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Trends in methamphetamine and opioid use among clients of needle-syringe programs in Queensland, Australia: 2007–2015

BRENDAN JACKA^{1,2}, ROBERT KEMP³, LOUISA DEGENHARDT¹, AMY PEACOCK^{1,4}, PHILIP CLARE¹, RAIMONDO BRUNO⁴, ABHILASH DEV⁵, OLUWADAMISOLA SOTADE¹, BRIONY LARANCE^{1,6}

¹National Drug and Alcohol Research Centre, UNSW Sydney, Sydney, Australia,

²Kirby Institute, UNSW Sydney, Sydney, Australia,

³Communicable Diseases Branch, Queensland Health, Brisbane, Australia,

⁴School of Medicine (Psychology), University of Tasmania, Hobart, Australia,

⁵Chief Medical Officer and Healthcare Regulation Branch, Queensland Health, Brisbane, Australia,

⁶School of Psychology, University of Wollongong, Wollongong, Australia

Abstract

Introduction and Aims.—Needle-syringe programs (NSP) are an underutilized source of data on drug injection trends; these data are essential for informing public health interventions. We examine trends in NSP service occasions from 2007–2015.

Design and Methods.—Using standardised data from 26 NSP outlets through the Queensland NSP Minimum Data Set (QNSPMDS), trends in service occasions among clients intending to inject methamphetamine, heroin, opioid substitution therapy (OST) medications and other pharmaceutical opioids were assessed using multilevel mixed-effects negative binomial regression, adjusting for month, year, age and clustering by site.

Results.—Over 1.5 million service occasions were recorded in 2007–2015. Methamphetamine was the main ‘drug intended to inject’ (33.7%), however cf. 2007, the incidence rate ratio decreased to 0.64 (95% CI: 0.62, 0.66) in 2009, remaining low until 2015. Among clients reporting methamphetamine injection, there was a shift in the form from base to the higher-potency crystal methamphetamine since 2012. Heroin injection (22.5% service occasions) initially increased (cf. 2007), followed by a decline to 0.77 (95% CI: 0.75, 0.79) in 2015. Significant and sustained increases in OST and other pharmaceutical opioids injection were observed throughout the study period, accounting for 7.2% and 19.8% of total visits, respectively.

Correspondence to Dr Briony Larance, National Drug and Alcohol Research Centre, UNSW Medicine, UNSW, Sydney, NSW 2052, Australia. Tel: +61 (02) 9385 0241; Fax: +61 (02) 9385 0222; b.larance@unsw.edu.au.

Brendan Jacka PhD, Research Associate, Robert Kemp, Principal Policy Officer, Louisa Degenhardt PhD, Professor, Amy Peacock PhD, Research Fellow, Philip Clare Masters in Biostatistics, Biostatistician and Senior Research Officer, Raimondo Bruno PhD, Associate Professor, Abhilash Dev MPH, Research Officer, Oluwadamisola Sotade MPH, Research Assistant, Briony Larance PhD, Senior Research Fellow.

Discussion and Conclusions.—The QNSPMDS provides unique, routinely collected, jurisdiction-wide and standardised data on the demographics of people who inject drugs, types of drugs injected and regional variations; these data are essential in informing policy, planning and program implementation. There remains significant opportunity to enhance engagement and linkage to care alongside needle-syringe provision.

Keywords

people who inject drugs; needle and syringe program; crystal methamphetamine; opioid substitution therapy; pharmaceutical opioids

Introduction

Injection drug use is a significant global public health concern. While injection drug use is often associated with concerns about HIV infection, its impact is far greater, with increased risk of overdose, physical trauma, other infectious diseases, homelessness, unemployment and psychiatric illness [1–3]. People who inject drugs (PWID) are disproportionately affected by hepatitis C virus, leading to increased risk of cirrhosis, chronic liver disease and primary hepatocellular carcinoma [2,4–6]. With an estimated 11–21 million people who inject drugs worldwide, there is considerable impact on morbidity and mortality [7]. Utilisation of harm reduction services, such as needle and syringe programs (NSP) and opioid substitution therapy (OST), have been demonstrated to reduce the risk of acquiring HIV and hepatitis C virus infections [8,9]. A better understanding of changing trends in drug use may enable more immediate responses to emerging public health concerns.

Nationally, patterns of drug use among PWID in Australia are captured through a number of complementary monitoring systems, including the Australian National Drug Strategy Household Survey [10], Australian Needle and Syringe Program Survey (ANSPS) [11] and Illicit Drug Reporting System (IDRS) [12]. Each of these data collections has strengths and limitations. Although the National Drug Strategy Household Survey collects information on illicit drug use from a representative sample of the general population (over 20 000 individuals) every 2–3 years, the survey excludes people who are homeless or institutionalised, and PWID are very likely under-represented. The two national data collections which focus on patterns of drug use among PWID specifically are the annual ANSPS (a survey of over 2000 attendees of NSP services across Australia in a defined two-week period), and the annual IDRS report (which triangulates data from surveys of a sentinel sample of over 800 PWID, interviews with key experts, and existing indicator data to identify emerging trends of national and local concern). While these two data collections provide insight into patterns of drug use among PWID, they are subject to the limitations of convenience sampling and in-depth analysis of temporal trends is precluded due to the infrequency of data collection. As part of the Queensland Needle and Syringe Program Minimum Data Set (QNSPMDS), standardised demographic, drug use and equipment variables are routinely collected for each occasion of service at participating NSPs in Queensland [13]. The continuous data collection and geographic coverage of NSPs across Queensland is a unique strength of this data set, and interrogation of data may yield a more nuanced understanding of temporal changes in overall rates of injecting and drugs injected.

As such, the aim of this study was to investigate trends in the types of drugs injected among clients at NSPs in Queensland between 2007 and 2015, with a specific focus on methamphetamines and opioids. A better understanding of injecting drug use and temporal changes in NSP clients' report of the drug they are intending to inject will provide insight to policy makers and health professionals and inform preventative measures, education and treatment strategies.

Methods

Study population

Demographic data, brief interventions and referrals by type, injecting equipment provided and 'drug intending to inject' following occasion of service were collected from 2007–2015 for each client visit to any of the 26 NSPs throughout Queensland that collect the QNSPMDS. Data collected through the QNSPMDS include client demographics (gender, postcode of residence, age, drug to be injected, Aboriginal and Torres Strait Islander status), equipment supplied (1 mL fixed needles-syringes, 3-, 5-, 10-, and 20 mL barrels, and butterflies issued), and interventions provided (intervention, referral destination, referral location, referral type, and time spent). Quantity of equipment provided was the sum of 1 mL fixed needle-syringes and all barrel sizes distributed. Providing information was voluntary, and service provision was not affected by client participation.

Collection of standardised data through the QNSPMDS began in December 2006 with 13 primary programs. Additional sites added over this time have increased the number to 19 primary programs (defined as a site with dedicated staff positions for provision of NSP services to PWID) and six secondary programs (limited NSP provision as an adjunct to other services). The NSPs in this study on an average accounted for 86% of needle and syringe distribution across all NSPs when equipment ordering data for their respective financial years were analysed. The NSP sites are geographically categorised into four regions: Brisbane City ($n = 2$ sites, 3 km between sites), Southern region ($n = 11$ sites, south of Brisbane River to Queensland-New South Wales border, 1.1–162 km between sites), Central region ($n = eight$ sites, Rockhampton to Brisbane, 15–501 km between sites) and Northern region ($n = 5$ sites, Cairns to Mackay, 1.5–590 km between sites).

Analysis

Descriptive analyses were performed to characterise the sample according to geographic classification; χ^2 , Fisher's exact and Kruskal–Wallis tests were used for comparisons as appropriate. As the unit of time, count data (occasion of service or quantity of equipment) were collated for each month of the study period according to age category (<25, 25–34, 35–44, 45), gender (male or female), and NSP site resulting in 2471 monthly aggregated counts. Trends in 'drug intending to inject' were assessed using multilevel mixed-effects negative binomial regression analyses (STATA xtnbreg command), to accommodate the overdispersion expected in this dataset [14]. The exponential functions of the negative binomial regression coefficients are reported as incidence rate ratios (IRR), being the standardised relative difference of the number of occasions of service between baseline period (2007, and month of January) and a subsequent year/month period. Trend analyses

were adjusted for age and gender, clustered by NSP site, and incorporated an exposure variable of total number of visits for all drug types (i.e. methamphetamine, heroin, other pharmaceutical opioid, OST medication, other drug, and not recorded). Where data on number of visits was missing ($n = 48$ of 2471, 2%), values were imputed using multiple imputation of chained equations [15] with the following complete variables: site, month, year, age category and gender. Statistically significant differences were assessed at $P < 0.001$; all P values are two-sided. All analyses were performed using STATA software (version 12.1; StataCorp LP, College Station, TX, USA). ArcGIS ArcMap 10.3 mapping software (Environmental Systems Research Institute, Inc., Redlands, CA, USA) was used to map occasions of service.

Results

Study population

In total, over 1.5 million occasions of service were recorded between January 2007 and December 2015, with a median of 14 255 (interquartile range 13 089, 15 255) occasions of service per month. During the study period, survey sites within the Brisbane City and Southern regions (Figure S1, Supporting Information) contributed over two-thirds of occasions of service, 35.7% and 34.5% respectively (Table 1). Sites from the Central region contributed 17.3% of occasions of service and those from the Northern regions contributed 12.5%. There was a decrease in the number of occasions of service per month across sites in the Brisbane City region, with approximately 6500 per month in 2007 to approximately 3500 per month in 2015 (Figure 1). The number of occasions of service per month increased in the Southern region during this period (approximately 2500 and approximately 5500 per month, for 2007 and 2015, respectively); however additional NSP sites were included over time.

The median age at the time of occasion of service was 35 (Q1: 29, Q3: 42), with females comprising one quarter of occasions of service (25%). Intersex or unstated gender comprised of <1% and were excluded from these analyses. Aboriginal and/or Torres Strait Islander (ATSI) identity was routinely collected from 2010–2015, with 7.1% self-identifying as ATSI in 2010 and 11.1% in 2015. The trends in drug use were similar between those identifying and those not identifying as ATSI (Figure S2). Age and gender at time of occasion of service differed significantly by region (Kruskal–Wallis P value: <0.001 and χ^2 P value: <0.01, respectively), with age at occasion of service and the proportion of occasions of service received by females lower in the Brisbane City region (Table 1).

Trends in ‘drug intending to inject’

Methamphetamine.—Overall, 518 338 (33.7%) occasions of service were associated with methamphetamine in the period 2007–2015. While accounting for total number of occasions of service, significant decreases in the number of occasions of service associated with methamphetamine occurred across all of Queensland and within each region (Figure 2). Compared to 2007, the IRR decreased to 0.71 (95% confidence interval [CI] 0.70, 0.72) in 2010 for all of Queensland and remained significantly below 1.0 until 2015 (Table S1). While remaining below 1.0, the IRR increased significantly between 2010 and 2015 across

all of Queensland and regions. The greatest reduction was seen in Northern Region, with the IRR being maintained at about 0.60 from 2009 onwards (Table S1). Half of attendees (51%, $n = 264\ 293$) intending to inject methamphetamine reported a form that would be used. Differences in characteristics between those that reported a form (Table S2) and those that did not precluded the ability to analyse trends, however there was a marked increase in the number of occasions of service associated with crystal methamphetamine use from 2011 onwards (Figure 3). Similarly, occasions of service associated with base methamphetamine (a brown moist form of methamphetamine) decreased from 2009 to 2015. Similar trends were seen for methamphetamine when comparing younger age (Figure 4), gender (Figure 5), ATSI status (Figure S2) or quantity of equipment provided compared to number of visits (Figure S3).

Heroin.—In total, 22.5% ($n = 346\ 422$) of occasions of service during the study period were associated with heroin use. Overall for all of Queensland there was a continuous decline in the number of occasions of service associated with heroin in the context of total number of occasions of service, with significantly reduced counts in 2012–2015 compared to 2007 (Figure 2). Similar patterns were evident among the regions, with significant reductions from 2013 in Brisbane City and from 2010 for the Southern and Central Regions (Table S1). The IRR was more variable in the Northern Region, with few years being significantly different to 2007 (Table S1), potentially reflecting lower power to detect changes. Similar trends were seen for methamphetamine when comparing younger age (Figure 4), gender (Figure 5), ATSI status (Figure S2) or quantity of equipment provided compared to number of visits (Figure S3).

Other pharmaceutical opioids.—One in five occasions of service (19.8%, $n = 304\ 357$) were associated with other pharmaceutical opioids (e.g. MS Contin, oxycodone, fentanyl) in the study period. A significant increase in the number of occasions of service associated with other pharmaceutical opioids was identified for all of Queensland (Figure 3a). The IRR increased to 1.24 (95% CI 1.21, 1.28) in 2008 and remained elevated throughout the study period compared to 2007 (Table S1). Regional differences were seen with regard to occasions of service associated with other pharmaceutical opioids. The increase in occasions of service associated with other pharmaceutical opioids was largely driven by the Central region, where the IRR increased to 2.00 (95% CI 1.87, 2.14) in 2009 and remained elevated until the completion of the study (Figure 3d). Occasions of service associated with other pharmaceutical opioids in Brisbane City, Southern Region and Northern Region were varied, with both significant yearly increases and decreases compared to 2007 (Figure 3b–e). Similar trends were seen for methamphetamine when comparing younger age (Figure 4), gender (Figure 5), ATSI status (Figure S2) or quantity of equipment provided compared to number of visits (Figure S3).

OST medication.—While contributing the fewest number of occasions of service ($n = 110\ 816$, 7.2%) between 2007 and 2015, OST medication (e.g. methadone, buprenorphine and buprenorphine-naloxone) had the greatest increase in IRR across Queensland (Figure 3a). Compared to 2007, the incident rate ratio increased yearly to a maximum of 1.80 (95% CI: 1.73, 1.89) in 2015. Significant increases in IRR were evident across all regions (Table S1).

From the low level of use in 2007, significant increases in IRR were observed over age (Figure 4), gender (Figure 5) and ATSI identity (Figure S2).

Discussion

The aim of the current study was to examine the use of methamphetamines and opioids among people utilising NSPs in Queensland in 2007–2015. Throughout this period there was significant and sustained change in the use of methamphetamine, heroin, OST medication, and other pharmaceutical opioids. While trends were similar across geographic regions, the magnitude of change was dependent on NSP location. Among clients reporting methamphetamine as the ‘drug intending to inject’, there was a clear shift in the form being reported since 2012, from base to the higher-potency crystal methamphetamine. Routinely collected administrative data such as the Queensland NSP Minimum Data Set provide a unique opportunity to obtain jurisdiction-wide standardised data to monitor changes in the demographics of people who inject drugs, types of drugs injected and regional variations for these drugs, and thus inform policy, planning and program implementation.

It is important to place these trends in the injection of illicit drugs in the context of broader demographic trends in Queensland. Over the past decade, Queensland has experienced the third highest population growth of all Australian jurisdictions [16]. The number of young people aged 15–29 years also grew by 15% in Queensland over the past decade, with the highest growth in the Health and Hospital Services regions of West Moreton, Torres and Cape, Gold Coast, Metro North, Sunshine Coast and Metro South [16]. Approximately, 18% of Queenslanders lived in areas of greatest disadvantage based on a range of socio-demographic characteristics [16]. Queensland has the second largest ATSI population after New South Wales and the second highest proportion after the Northern Territory [16]. In 2016, the Health and Hospital Services regions with the largest ATSI Queensland populations were Cairns and Hinterland followed by Metro South, Metro North and Townsville [16]. The regions with the highest ATSI proportions were the Torres and Cape (70%), North West (31%), South West (13%) and Townsville (9%). ATSI Queenslanders typically have a younger age profile [16].

With respect to specific drug trends, methamphetamine remained the most commonly reported drug intended to inject across all regions and Queensland as a whole. There was a significant and substantial decrease in the reported intention to inject methamphetamine from 2007 to 2010 (27% reduction in 2010 compared to 2007), followed by a gradual rise through to 2015 (although this still represented an 18% reduction compared to 2007). Similar substantial fluctuations are seen in the proportion of Queensland NSP attendees in the ANSPS and IDRS reporting methamphetamine as last drug injected. The prevalence of methamphetamine injection among ANSPS participants reduced from 35% in 2007 to 27% in 2010 and returned to 34% in 2015 [11,17], while the prevalence of methamphetamine injection among IDRS participants decreased to 21% in 2010 from 28% in 2008, and increase to 38% in 2015 [18–20]. While the IDRS draws on relatively small numbers ($n = 100$ per annum, largely from Brisbane City and Southern regions), triangulation between the current survey the ANSPS and the IDRS enables comparison and contrast of trends amongst this population.

Queensland's 2016 Crime and Corruption Commission report highlights methamphetamine as the fastest growing illicit drug market, showing strong and consistent demand, high levels of organised crime involvement and causing significant harms to the user and the community [21]. A shift in the main form of methamphetamine available and used in Queensland from predominantly powder form to crystalline form (ice) has been documented in drug seizure data [21] and wastewater analyses [22,23]. The number of Queensland methamphetamine seizures and arrests (including those for drug driving) continue to increase [21,24]. This picture is consistent with that of Australia more generally; both regular and dependant methamphetamine use have increased, with shifts from low potency speed/base to high potency crystal methamphetamine, and evidence of increased non-injecting consumption [25,26]. Additional enhanced surveillance involving non-NSP data sources is required to monitor health impacts in the context of increased purity and non-injecting consumption such as crystal methamphetamine smoking.

As the second most commonly reported 'drug intended to inject', there was a significant decline in heroin among clients of Queensland NSP services during the period of the study. Initially, heroin use increased approximately 10% in 2008–2010 compared to 2007, followed by a sustained decline to reach a 25% reduction in 2015. The greatest reductions were seen in Southern (30% reduction compared to 2007) and Central regions (40% reduction compared to 2007), while Northern region had >30% increases compared to 2007. Trends in heroin injecting among Queensland participants of the ANSPS demonstrate similar reductions, with heroin reported as last drug injected reducing from one quarter in 2007 to 15% in 2014 [11]. In contrast, among participants of the IDRS survey in south-east Queensland, heroin use as the last drug injected increased from 24% to 31% in the years 2007 and 2015 [12,27], although the relatively smaller sample size and restricted geographical region for recruitment should be noted for the IDRS relative to the Queensland NSP service data.

The heroin market in Queensland is small and remains concentrated in pockets of south-east Queensland [21], with the majority of heroin seizures occurring in the greater Brisbane region. Very little heroin is available outside the south-east of Queensland. Pharmaceutical opioids, such as OxyContin®, fentanyl and morphine, are more commonly used among people who inject drugs in regions where there is a lack of heroin [21]. Overall, there has been a significant increase in the availability of opioid preparations for analgesia and opioid dependence in Australia between 1992 and 2012 [28], with substantial geographic variation in opioid utilisation and related mortality and morbidity [29–32]. Several data sources now indicate that there is geographic variation in the injection of prescription opioids in Queensland. For example, among Queensland IDRS participants surveyed at NSP services in Brisbane City and Southern regions, 12% reported OST medication and 17% reported morphine/oxycodone as last drug injected in 2015, respectively [19]. In the current study of QNSPMDS data, the only sustained increased rate of injection relative to other drug classes was observed for prescription opioids, in particular for OST medications (although it is important to note the intention to inject OST medications was reported on less than one tenth of all occasions of service). Increases in other pharmaceutical opioids such as morphine and oxycodone were variable across the Queensland regions, with Central region showing a sustained two-fold increase in the incidence rate ratio in 2008–2015 and remaining regions

showing up to 30% increases in this time. In the ANSPS, the proportion of Queensland participants reporting injection of prescription opioids (excluding OST medications) increased from 19% to 26% between 2007 and 2014, respectively and injection of prescription opioids was associated with non-urban residence in 2014 [11]. Similarly, the injection of OST medications increased from 11% to 17% in the same study period [11]. A similar pattern of geographic variability in the injection of opioids was observed in a cohort of people who tamper with prescription opioids [33]. It is likely that these variations reflect differences in the availability of prescription opioids and heroin.

There are a number of limitations to this study. The anonymous and confidential routine data collection means clients may be represented multiple times in the sample. As such, significance levels are not included in the comparison of groups. Additionally, the measure of occasions of service may underestimate the frequency of use of methamphetamines and opioids as clients are able to obtain equipment for multiple injections at a single visit. Disclosure of accurate drug use behaviours is dependent on the trust held by clients of the service. The anonymous and confidential nature of the data collection aims to overcome this limitation, and prior research shows sufficient reliability and validity of self-reported illicit drug use in similar contexts against biomarkers [34]. As the QNSP-MDS further develops, consideration might be given to capture of the specific practice of injecting multiple substance simultaneously, one example is 'speedballing', the simultaneous injection of a mix of methamphetamine and heroin (currently not accurately reported in the QNSP-MDS data). Finally, the small number (2%) of missing data mathematically imputed for the multilevel mixed-effects negative binomial regression analyses may not accurately reflect the number of visits seen by NSP services, particularly in the Northern and Central regions. Imputations were not possible where 'drug intending to inject' was not reported, potentially affecting the exposure variable of total number of visits.

This study provides an illustration of the potential of monitoring NSP service utilisation through a state-wide standardised data collection system, captured as part of routine service provision. Standardised and comprehensive data collection across NSP services collated and reported regularly is essential in planning and developing programs to support the core function of the NSP program, such as ensuring adequate cover in different locations and that the mix of services and resources is optimal for clients. Implementation of a minimum dataset in other Australian and international jurisdictions would ensure NSP development and provision is guided by valid and reliable data, and would allow greater comparison of drug use among PWID on a national and global scale. Although the Queensland NSP data are routinely collected and close to 'real-time' monitoring is possible, the data are typically analysed retrospectively aggregating either monthly [e.g. [35]] or annually (as in the current study).

In capturing >85% of NSP state-wide equipment distribution and the associated population of PWID over the period 2007–2015 (Robert Kemp, personal communication), this study provides empirical evidence of changes in the type of drugs injected by clients of NSP services in Queensland. The routine collection of data using a minimum dataset in Queensland has permitted investigation of changing drug use patterns and provides an opportunity to inform intervention programs and services to meet the needs of clients. While

there was a significant decrease in the delivery of services to people who intend to inject heroin and methamphetamine, increases in the occasions of service for people injecting pharmaceutical opioids was observed. Considering the trusted interaction between client and service providers, there remains significant opportunity to enhance engagement and linkage to care alongside needle and syringe provision.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Total number of occasions of service at participating Queensland needle and syringe program outlets.

Figure 2.

Incidence rate ratio of 'drug intending to inject' at time of occasion of service at Queensland needle and syringe programs, 2007–2015. Data represent whole of Queensland (a), Brisbane City (b), southern region (c), central region (d) and northern region (e). Note: The incident rate ratio is the standardised relative difference of the number of occasions of service between baseline period (2007 and month of January) and a subsequent year/month period. For reference, the relative burden of each drug class for the entire study period is: methamphetamine (34%), heroin (23%), other pharmaceutical opioid (20%) and opioid substitution therapy (OST) medication (7%).

Figure 3.
Count of form of methamphetamine ‘intending to inject’ at time of occasion of service at Queensland needle and syringe programs, 2007–2015. Half of needle and syringe program attendees nominating methamphetamine as drug intending to inject did not nominate a form, while the remainder nominated either base, powder, crystal or other.

Figure 4.

Trends in occasions of service by 'drug intending to inject' among clients of Queensland needle and syringe programs stratified by age (greater or less than 25 years), 2007–2015. Data represent methamphetamine (a), heroin (b), other pharmaceutical opioid (c), and opioid substitution therapy (OST) medication (d).

Figure 5. Trends in ‘drug intending to inject’ among clients of Queensland needle and syringe programs stratified by gender, 2007–2015. Data represent methamphetamine (a), heroin (b), other pharmaceutical opioid (c) and opioid substitution therapy (OST) medication (d).

Table 1.

Client characteristics at occasion of service at Queensland NSPs, 2007–2015

	Combined	Brisbane City	Region		
			Southern	Central	Northern
Number of occasions of service	1 520 156	546 305	524 060	274 611	175 180
Quantity of equipment supplied	41.7 million	11.9 million	14.1 million	7.6 million	8.1 million
Number of sites, maximum	26	2	11	8	5
Age, median (Q1, Q3)	35 (29, 42)	34 (28, 40)	35 (28, 41)	36 (29, 43)	36 (29, 44)
Female gender, <i>n</i> (%)	391 485 (25%)	120 558 (22%)	138 970 (26%)	78 521 (29%)	49 982 (26%)
Drug intending to inject, <i>n</i> (%)					
Amphetamine	518 338 (33.7%)	186 931 (34.1%)	186 510 (35.2%)	88 419 (33.2%)	56 478 (29.5%)
Heroin	346 422 (22.5%)	171 750 (31.3%)	137 896 (26.0%)	28 646 (10.8%)	8130 (4.2%)
Other pharmaceutical opioids	304 357 (19.8%)	87 209 (15.9%)	84 631 (16%)	76 731 (28.8%)	55 786 (29.1%)
OST medication	110 816 (7.2%)	50 429 (9.2%)	34 871 (6.6%)	16 337 (6.1%)	9179 (4.8%)
Other drugs	175 469 (11.4%)	44 569 (8.2%)	72 237 (13.7%)	29 402 (11.1%)	29 261 (15.3%)
Not recorded or unknown	81 284 (5.3%)	71 55 (1.3%)	14 283 (2.7%)	27 049 (10.2%)	32 797 (17.1%)

OST, opioid substitution therapy.