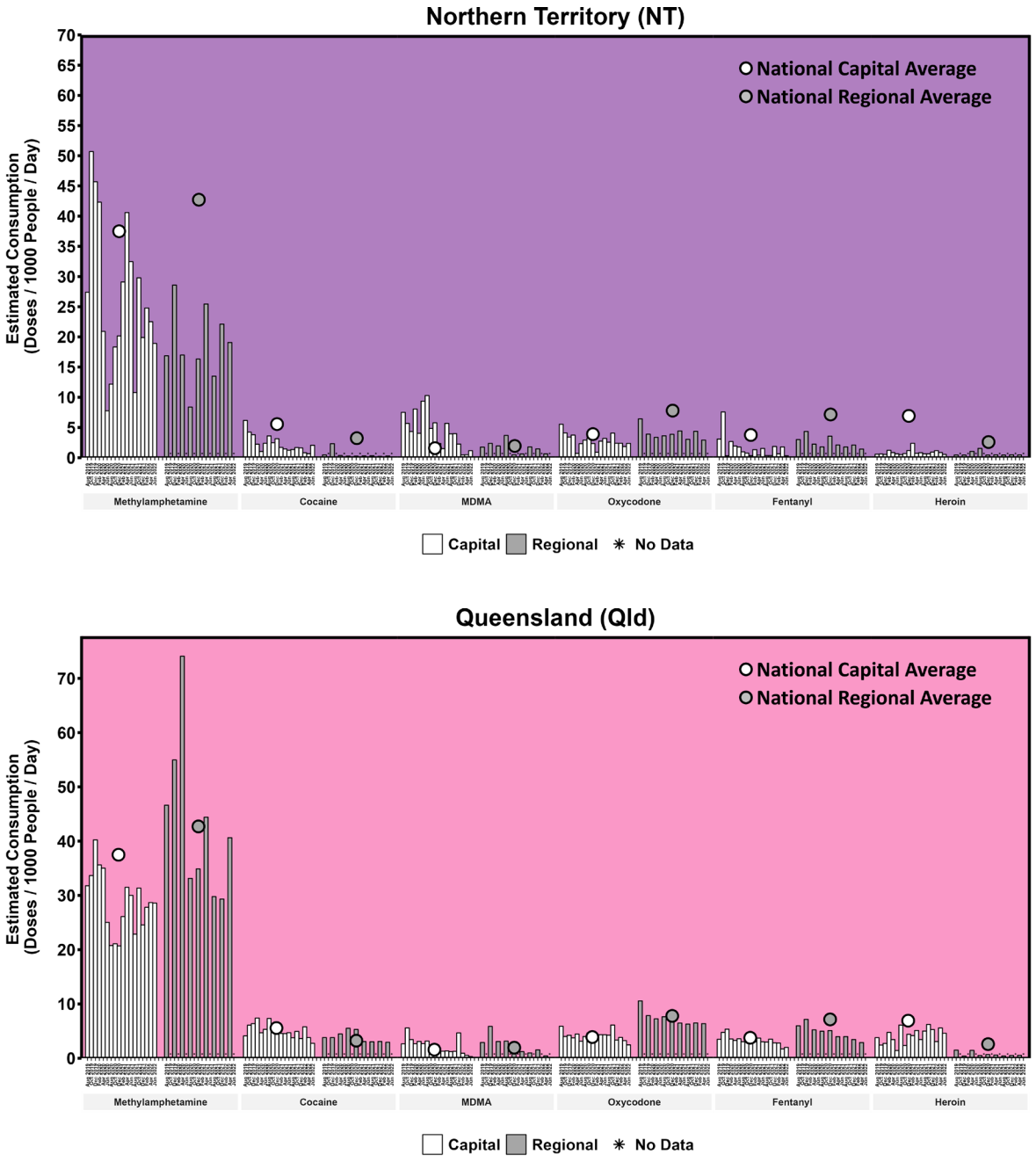
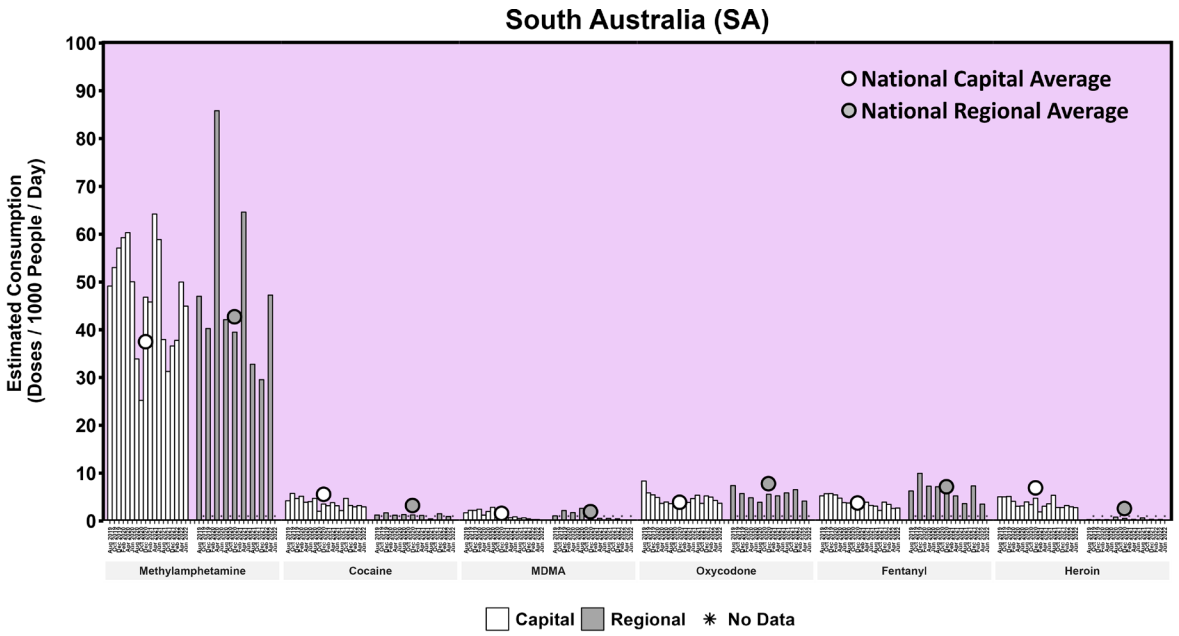


Figure 52: Profile of average drug consumption by state or territory, August 2019 to June 2022 for capital sites and to April 2022 for regional sites. Note: the y axis for South Australia is higher than the other jurisdictions.



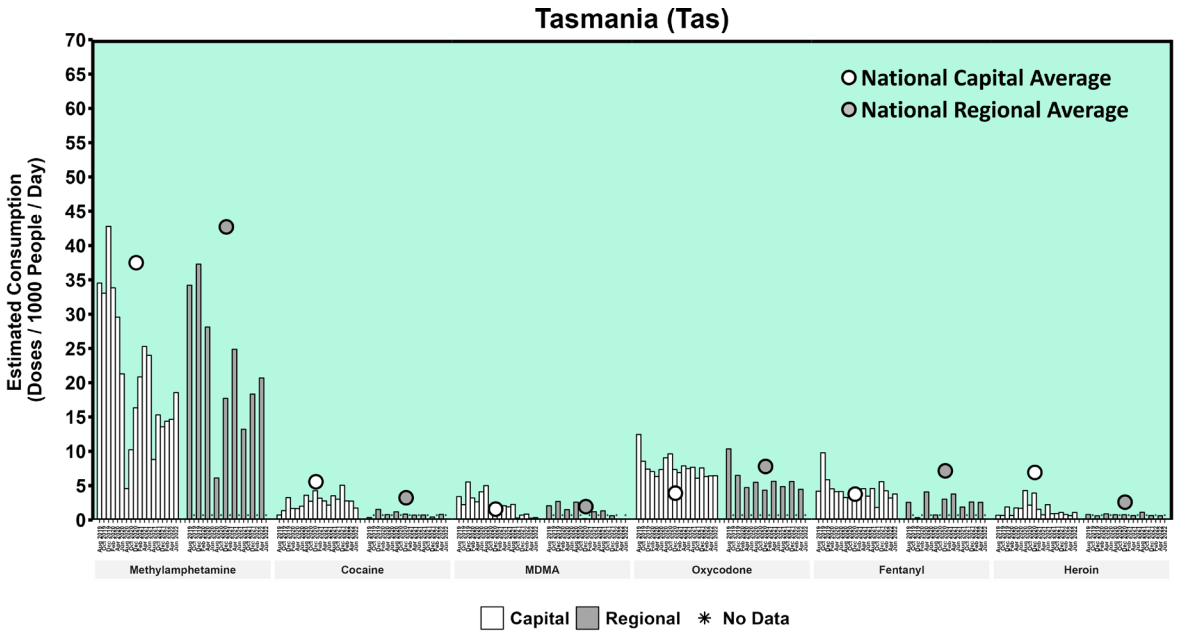
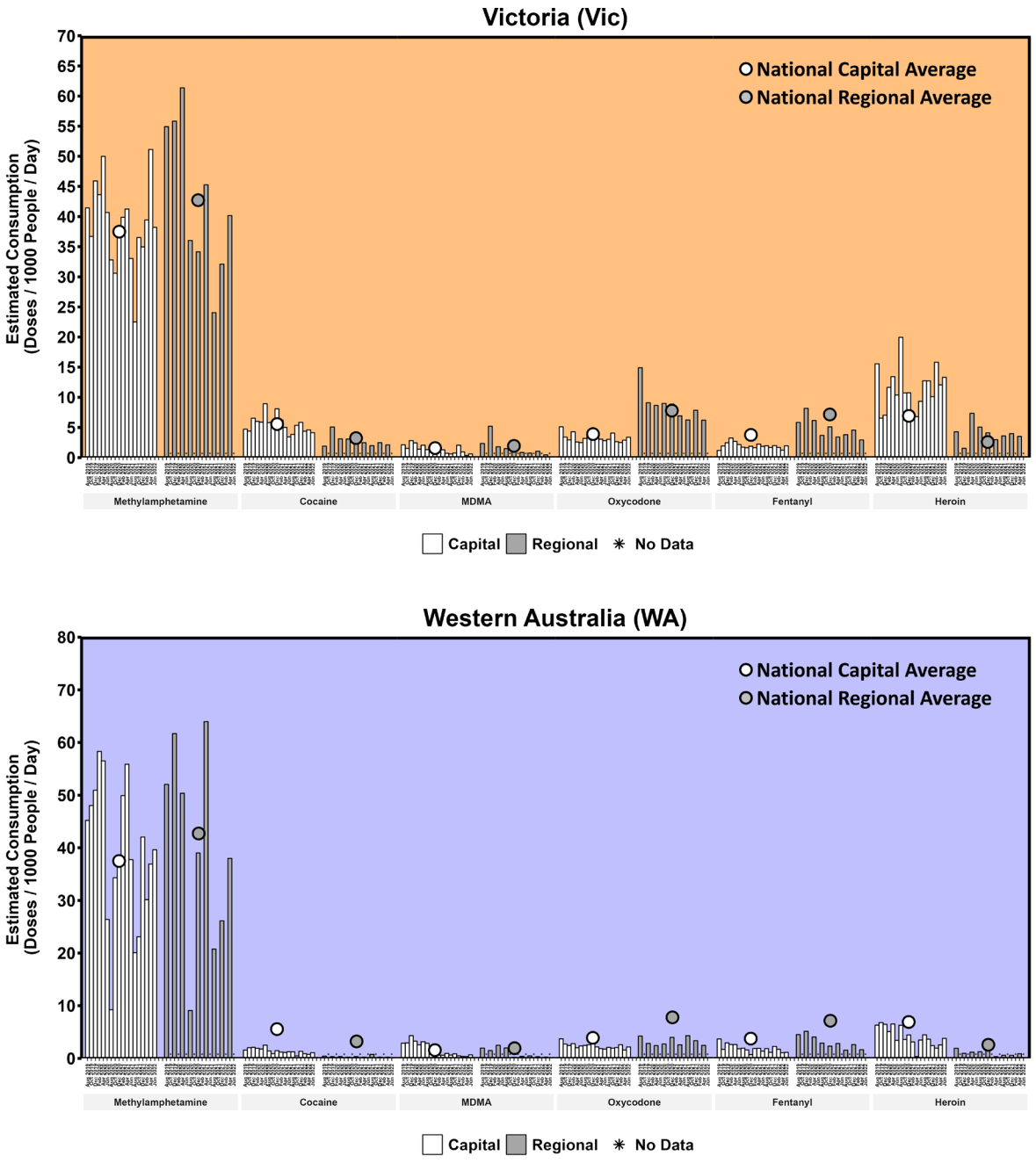


Figure 53: Profile of average drug consumption by state or territory, August 2019 to June 2022 for capital sites and to April 2022 for regional sites. Note: the y axis for Western Australia is higher than the other jurisdictions.



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The symbols/images used in Figure 3 in the report were provided courtesy of the Integration and Application Network, University of Maryland, Center for Environmental Science (ian.umces.edu/symbols/).

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7: APPENDICES

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

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

Analyte/metabolite	Drug	Limit of detection (LOD) [ng/L]	Limit of quantification (LOQ) [ng/L]	Excretion factor	Standard dose pure drug (mg)
Amphetamine	Amphetamine	12	16	0.394[a]	30[b]
Cocaine	Cocaine	17	50	0.075[b]	100[b]
Cotinine	Nicotine	33	100	0.3[c]	1.25[c]
Norfentanyl	Fentanyl	0.1	0.1	0.3[d]	0.2[d]
MDA *	MDA	1	4	n.a.	n.a.[#]
MDMA	MDMA	1.5	2	0.225[b]	100[b]
Mephedrone	Mephedrone	0.4	0.8	n.a.	n.a.
Methylamphetamine	Methylamphetamine	33	100	0.39[g]	30[b]
Methylone	Methylone	0.01	0.1	n.a.	n.a.
Hydroxycotinine	Nicotine	17	50	0.44[c]	1.25[c]
Noroxycodone	Oxycodone	0.1	1	0.22[f]	20[d]
Ethyl Sulphate	Alcohol (ethanol)	167	500	0.00012[e]	10g[e]
Benzoylecgonine	Cocaine	33	100	0.35[g]	100[b]
6-Monoacetylmorphine	Heroin	0.5	1.0	0.013[h]	20[i]
THC-COOH	THC (Cannabis)	30	180	0.006[b]	n.a.
Norketamine	Ketamine	1	2	n.a.^	n.a.

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, or 100 mg.

^Ketamine is excreted as norketamine and several conjugated metabolites. As the level of conjugation is not well known and conjugated metabolites (e.g., glucuronides) are likely to deconjugate in the sewer, a ketamine excretion rate has not been assigned at this time. Once the impact of in-sewer deconjugation is known, this will be revised.

APPENDIX 2: SAMPLING DETAILS FOR THIS REPORT

Site	Capital or regional	Apr 2022	Jun 2022	Population
ACT: 009	Capital	7	7	> 150,000
NSW: 003	Capital	7	7	> 150,000
NSW: 006	Capital	7	7	> 150,000
NSW: 008	Capital	7	7	> 150,000
NSW: 016	Regional	7	–	30,000 to 150,000
NSW: 025	Regional	7	–	30,000 to 150,000
NSW: 068	Regional	7	–	> 150,000
NSW: 081	Regional	7	–	< 30,000
NSW: 115	Regional	7	–	30,000 to 150,000
NSW: 163	Regional	7	–	< 30,000
NSW: 164	Regional	7	–	< 30,000
NSW: 165	Regional	7	–	< 30,000
NT: 010	Capital	7	7	30,000 to 150,000
NT: 078	Regional	7	–	< 30,000
Qld: 002	Capital	7	7	> 150,000
Qld: 005	Capital	7	7	> 150,000
Qld: 011	Capital	7	7	> 150,000
Qld: 012	Regional	7	–	> 150,000
Qld: 024	Regional	7	–	30,000 to 150,000
Qld: 028	Regional	7	–	30,000 to 150,000
Qld: 029	Regional	7	–	30,000 to 150,000
Qld: 033	Regional	7	–	30,000 to 150,000
Qld: 042	Regional	7	–	30,000 to 150,000
Qld: 053	Regional	7	–	< 30,000
Qld: 077	Regional	7	–	< 30,000
SA: 007	Capital	7	7	> 150,000
SA: 013	Capital	7	7	> 150,000
SA: 027	Capital	7	7	30,000 to 150,000
SA: 059	Capital	7	7	> 150,000
SA: 017	Regional	7	–	< 30,000
SA: 022	Regional	7	–	< 30,000
SA: 063	Regional	7	–	< 30,000
SA: 076	Regional	7	–	< 30,000
SA: 119	Regional	7	–	< 30,000
Tas: 004	Capital	5	5	< 30,000
Tas: 019	Capital	5	5	< 30,000
Tas: 041	Capital	5	5	< 30,000
Tas: 018	Regional	5	–	< 30,000
Tas: 048	Regional	5	–	< 30,000

APPENDIX 2 (CONTINUED)

Site	Capital or regional	Apr 2022	Jun 2022	Population
Vic: 001	Capital	7	7	> 150,000
Vic: 067	Capital	7	7	> 150,000
Vic: 037	Regional	7	–	> 150,000
Vic: 061	Regional	7	–	30,000 to 150,000
Vic: 066	Regional	7	–	30,000 to 150,000
Vic: 114	Regional	7	–	30,000 to 150,000
Vic: 121	Regional	7	–	< 30,000
Vic: 122	Regional	7	–	< 30,000
Vic: 125	Regional	7	–	30,000 to 150,000
Vic: 155	Regional	7	–	30,000 to 150,000
Vic: 156	Regional	7	–	< 30,000
WA: 101	Capital	7	7	> 150,000
WA: 103	Capital	7	7	> 150,000
WA: 104	Capital	7	7	> 150,000
WA: 102	Regional	7	–	30,000 to 150,000
WA: 116	Regional	7	–	< 30,000
WA: 120	Regional	7	–	30,000 to 150,000
WA: 129	Regional	7	–	< 30,000
Regional Sites	37	–		
Capital Sites	20	20		
Total Sites	**57**	**20**		
Regional Samples	255	–		
Capital Samples	134	134		
Total Samples	389	134		
Cumulative Samples	**8,403**	**8,537**		

APPENDIX 3: PROPORTION OF SAMPLES ABOVE LOD (%) FOR EACH DRUG AND PERIOD ASSESSED[5]

Drug	Capital or regional	Apr 2022	Jun 2022
Alcohol	Capital	100	100
Alcohol	Regional	100	–
Cannabis	Capital	98	100
Cannabis	Regional	98	–
Cocaine	Capital	97	100
Cocaine	Regional	79	–
Fentanyl	Capital	97	93
Fentanyl	Regional	89	–
Heroin	Capital	73	78
Heroin	Regional	36	–
Ketamine	Capital	95	97
Ketamine	Regional	77	–
MDA	Capital	28	67
MDA	Regional	14	–
MDMA	Capital	96	99
MDMA	Regional	91	–
Methylamphetamine	Capital	100	100
Methylamphetamine	Regional	100	–
Nicotine	Capital	100	100
Nicotine	Regional	100	–
Oxycodone	Capital	100	100
Oxycodone	Regional	100	–

5 Percentage detections for previous collection periods are available in Appendix 4 of Report 6 and Appendix 3 of Reports 7 to 16.

APPENDIX 4: POPULATION ESTIMATE CHANGES FROM 2016 TO 2021, APPLIED FROM APRIL 2022[6]

Site	State	Capital or regional	Change from 2016 population (%)	Annual change (%)
009	ACT	Capital	12.1	2.4
003	NSW	Capital	8.4	1.7
006	NSW	Capital	7.5	1.5
008	NSW	Capital	1.4	0.3
071	NSW	Capital	5.3	1.1
016	NSW	Regional	6.1	1.2
021	NSW	Regional	6.1	1.2
025	NSW	Regional	8.1	1.6
040	NSW	Regional	3.2	0.6
051	NSW	Regional	1.3	0.3
068	NSW	Regional	4.0	0.8
081	NSW	Regional	-5.0	-1.0
115	NSW	Regional	5.6	1.1
163	NSW	Regional	0.1	0.0
164	NSW	Regional	-2.6	-0.5
165	NSW	Regional	2.7	0.5
010	NT	Capital	5.3	1.1
078	NT	Regional	3.3	0.7
002	Qld	Capital	13.9	2.8
005	Qld	Capital	15.7	3.1
011	Qld	Capital	14.5	2.9
012	Qld	Regional	11.3	2.3
020	Qld	Regional	12.1	2.4
024	Qld	Regional	10.0	2.0
028	Qld	Regional	23.4	4.7
029	Qld	Regional	5.4	1.1
033	Qld	Regional	8.1	1.6
039	Qld	Regional	-0.8	-0.2
042	Qld	Regional	2.3	0.5
053	Qld	Regional	9.5	1.9
077	Qld	Regional	4.1	0.8
092	Qld	Regional	8.4	1.7

6 Population estimates were revised and used from April 2022. New estimates used Census 2021 usual residential populations of the wastewater treatment plant service areas. Negative population change indicates a decrease in population estimate from 2016 to 2021 population estimates of the usual residential population. Note: the method used to estimate the population was revised for the 2021 estimate, using the proportion of addresses within the catchment as a weighting factor to sum the proportion of Census mesh block populations within the catchment area. Previous estimates used the proportion of mesh blocks by area within the catchment to calculate the catchment population. The new method has fewer assumptions and should yield better population estimates in rural areas.

APPENDIX 4: (CONTINUED)

Site	State	Capital or regional	Change from 2016 population (%)	Annual change (%)
007	SA	Capital	8.9	1.8
013	SA	Capital	8.9	1.8
027	SA	Capital	14.3	2.9
059	SA	Capital	5.4	1.1
017	SA	Regional	2.3	0.5
022	SA	Regional	9.1	1.8
063	SA	Regional	1.2	0.2
076	SA	Regional	1.2	0.2
119	SA	Regional	-2.2	-0.4
004	Tas	Capital	15.7	3.1
019	Tas	Capital	13.0	2.6
041	Tas	Capital	19.7	3.9
018	Tas	Regional	5.2	1.0
038	Tas	Regional	8.6	1.7
048	Tas	Regional	5.7	1.1
058	Tas	Regional	5.8	1.2
001	Vic	Capital	6.0	1.2
067	Vic	Capital	5.1	1.0
037	Vic	Regional	18.1	3.6
046	Vic	Regional	14.1	2.8
061	Vic	Regional	8.9	1.8
062	Vic	Regional	8.9	1.8
066	Vic	Regional	5.9	1.2
114	Vic	Regional	15.0	3.0
121	Vic	Regional	5.2	1.0
122	Vic	Regional	8.3	1.7
123	Vic	Regional	20.9	4.2
124	Vic	Regional	-0.4	-0.1
125	Vic	Regional	4.3	0.9
155	Vic	Regional	-11.4	-2.3
156	Vic	Regional	-8.9	-1.8
101	WA	Capital	9.1	1.8
103	WA	Capital	12.0	2.4
104	WA	Capital	9.6	1.9
102	WA	Regional	4.0	0.8
116	WA	Regional	0.2	0.0
118	WA	Regional	-1.4	-0.3
120	WA	Regional	-12.7	-2.5
129	WA	Regional	-1.1	-0.2

CONCLUSIONS

For the 17th report of the National Wastewater Drug Monitoring Program, wastewater analysis was conducted in April (capital city and regional sites) and June 2022 (capital city sites only). The Program 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 with known doses, nicotine and alcohol are the most consumed drugs in Australia, while methylamphetamine remains the most consumed illicit drug.[7]

METHYLAMPHETAMINE

When comparing data for December 2021 and April 2022, the population-weighted average consumption of methylamphetamine increased in both capital city and regional sites. Average capital city methylamphetamine consumption then decreased from April to June 2022. In April 2022, regional methylamphetamine consumption exceeded capital city consumption. In April 2022, Victoria had the highest estimated average capital city consumption of methylamphetamine, while South Australia had the highest average regional consumption.

COCAINE

When comparing data for December 2021 and April 2022, the population-weighted average consumption of cocaine decreased in both capital city and regional sites. Average capital city cocaine consumption then increased from April to June 2022. Average capital city cocaine consumption continued to exceed average regional consumption. In April 2022, New South Wales had the highest estimated average capital city and regional consumption of cocaine.

3,4-METHYLENEDIOXYMETHYLAMPHETAMINE (MDMA)

When comparing data for December 2021 and April 2022, the population-weighted average consumption of MDMA decreased in capital city and regional sites, both to record low levels. Average capital city MDMA consumption then increased from April to June 2022. In April 2022, average regional MDMA consumption exceeded capital city consumption. In April 2022, Queensland had the highest estimated average capital city MDMA consumption, while the Northern Territory[8] had the highest regional consumption.

3,4-METHYLENEDIOXYAMPHETAMINE (MDA)

MDA is a metabolite of MDMA, but also an illicit drug in its own right. When comparing data for December 2021 and April 2022, MDA excretion decreased in capital city and regional sites, both to record low levels. Average capital city MDA excretion then increased from April to June 2022. In April 2022, average regional MDA excretion exceeded average capital city excretion. In April 2022, Queensland had the highest estimated average capital city excretion of MDA, while the Northern Territory[9] had the highest average regional excretion.

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

8 As the Northern Territory only had 2 participating sites, results may not be representative of the Territory as a whole, however the 2 sites cover approximately 25% of the population of the Northern Territory.

9 Ibid.

HEROIN

When comparing data for December 2021 and April 2022, the population-weighted average consumption of heroin was relatively stable in the capital cities and increased in regional sites. Average capital city heroin consumption then increased from April to June 2022. Average capital city heroin consumption continued to exceed average regional consumption. In April 2022, Victoria had the highest estimated average capital city consumption of heroin, while New South Wales had the highest average regional consumption.

CANNABIS

When comparing data for December 2021 and April 2022, the population-weighted average consumption of cannabis decreased in both capital city and regional sites. Average capital city cannabis consumption then increased from April to June 2022. Average regional cannabis consumption continued to exceed average capital city consumption. In April 2022, Tasmania had the highest estimated average capital city consumption of cannabis, while South Australia had the highest average regional consumption.

KETAMINE

When comparing data for December 2021 and April 2022, the population-weighted average excretion of ketamine decreased in both capital city and regional sites. Average ketamine excretion then increased from April to June 2022. Average capital city ketamine excretion exceeded regional ketamine excretion. In April 2022, Victoria had the highest estimated average capital city and regional ketamine excretion.

OXYCODONE

When comparing data for December 2021 and April 2022, the population-weighted average consumption of oxycodone decreased in capital city and regional sites, both to record low levels. Average capital city oxycodone consumption then increased from April to June 2022. Average regional oxycodone consumption continued to exceed average capital city consumption. In April 2022, Tasmania had the highest estimated average capital city consumption of oxycodone, while Queensland had the highest average regional consumption.

FENTANYL

When comparing data for December 2021 and April 2022, the population-weighted average consumption of fentanyl decreased in capital city and regional sites, both to record low levels. Average capital city fentanyl consumption then increased from April to June 2022. Average regional fentanyl consumption continued to exceed average capital city consumption. In April 2022, Tasmania had the highest estimated average capital city consumption of fentanyl, while South Australia had the highest average regional consumption.

NICOTINE

When comparing data for December 2021 and April 2022, the population-weighted average consumption of nicotine decreased in both capital city and regional sites. Average capital city nicotine consumption then increased from April to June 2022. Average regional nicotine consumption continued to exceed average capital city consumption. In April 2022, the Northern Territory[10] had the highest estimated average capital city and regional consumption of nicotine.

ALCOHOL

When comparing data for December 2021 and April 2022, the population-weighted average consumption of alcohol decreased in both capital city and regional sites. Average capital city alcohol consumption then increased from April to June 2022. Average regional alcohol consumption exceeded average capital city consumption. In April 2022, the Northern Territory[11] had the highest estimated average capital city and regional consumption of alcohol.

NEXT REPORT

The 18th report of the National Wastewater Drug Monitoring Program is scheduled for public release in February 2023.

10 As the Northern Territory only had 2 participating sites, results may not be representative of the Territory as a whole, however the 2 sites cover approximately 25% of the population of the Northern Territory.

11 Ibid.