

## Estimates of people who inject drugs in NSW and Australia

### Key messages

- We estimated that in 2014, 36,000 (lower and upper limits of 26,300 and 45,800) people aged 15-64 years injected drugs in NSW
- Injecting drug use is more common among men than women, and we estimate most common among those aged 35-44 years
- The Local Health Districts estimated to have the largest populations of people who inject drugs were Sydney, South Western Sydney and Hunter New England
- Nationally, we estimated that in 2014, 93,000 (lower and upper limits of 67,800 and 118,200) people aged 15-64 years injected drugs
- Validation using data on drug-related deaths suggest these figures are underestimates of the population of people who inject drugs
- This work has identified that there are limited data available to inform estimates of this population in NSW and Australia
- There is a need for greater linkage between administrative data sets and other surveys of people who inject drugs in order to inform more sophisticated methods of population estimation, such as multi-parameter evidence synthesis

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## Background and methods

Injecting drug use is associated with considerable morbidity and mortality, including viral hepatitis and HIV transmission as a result of shared use of needles and syringes. Needle and syringe programs (NSP) assist people who inject drugs to reduce their risk for HCV and HIV infection.<sup>1</sup> An understanding of the population prevalence of injecting drug use informs planning of NSP and other services for people who inject drugs, and allows for estimation of NSP coverage.

We have estimated the number of people who injected drugs in 2014:

- a. In New South Wales (NSW), by sex, age group, and Local Health District (LHD)
- b. In Australia, by sex, age group and state/territory

As a 'hidden' population, we have used *multiplier methods* to derive these estimates.<sup>2,3</sup> This method uses benchmark data that enumerate, at a population level, a behaviour or outcome associated with injecting drug use. The benchmark data are multiplied by a factor derived from the prevalence of that behaviour or outcome in a sample of people who inject drugs, giving an estimate of the total population.

*A hypothetical example of the multiplier method:*

- There were 200 in drug treatment in a population in one year
- 20% of people in a cohort of people who inject drugs were in treatment in one year
- $200 \times (1/0.2) = 1,000$  people who inject drugs

The multiplier method assumes that the prevalence of a specified behaviour or outcome in people who inject drugs is known. However, as a hidden, stigmatised population, it is not possible to obtain a completely random sample of people who inject drugs. As such, multipliers may not reflect the true distribution of the behaviour in the total population of people who inject drugs, therefore under- or over-estimating the true population size. Despite this limitation, multiplier methods are widely used and considered an appropriate method for estimating people who inject drugs if other methods are not feasible.<sup>4</sup>

Full details of the methods used to derive the estimates reported here are provided in the Methodological Appendix. In brief, we sourced potential benchmark data from multiple data custodians within the NSW Ministry of Health, the NSW Bureau of Crime Statistics and Research, the Australian Bureau of Statistics, and the Australian Institute of Health and Welfare. A search of the

peer-reviewed and grey literature was undertaken to identify potential multipliers to apply to the benchmark data. The custodians of surveillance studies relating to injecting drug use (e.g. Illicit Drug Reporting System; Australian Needle and Syringe Program Survey) were also approached to provide specific data points to inform multipliers.

After reviewing the data collected, we elected to use benchmark and multiplier data relating to opioid substitution therapy as reported in the National Opioid Pharmacotherapy Statistics Annual Data Collection. Benchmark data for this indicator, and relevant multipliers, were available for NSW, other states and territories, and nationally. For LHD estimates, benchmark data were taken from the Pharmaceutical Drugs of Addiction System. People receiving OST were allocated to LHDs based on postcode of treatment, and the NSW multiplier was used across all LHDs.

The NSW and national estimates were stratified by sex and age group using the sex and age group distributions observed in the various data sources that were collated for this study. Denominators for population prevalence of injecting drug use were obtained from the Australian Bureau of Statistics and HealthStats NSW.

Work was informed by reference group meetings comprising members from NSW Ministry of Health, the NSW Hepatitis B and C Strategies Implementation Committee and Needle and Syringe Program Planning Committee, community organisations, and researchers. Reference group members are listed in the Acknowledgements.

## Estimates of people who inject drugs in NSW

We estimate that in 2014, there were 36,000 (lower and upper limits of 26,300 and 45,800) people aged 15-64 years who injected drugs in NSW (Table 1). The population prevalence of injecting drug use was 7.3 per 1,000 people aged 15-64 years. Injecting drug use was more common among men than women, and most common among those aged 35-44 years.

Table 1: Estimates of people who inject drugs aged 15-64 years in NSW, 2014

Group	Estimated number of people who inject drugs			Prevalence of injecting drug use per 1,000 of population		
	Lower	Mid	Upper	Lower	Mid	Upper
All persons	26,300	36,000	45,800	5.3	7.3	9.3
Sex						
Male	17,900	24,500	31,100	7.2	9.9	12.6
Female	8,400	11,500	14,700	3.4	4.7	5.9
Age group						
15-24 years	1,300	1,800	2,000	1.3	1.8	2.3
25-34 years	6,300	8,700	11,000	5.8	8.0	10.2
35-44 years	9,700	13,300	16,900	9.5	13.0	16.5
45-54 years	6,600	9,000	11,500	6.7	9.1	11.6
55-64 years	2,400	3,200	4,100	2.7	3.7	4.7
Local Health Districts						
Central Coast	1,200	1,700	2,200	6.1	8.4	10.7
Far West	<100	<100	<100	2.0	2.7	3.4
Hunter New England	2,600	3,600	4,600	4.7	6.4	8.1
Illawarra Shoalhaven	1,400	1,900	2,400	5.6	7.7	9.7
Murrumbidgee	400	600	800	3.0	4.1	5.1
Mid North Coast	800	1,100	1,400	6.6	9.0	11.4
Nepean Blue Mountains	1,200	1,600	2,000	4.8	6.6	8.4
Northern NSW	1,200	1,700	2,100	6.8	9.3	11.8
North Sydney	1,100	1,500	1,900	1.9	2.6	3.3
South Eastern Sydney	2,400	3,300	4,200	3.9	5.3	6.7
Sydney	3,100	4,200	5,400	6.9	9.5	12.0
Southern NSW	600	800	1,000	4.4	6.0	7.6
South Western Sydney	3,000	4,200	5,300	5.0	6.8	8.7
Western NSW	800	1,100	1,400	4.6	6.3	8.0
Western Sydney	2,300	3,200	4,000	3.8	5.2	6.6

Notes: Sex and age group estimates may not sum to the NSW estimate due to rounding. LHD estimates may not sum to the NSW estimate due to rounding, exclusion of incarcerated persons from LHD estimates, and missing LHD data in the benchmark dataset.

The largest estimated numbers of people who inject drugs were seen in the Sydney, South Western Sydney and Hunter New England LHDs, with the highest prevalence of injecting drug use estimated for Sydney, Northern NSW and Mid North Coast LHDs (Table 1). Two caveats must be kept in mind in interpreting LHD estimates: these estimates are based on the LHD where treatment was received,

rather than LHD of residence, and a state-wide multiplier was used, as LHD-level multipliers produced implausible estimates. The accuracy of LHD estimates may be affected by differential access to OST by geographical area. This is discussed in further detail below.

## Estimates of people who inject drugs in Australia

Nationally, we estimated that there were 93,000 (lower and upper limits of 67,800 and 118,200) people aged 15-64 years who injected drugs in Australia in 2014, for a population prevalence of 6.0 per 1,000 people aged 15-64 years (Table 2). As in NSW, injecting drug use was more common among men than women, and most common among those aged 35-44 years. Prevalence of injecting drug use varied between states and territories; NSW, South Australia and Victoria had the highest estimated prevalence of injecting drug use.

*Table 2: Estimates of people who inject drugs aged 15-64 years in Australia, 2014*

Group	Estimated number of people who inject drugs			Prevalence of injecting drug use per 1,000 of population		
	Lower	Mid	Upper	Lower	Mid	Upper
All persons	67,800	93,000	118,200	4.3	6.0	7.6
Sex						
Male	46,100	63,300	80,400	5.9	8.1	10.3
Female	21,700	29,800	37,800	2.8	3.8	4.9
Age group						
15-24 years	2,700	3,700	4,700	0.9	1.2	1.5
25-34 years	16,300	22,300	28,400	4.7	6.4	8.2
35-44 years	25,800	35,300	44,900	8.0	11.0	13.9
45-54 years	17,000	23,300	29,500	5.5	7.5	9.5
55-64 years	6,100	8,400	10,600	2.3	3.1	4.0
States and territories						
New South Wales	26,300	36,000	45,800	5.3	7.3	9.3
Victoria	15,900	21,800	27,700	4.1	5.6	7.1
Queensland	12,200	16,700	21,200	3.9	5.3	6.8
Western Australia	6,300	8,600	10,900	3.6	4.9	6.2
South Australia	4,900	6,700	8,600	4.5	6.1	7.8
Tasmania	900	1,200	1,500	2.6	3.6	4.5
Australian Capital Territory	1,000	1,400	1,700	3.7	5.1	6.4
Northern Territory	400	600	800	2.6	3.5	4.5

Note: Sex and age group estimates may not sum to the total estimate due to rounding. Northern Territory estimate based on 5-year rolling average due to low annual numbers in benchmark and multiplier data sources.

## **Validation**

If we assume an annual drug-related mortality rate of 0.53% among people who inject drugs,<sup>5</sup> and apply this rate to the above estimates, in NSW we would expect to see between 139 and 243 drug-induced deaths that are potentially related to injecting drug use (i.e. opioid-, amphetamine-, or cocaine-induced deaths). There were 262 such deaths in NSW in 2014. Nationally, we would expect to see between 360 and 626 drug-related deaths; in 2014, there were 846 such deaths. Although not all of these deaths would be related to injecting drug use (particularly given recent increases in pharmaceutical opioid use and fatalities among people without a history of injecting drug use), the number of actual opioid-, amphetamine-, or cocaine-induced deaths is greater than would be expected based on these estimates.

## Interpretation and discussion

We used multiplier methods to estimate that there were 26,300-45,800 people in NSW aged 15-64 years who injected drugs in 2014. This equates to 5-9 people who inject drugs per 1,000 people aged 15-64. Nationally, we estimated 67,800-118,200 people aged 15-64 years injected drugs in 2014, equating to 4-8 people who inject drugs per 1,000 people aged 15-64 years. Comparison of expected drug-related deaths based on these estimates to actual drug-related deaths suggests that these may be underestimates of the true prevalence of injecting drug use. Alternatively, it may be that the mortality rate used in the validation exercise, derived from a cohort of people who inject drugs based in Melbourne, is not applicable to other settings.

One possible source of bias influencing these estimates is the potential underrepresentation of people who primarily inject methamphetamine in the data used to generate the multiplier. The Australian NSP Survey interviews people attending NSPs during a 1-2 week period each year. This methodology is ideal for recruitment of people who inject regularly (i.e. daily or almost daily). This pattern of injecting is commonly associated with opioid injecting. Methamphetamine injecting, on the other hand, is less frequent and may involve short periods of intense use (i.e. 'binges'). If people who primarily inject methamphetamine are underrepresented in the Australian NSP Survey data, this will artificially lower the multiplier, thereby underestimating people who inject drugs.

In relation to the LHD estimates, an important and likely source of bias is that our multiplier assumes a consistent level of OST engagement among people who inject drugs across the state of NSW. This is not the case. In those LHDs with a lower proportion of NSP survey respondents in OST, the multiplier would be too low, again underestimating people who inject drugs. An attempt was made to use LHD-specific multipliers for these estimates, but these produced highly implausible estimates for some LHDs. We recommend particular caution in interpreting the LHD estimates of people who inject drugs, and further recommend more methodologically sophisticated approaches to estimating these populations, as described below.

The estimates presented here can be compared to findings from the 2013 National Drug Strategy Household Survey, which estimated 12-month prevalence of injecting drug use at 0.3%, or around 60,000 people nationally.<sup>6</sup> This is fewer than the lower bound of the national estimate presented here, but this is to be expected since general population surveys underestimate injecting drug use for several reasons. First, sampling excludes people who are homeless, unstably housed or incarcerated; secondly, if contacted, people who inject drugs may be reluctant to participate and/or

disclose this behaviour.<sup>2</sup> We would therefore expect our estimates to be greater than estimates derived from general population surveys.

The most recent indirect prevalence estimates of people who inject drugs in Australia were for 2005, when it was estimated that there were 215,000 (lower and upper limits of 128,000 and 294,000) people who had injected drugs in the past 12 months.<sup>7</sup> This estimate was derived by taking a previous estimate of the population (itself obtained via a process of expert consultation and consensus<sup>8</sup>), and modelling a decline in injecting drug use from 2001 onwards, consistent with observed reductions in heroin- and injecting-related indicators.<sup>7</sup> Crucially, the consensus estimate from which the 2005 estimate was derived was not validated, and therefore its veracity cannot be assessed. Any over- or under-estimation associated with the original consensus estimate would lead to over- or under-estimation of people who injected drugs in 2005. This may explain some of the discrepancy between the 2005 estimate and the estimates presented here; further examination of trends over time using the methods described here would also shed light on this issue.

We have presented conservative estimates with broad plausible limits, reflecting the limitations of the available data to more precisely estimate people who inject drugs. There is a need for more data that can be used in population estimation; this could be routinely collected as part of surveillance systems that monitor illicit and injecting drug use. Questions should be designed to match available indicators. One important gap identified through this estimation exercise was lack of data on injecting behaviours during OST. Routine surveys of people in OST and other forms of drug treatment could benefit future population estimation work, as well as providing data to inform the treatment system and service provision. Such a monitoring system could be based on the model of the Australian Needle and Syringe Program Survey.<sup>9</sup>

We did not estimate Aboriginal and Torres Strait Islander people who inject drugs. Aboriginal and Torres Strait Islander people are overrepresented in injecting populations, but the available data were not sufficient to enable specific estimation of this group. Additionally, we did not estimate lifetime injecting drug use. This is of critical importance for issues relating to burden of disease attributable to injecting drug use, such as total burden of HCV infection and treatment need.

## **Recommendations**

We have used relatively simple methods to generate these estimates of people who inject drugs. A more sophisticated approach to this task, multi-parameter evidence synthesis (MPES), has been developed in recent years.<sup>10,11</sup> This approach relies on linkage between administrative data sets and surveys of people who inject drugs to produce a population estimate that uses all available data and

is internally validated. Assuming the availability of appropriate data, MPES can estimate specific sub-populations (e.g. Aboriginal and Torres Strait Islander persons; specific geographic areas), and people who have ever injected drugs. Considerable time and resources are needed to complete such work, but this should be undertaken given the policy and programme significance of these estimates, such as informing needle and syringe program and other service delivery, and projecting burden of disease attributable to injecting drug use.

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## Methodological appendix

### **Benchmark data**

Multiplier estimation requires benchmark data that describes a behaviour or outcome associated with injecting drug use. Benchmark data that were requested and received for this estimation exercise are summarised in Table A1.

*Table A1: Data received to inform estimates of people who inject drugs in NSW and Australia*

	<b>Benchmark dataset</b>	<b>Indicator</b>
NSW-specific datasets	Pharmaceutical Drugs of Addiction System	Number of people in opioid substitution therapy at July 1, 2014
	Needle and Syringe Program data	Number of needles and syringes distributed by public needle and syringe programs and pharmacies in NSW, 2014
	Australian Bureau of Statistics mortality data	Number of amphetamine-, cocaine- and opioid-induced deaths in NSW, 2014
	Re-offending Database	Number of persons proceeded against for use/possess amphetamine, cocaine or narcotics, 2014
	NSW Ambulance	Number of ambulance attendances where naloxone was administered, 2014
	Emergency Department Data Collection	Emergency department presentations for amphetamine, cocaine or opioid overdose, 2014
	Admitted Patients Data Collection	Hospital separations for amphetamine, cocaine or opioid overdose, 2014
National datasets	National Opioid Pharmacotherapy Statistical Annual Data Collection	Number of people in opioid substitution therapy on a snapshot day in Australia and all states and territories, 2014
	Australian Bureau of Statistics mortality data	Number of amphetamine-, cocaine- and opioid-induced deaths in Australia and all states and territories, 2014

### **Multiplier data**

An exhaustive literature search was undertaken to identify multipliers that could be applied to the benchmark data. State and national multipliers for the OST data were derived from data collected for the Australian Needle and Syringe Program Survey (ANSPS).<sup>9</sup> ANSPS participants are asked if they are currently in OST, matching our benchmark data of number of people currently in OST. As benchmark data were available for all states and territories, separate multipliers were derived for all states and territories, and nationally, as shown in Table A2.

Table A2: Multipliers applied to OST benchmark data in estimating people who inject drugs in NSW and Australia

Area	Proportion of people in ANSPS reporting current OST	Multiplier (1/proportion)
New South Wales	0.42	2.38
Victoria	0.51	1.96
Queensland	0.30	3.33
Western Australia	0.31	3.26
South Australia	0.37	2.68
Tasmania	0.46	2.16
Australian Capital Territory	0.53	1.90
Northern Territory	0.11*	8.75*

\*Proportion and multiplier based on five-year moving average due to low numbers in benchmark and multiplier data sources

We were largely unsuccessful in identifying suitable multipliers for other data sources, or had concerns about the applicability of the benchmark data to the population of people who inject drugs (Table A3).

Table A3: Availability of multipliers for benchmark data sources in estimating people who inject drugs in NSW and Australia

Benchmark data	Outcome of multiplier search
Needles and syringes distributed by public needle and syringe programs and pharmacies	Data related to number of needle and syringe units distributed rather than individuals accessing needles and syringes. A two-step estimation process that used published data to construct a benchmark number of people accessing needle and syringe programs, followed by standard multiplier method, produced implausibly low estimates
Australian Bureau of Statistics: Number of amphetamine-, cocaine-, and opioid-related deaths	An increasing proportion of opioid-related deaths in Australia are due to pharmaceutical opioids and may be among people who do not inject drugs; hence there were concerns that the benchmark data may not represent the population of people who inject drugs and use of these data would overestimate people who inject drugs
Bureau of Crime Statistics and Research: Number of individuals charged with use/possess amphetamine, cocaine or opioids	Unable to identify suitable multiplier (arrested/charged with use/possess amphetamine, cocaine or opioids in the previous 12 months).
NSW Ambulance: Number of ambulance attendances where naloxone was administered	Data only available from 2009. Unable to identify suitable multiplier (had an overdose in the past 12 months were an ambulance attended and administered naloxone). The Illicit Drug Reporting System collects data on treatment responses to overdose, but it was not possible to construct a multiplier referring specifically to ambulance-administered naloxone.
NSW Emergency Department Data Collection: Number of amphetamine, cocaine, and opioid overdose presentations	Unable to identify suitable multiplier (attended an emergency department with amphetamine, cocaine or opioid overdose in the past 12 months)
NSW Admitted Patients Data Collection: Number of hospital separations for amphetamine, cocaine or opioid overdose	Unable to identify suitable multiplier (admitted to hospital with amphetamine, cocaine or opioid overdose in the previous 12 months)

### ***Combining benchmark and multiplier data***

Our selected benchmark data records the number of people in OST at a particular point in time, but it is likely that not all people in OST will have injected drugs in a given year. We identified unpublished data from a study of OST patients<sup>12</sup>, recruited in 2013, in which 57.4% of participants had injected drugs in the previous six months. We were unable to identify any data on past 12-month injecting drug use. If we adjust our benchmark data using this percentage, then apply the multiplier, this can be assumed to be a plausible lower bound of the number of people who injected drugs in a year; i.e.

$$N_{\text{lower}} = \text{benchmark} \times 0.574 \times \text{multiplier}$$

If we assume that *all* people in OST have injected in the past 12 months, we can assume this to be an upper bound of the number of people who inject drugs; i.e.

$$N_{\text{upper}} = \text{benchmark} \times \text{multiplier}$$

The mid-point of  $N_{\text{lower}}$  and  $N_{\text{upper}}$  was used as the point estimate of people who inject drugs.

These formulas were used to calculate state and territory estimates. The national estimate was derived by summing the state and territory estimates.

### ***Stratified estimates***

To derive sex- and age-group estimates, we extracted the sex and age group (15-24 years, 25-34 years, 34-44 years, 45-54 years, 55-64 years) distributions of the benchmark data and multiplier data sources (i.e. 66% of NSW OST clients at July 1 2014 were male; 38% of drug-induced deaths nationally in 2014 were in people aged 35-44 years). The extracted proportions were combined in random effects meta-analysis models to derive summary proportions. Separate summary proportions were calculated for NSW and national data. These were applied to the relevant NSW or national estimate to give sex- and age-group specific estimates.

### ***LHD estimates***

LHD estimates were derived by applying the NSW multiplier to LHD-level benchmark data. Using LHD-level multipliers produced implausible estimates in some LHDs, possibly related to small sample sizes in some LHDs. In interpreting LHD estimates, it is important to bear in mind that these estimates reflect location of health care, rather than location of residence. However, it is unlikely that this would greatly increase or decrease the estimate.

Another important possible source of bias in the LHD estimates is that our multiplier assumes a consistent level of OST engagement among people who inject drugs across the state of NSW. This is not the case. In those LHDs with a lower proportion of NSP survey respondents in OST, the multiplier would be too low, again underestimating people who inject drugs. An attempt was made to use LHD-specific multipliers for these estimates, but these produced highly implausible estimates for some LHDs.

### ***Population prevalence of injecting drug use***

Denominators for all prevalence estimates except LHD prevalence estimates were obtained from publicly available Australian Bureau of Statistics data tables for 2014.<sup>13</sup> Denominators for LHD prevalence estimates were obtained from HealthStats NSW. Prevalence was calculated per 1,000 men/women/persons aged 15-64 years (or specific age group, for age group estimates).

### ***Validation***

The derived population estimates were compared against actual drug-induced deaths. We assumed an annual mortality rate of 0.53%, derived from a cohort study of people who inject drugs in Melbourne, Victoria, 2008-2012.<sup>5</sup> Other mortality rates considered for use for validation were rejected for being applicable only to opioid users,<sup>14</sup> or only to people with treatment exposure (unpublished data held by the authors). We applied this rate to the NSW and national estimates to obtain the expected number of deaths based on our estimated population. Expected deaths were compared to actual opioid-, amphetamine- and cocaine-induced deaths in NSW and Australia.