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Rates of opioid agonist treatment prescribing in provincial prisons in Ontario, Canada, 2015 to 2018: A repeated cross-sectional analysis

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Rates of opioid agonist treatment prescribing in provincial prisons in Ontario, Canada, 2015 to 2018: A repeated cross-sectional analysis

Authors: Claire Bodkin, MD[1] Susan J. Bondy, PhD[2] Lori Regenstreif, MD, MSc[1] Lori Kiefer, MD, MHSc[2,3] Fiona G. Kouyoumdjian, MD, PhD[1]

Affiliations:

[1]Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada

[2]Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada

[3]Ontario Ministry of the Solicitor General, Toronto, Ontario, Canada

Corresponding Author:

Claire Bodkin
claire.bodkin@medportal.ca
226-688-8282
David Braley Health Sciences Centre, 3rd floor
100 Main St West
Hamilton, ON
L8P1H6

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Abstract

Objective:

To describe opioid agonist treatment prescribing rates in provincial prisons and compare with community prescribing rates.

Design:

We used quarterly, cross-sectional data on the number and proportion of people prescribed opioid agonist treatment in prison populations. Trends were compared with Ontario surveillance data from prescribers, reported on a monthly basis.

Setting:

Provincial prisons and general population in Ontario, Canada between 2015 and 2018.

Participants:

Adults incarcerated in provincial prisons and people ages 15 years and older in Ontario.

Main Outcomes and Measures:

Opioid agonist treatment prescribing prevalence, defined as treatment with methadone or buprenorphine/naloxone.

Results:

In prison, 6.9% to 8.4% of people were prescribed methadone; 0.8% to 4.8% buprenorphine/naloxone; and 8.2% to 13.2% either treatment over the study period. Between 2015 and 2018, methadone prescribing prevalence did not substantially change in prisons or in the general population. The prevalence rate of buprenorphine/naloxone prescribing increased in prisons by 1.70 times per year (95%CI 1.47-1.96), which was significantly higher than the increase in community prescribing: 1.20 (95%CI 1.19-1.21). Buprenorphine/naloxone prescribing prevalence was significantly different across prisons.

Conclusions:

Opioid agonist treatment prescribing increased between 2015 and 2018 in provincial prisons in Ontario, Canada due to increased buprenorphine/naloxone prescribing, and increased more in prisons than in the general population.

Article Summary:

Strengths of this study

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- This is the first study describing the rates of opioid agonist treatment prescribing in a prison population over time and during the opioid overdose crisis.
- We used whole population prescribing rates for people in prisons and in the community.

Limitations of this study

- We lack data on the prevalence of opioid use disorder to determine opioid agonist treatment coverage for people with opioid use disorder.

Keywords:

Opioid-Related Disorders, Addiction Medicine, Prisons, Prisoners, Opiate Substitution Treatment

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Background

There is a substantial burden of opioid-related morbidity and mortality in people who experience incarceration in Canada.[1-4] Research consistently identifies high rates of substance use disorders in this population,[5-10] and a majority of people report recent drug use at the time of admission to custody,[7,8,11-14] including use of opioids,[12] and a substantial proportion use drugs in custody.[8,13,15-17] People who experience incarceration commonly engage in behaviours such as injecting drugs,[5,11,12,14,16,18-23] sharing needles and other paraphernalia,[5,18,20,23-25] and polysubstance use,[7,11] which increase the risk of harms such as overdose and bloodborne infections. Further, evidence from Ontario reveals that the risk of death from overdose is high in this population compared to the general population, in particular at the time of release.[1,2] Not only do people in prison have higher rates of illicit substance use, but people who use drugs have higher rates of incarceration in the context of the criminalization of drug use.[26]

Opioid agonist treatment (OAT) is the first line treatment for opioid use disorder (OUD), and the standard of care across Canada.[27] OAT provides a long-acting opioid medication that binds to opioid receptors and prevents drug cravings and opioid withdrawal symptoms. OAT reduces both all-cause and overdose mortality.[28] In incarcerated populations, OAT reduces HIV transmission and complications, hepatitis C transmission and complications, and mortality after release, and improves a host of other health, social, and psychological outcomes.[29-32] Implementation of a state-wide correctional OAT program in Rhode Island produced a 60.5% reduction in overdose mortality rates within 1 year of release from prison.[33] OAT may also positively impact recidivism, but available evidence is limited in quantity and quality.[34]

Though challenges to access remain, OAT is widely available in the community and is being rapidly scaled in response to the current opioid overdose crisis. Canadian and international law confers an obligation to provide equivalent care in prison. The United Nations Standard Minimum Rules for the Treatment of Prisoners, also known as the Nelson Mandela Rules, were adopted by the UN General Assembly in 2015 and call for prison health care services that are comparable to community services and continuity of care from the community to prison and back again.[35] Despite the burden of opioid-related morbidity and mortality, evidence of OAT effectiveness, and the principle of

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equivalence, access to OAT in correctional facilities is often limited. A recent qualitative study of OAT prescribing in provincial correctional facilities in Ontario demonstrated that many physicians working in this setting do not prescribe OAT, and a minority initiate OAT for patients in custody.[36] Quantitative data from Vancouver, British Columbia revealed that among 597 recently incarcerated people with opioid use disorder, only 35% were prescribed OAT while in custody, and less that 10% of those prescribed OAT in custody were new initations.[37]

Information on OAT use in people in prison is important to understand whether this population has access to this evidence-based treatment, which could mitigate the risk of harms for people who experience incarceration. We aimed to describe rates of OAT prescribing in provincial prisons in Ontario, Canada between 2015 and 2018, and compared this with rates of OAT prescribing in the community.

Methods

Context

Provincial prisons in Canada hold adults aged 18 years and older who are awaiting trial or sentencing, or who are sentenced to less than 2 years in prison. In Ontario, provincial prisons are publicly funded and administered by the Ministry of the Solicitor General. We use the term "provincial prison" to represent all provincial correctional facilities, and "people who experience incarceration" to represent the population of those who experience detention and incarceration in provincial prisons, and "in custody" to refer to the time while in a provincial prison.

For Ontario residents, hospitalizations and medically necessary physician services are paid for through the public health insurance system, the Ontario Health Insurance Plan (OHIP), including while in provincial prison. In custody, prescribed medications are paid for by the Ministry of the Solicitor General. In the community, a subset of OHIP-eligible people are eligible for coverage of prescribed medication costs through the Ontario Drug Benefit (ODB) program, including people aged 65 years or older, and people who receive benefits based on financial need and employment status or disability.

Regarding health care in Ontario provincial prisons, people are routinely assessed by a nurse on admission, which includes a history of prescribed medications and substance

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use. They are then seen by a physician or nurse practitioner in the ensuing weeks or sooner if medically indicated. The physician or nurse practitioner may order prescribed medications without seeing a patient, e.g., at the time of admission for continuity of medication, or after assessing the patient. The model of care in Ontario prisons requires that every facility have at least one OAT prescriber but does not require all primary care physicians to prescribe OAT, which may represent a barrier to accessing OAT. As this study was a review of administrative health data, patients and the public were not consulted in the development of this study.

Data Sources

The Ministry of the Solicitor General provided quarterly snapshot data between 2015 and 2018 on the number and proportion of people in each provincial prison who were prescribed buprenorphine/naloxone and methadone, which were the two forms of OAT available during the period under study. These snapshots were aggregate cross-sectional data of people prescribed these treatments on a single day. These data are routinely reported by health care staff in each provincial prison to the Ministry of the Solicitor General. The Ministry of the Solicitor General also provided data on the number of people in each prison. Data were not available by age-group or gender. One prison closed in 2018 but data for that prison were included up to that date (i.e., excluding the last two time periods).

We accessed data on OAT use rates and proportions in the community between 2015 and 2018 using publicly available data from the Narcotics Monitoring System (NMS), which included people ages 15 and older who received methadone or buprenorphine/naloxone in Ontario between January 1 2015 and December 31 2018. The NMS is administered by Ontario's Ministry of Health and collects information from dispensers on all prescribed monitored drugs dispensed to people in the community in Ontario (i.e., not including people in hospital or in provincial prisons), including buprenorphine/naloxone and methadone. We accessed these data through the Ontario Prescription Opioid Tool, which is a publicly available tool that presents data on the number and rates of people prescribed all opioids, including OAT, in Ontario.[38] These data are available as counts (absolute number of prescriptions) and a rate per 1000 population on a monthly and

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yearly basis. Yearly data are available by sex, and by age groups. Age groups are 0-14, 15-24, 25-44, 45-64, and 65+ years of age. Data for OAT were presented for ages 15 and older and so our analyses use data for age 15 and older.

Statistical Analysis

We describe the rates of prescribed OAT as the percent of people in the applicable study population receiving OAT in the time period of data capture (prevalence rates expressed as percent or per population size). We also estimated the rate of change in OAT prescribing prevalence between February 2015 and September 2018 across provincial prisons and the rate of change in prescribing in the community over the same time period. Rates of change were expressed as prevalence rate ratios (PRR) per year and were estimated using Poisson regression with robust standard errors. Prevalence rates of opioid agonist prescribing for all of Ontario were graphed by time. We performed simple Wald contrasts to determine if the PRRs for OAT prescribing, using pooled data across prisons, were significantly different (α level of .05) from the overall provincial rates of change, in the 2015 to 2018 time period.

Variability in OAT prescribing across prisons and over time, was illustrated using box-plot graphs. These present the median prescribing rate, across prisons, the 25th and 75th percentiles for prescribing rates and markers for prisons with prescribing rates outside this range. Hypothesis tests assessed if the observed differences in prescribing rates across prisons were statistically significant as a main effect. These were conducted as overall significance tests for a main effect in prescribing rate across prison (global test for all prisons being different from the overall mean rate). Tests for overall differences across prisons were performed using negative binomial regression controlling for time of reporting. For tests of statistical significance, α was set at .05. Analyses were performed using Stata software, version 16 (StataCorp).

Results

We examined data for 26 provincial prisons. We had cross-sectional prescribing data for provincial prisons at two time points in 2015, four time points in 2016, four time points in 2017, and two time points in 2018. During the period under study, the cross-sectional

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population size for the included provincial prisons ranged from 11 people in the smallest prison to 1,096, and the total population across the 26 provincial prisons ranged between 7,140 and 8,122.

Over the study period and across provincial prisons, the total percentage of people treated with methadone ranged between 6.9% and 8.4%, with buprenorphine/naloxone ranged between 0.8% and 4.8%, and with either treatment ranged between 8.2% and 13.2% (Figure 1).

As shown in Table 1, methadone prescribing did not increase significantly in the prison population between 2015 and 2018, and it decreased by a factor of 0.99 per year in the whole population. In contrast, buprenorphine/naloxone prescribing increased significantly in provincial prisons as well as in the whole population: the prevalence rate increased in provincial prisons by a factor of 1.70 per year, which was significantly higher than the increase in prescribing for the whole population, where the prevalence rate increased by 1.20 times per year.

The percentage of people prescribed OAT was variable across provincial prisons, as shown in Figure 2. Methadone prescribing across prisons was fairly consistent over the time period. Buprenorphine/naloxone prescribing across prisons increased over the time period with the median prevalence, and 25th and 75th percentiles all increasing over the period under study. Relative to the overall pattern for methadone, buprenorphine/naloxone prescribing was more variable across prisons, with several prisons being outliers with prescribing rates far higher than those seen in the lower 75% of all prisons.

The difference in prescribing prevalence between prisons was statistically significant, as a main effect for prison, and beyond variability by chance. Results for the global tests contrasting prevalence across all 26 prisons relative to the provincial average in prisons (testing as a main effect) were statistically significant ($p<0.001;25df$) in all cases. Results from likelihood ratio tests for prisons after controlling for date of data collection were similarly statistically significant for all three models for methadone, buprenorphine/naloxone and overall OAT ($p<0.001;25df$). The same modeling confirmed that there was no statistically significant trend over time in for methadone prescribing, during this time window (there was no trend treating date as a continuous variable or for

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reporting date treated as categorical). All analyses found significant effects for both date (i.e., trend over time) and across prisons (as a categorical main effect) for buprenorphine/naloxone prescribing and any OAT prescribing.

Discussion

This study demonstrates that rates of OAT prescribing increased over the study period in provincial prisons. This may reflect increased need over time, as opioid-related emergency department visits and mortality in Ontario increased year-over-year from 2015 to 2018 and hospitalizations increased every year but one from 2015 to 2018.[39] It may also reflect changes in accessibility or acceptance of OAT in Ontario prisons. We also found there were highly variable rates of OAT prescribing across provincial prisons for the same time period, which is unlikely to be solely attributable to variation in patient eligibility for and interest in treatment. Some of the difference in rates of OAT prescribing between prisons may reflect regional variability in community prescribing, which we did not assess in this study.

This study has several limitations. Information on OAT prescribing was only available as quarterly point-in-time data. These data do not differentiate between initiation of OAT and continuation of OAT in provincial prison, and this information would be relevant for developing interventions to improve OAT access and quality in prisons. In the absence of individual-level clinical data, we are unable to examine characteristics of individuals treated over time or assess whether there was continuity of OAT on admission and release. We are also not able to understand whether people have access to OAT, e.g., whether people were offered OAT on admission if indicated, or indicators of high-quality OAT, such as whether dose was increased in a timely fashion and whether a therapeutic dose was achieved. Further information from charts and from people in prisons would provide additional information. Information on OAT receipt and OAT coverage in the community was available in age groups that did not match the age group of the incarcerated population; community data was presented for the age group of 15 years of age and older, while the incarcerated population was ages 18 and up.

A recent study of Berlin prisons examined similar questions regarding prevalence of OAT prescribing.[40] They found that 6.8% of the incarcerated population was on OAT.

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We found a substantially higher prevalence rate, which may be due to differing need between these two contexts. Our study adds to that by including data over a several year period, for a large population, in North America during opioid overdose crisis, and compares across institutions and with community. In comparison theirs is very recent and only examines a single point in time; however, they were able to determine the prevalence of opioid dependence and thus look at treatment coverage.

While it is encouraging to see an upward trend in correctional OAT prescribing in this population, the degree to which treatment needs are being met in this setting remains unclear as we lack data on the prevalence of opioid use disorder in people in Ontario provincial prisons. To support health system and treatment planning, research is needed to determine the prevalence of opioid use disorder and to describe OAT access, initiation and continuity for people who experience incarceration. Such work would be facilitated through the use of clinical data as well as administrative data, and the lack of an electronic medical record in Ontario provincial prisons is a current barrier to data collection and analysis. In addition, research should explore differences between prisons that may prevent or promote access to high quality OAT, and facilitators to OAT access in other jurisdictions that have successfully improved OAT access.

Research and public health interventions should also consider the structural forces that create an environment where people who use drugs are more likely to experience incarceration. Criminalization of drug use ipso facto leads to incarceration, and structural factors such as homelessness and poverty create conditions that further increase the risk of incarceration. Of particular importance are the ways that racism and colonization shape drug policy, the policing of Black and Indigenous people, and the over-incarceration of Black and Indigenous people in Canada. Increasing OAT access may reduce the likelihood of subsequent incarceration.[41]

This study demonstrates that OAT prescribing increased substantially between 2015 and 2018 in provincial prisons in Ontario, Canada. Furthermore, there was significant variation in prescribing prevalence between different prisons. Future research is needed on opioid use disorder prevalence in people in prisons and on institutional and systems level factors that promote or inhibit access to OAT. In the meantime, health and correctional staff and administration should work to support universal access to high

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quality OAT for people with opioid use disorder in provincial prison and after release. Supporting treatment for opioid use disorder could prevent the substantial burden and harms associated with opioid use in this population.

Author Contributions

F. Kouyoumdjian conceived and supervised the study. S. Bondy completed the analyses. C. Bodkin contributed to study design and wrote the first draft of the manuscript. All authors contributed to interpretation of analyses, revised the manuscript, and approved the final version.

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Competing Interests

L. Regenstreif received honoraria from Indivior for giving presentations on Sublocade and for Advisory Board participation on Sublocade and Suboxone film. We have no other competing interests to disclose.

Ethics

This study was approved by the Hamilton Integrated Research Ethics Board (#5878).

Data sharing statement

We are not able to share data because of restrictions specified in our Research Agreement with the Ministry of the Solicitor General. To request access to data, interested persons could contact mcscsresearch@ontario.ca.

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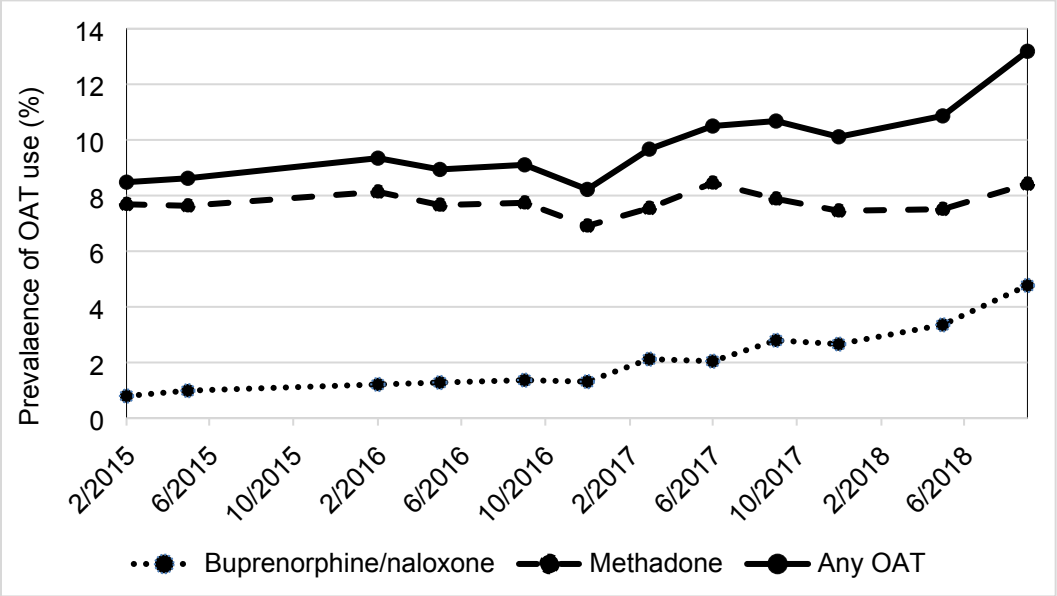
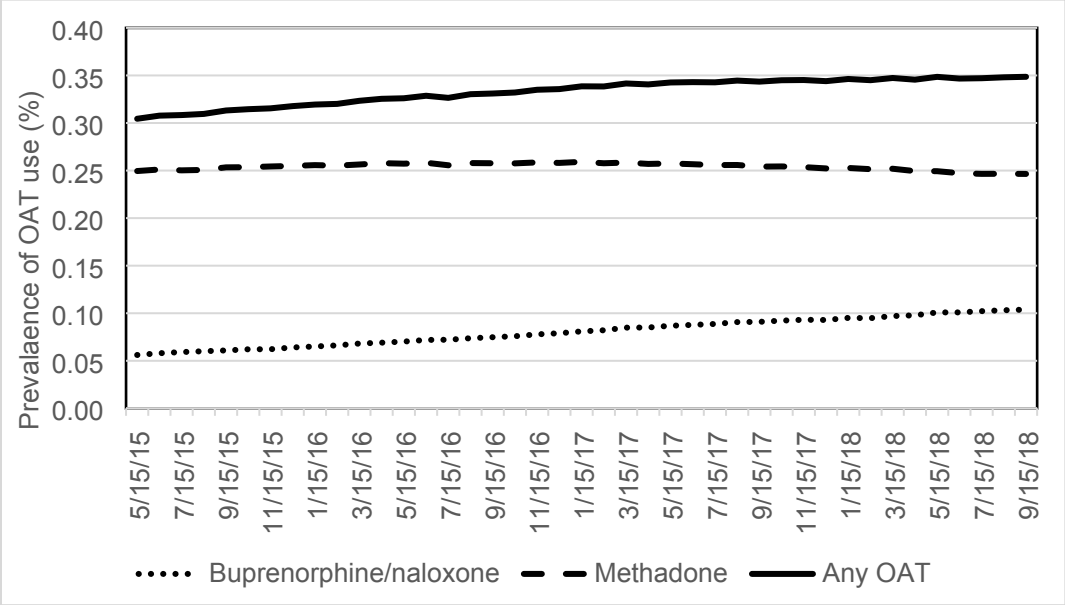
Figure 1. Percentage of people prescribed OAT in provincial prisons and in the whole population in Ontario, 2015 to 2018 by OAT type



Ontario provincial prisons



Ontario whole population

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Table 1. Prevalence rate ratio of trends in prescribed methadone, buprenorphine/ naloxone or either in Ontario, Canada, 2015 to 2018

	Provincial prison population*				Whole population				Are PRRs different?
	PRR	95% CI		p value for trend	PRR	95% CI		p value for trend	
Methadone	1.01	0.94	1.09	0.77	0.99	0.99	0.999	0.034	p=0.078
Buprenorphine/ naloxone	1.70	1.47	1.96	0.000	1.20	1.19	1.21	0.000	p<0.001
Any OAT	1.12	1.04	1.21	0.003	1.04	1.04	1.04	0.000	p<0.001

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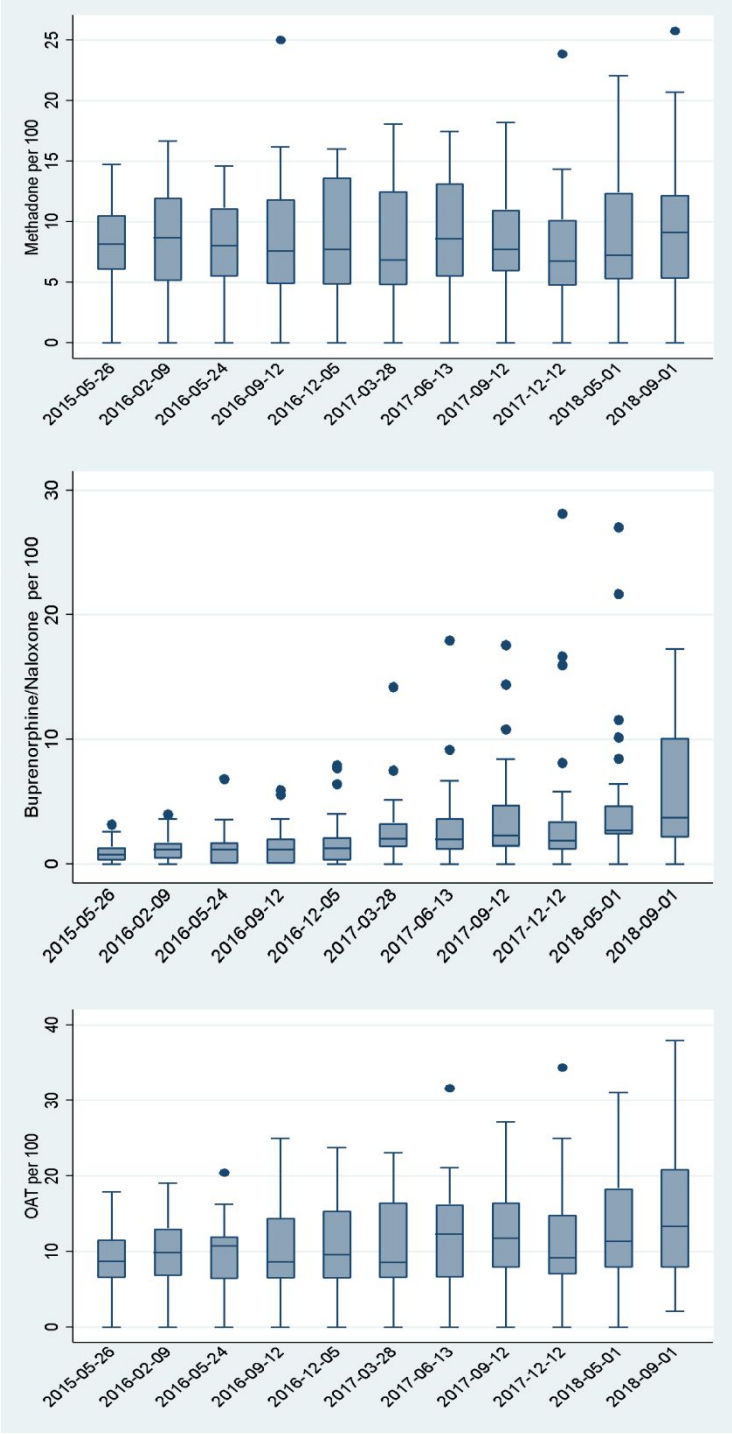
Figure 2. Boxplots* of percent of people prescribed methadone, buprenorphine/ naloxone or either per quarter across provincial prisons in Ontario, 2015 to 2018



*The centre line indicates the median prevalence of prescribing, and the box shows the range in rates for the 25th and 75th percentiles for prevalence of prescribing; dots indicate provincial prisons with extreme prevalence rates.

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6,7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6,7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6,7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4,6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6,7
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	6,7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7,8
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5,6,7
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	8,12,13,14

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Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8.12.13.14
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8,9
Discussion			
Key results	18	Summarise key results with reference to study objectives	9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9,10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Rates of opioid agonist treatment prescribing in provincial prisons in Ontario, Canada, 2015 to 2018: A repeated cross-sectional analysis

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Rates of opioid agonist treatment prescribing in provincial prisons in Ontario, Canada, 2015 to 2018: A repeated cross-sectional analysis

Authors: Claire Bodkin, MD[1] Susan J. Bondy, PhD[2] Lori Regenstreif, MD, MSc[1] Lori Kiefer, MD, MHSc[2,3] Fiona G. Kouyoumdjian, MD, PhD[1]

Affiliations:

[1]Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada

[2]Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada

[3]Ontario Ministry of the Solicitor General, Toronto, Ontario, Canada

Corresponding Author:

Claire Bodkin
claire.bodkin@medportal.ca
226-688-8282
David Braley Health Sciences Centre, 3rd floor
100 Main St West
Hamilton, ON
L8P1H6

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Abstract

Objective:

To describe opioid agonist treatment prescribing rates in provincial prisons and compare with community prescribing rates.

Design:

We used quarterly, cross-sectional data on the number and proportion of people prescribed opioid agonist treatment in prison populations. Trends were compared with Ontario surveillance data from prescribers, reported on a monthly basis.

Setting:

Provincial prisons and general population in Ontario, Canada between 2015 and 2018.

Participants:

Adults incarcerated in provincial prisons and people ages 15 years and older in Ontario.

Main Outcomes and Measures:

Opioid agonist treatment prescribing prevalence, defined as treatment with methadone or buprenorphine/naloxone.

Results:

In prison, 6.9% to 8.4% of people were prescribed methadone; 0.8% to 4.8% buprenorphine/naloxone; and 8.2% to 13.2% either treatment over the study period. Between 2015 and 2018, methadone prescribing prevalence did not substantially change in prisons or in the general population. The prevalence rate of buprenorphine/naloxone prescribing increased in prisons by 1.70 times per year (95%CI 1.47-1.96), which was significantly higher than the increase in community prescribing: 1.20 (95%CI 1.19-1.21). Buprenorphine/naloxone prescribing prevalence was significantly different across prisons.

Conclusions:

The increase in opioid agonist treatment prescribing between 2015 and 2018 in provincial prisons shows that efforts to scale up access to treatment in the context of the opioid overdose crisis have included people who experience incarceration in Ontario. Further work is needed to understand unmet need for treatment, and treatment impacts.

Article Summary:

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Strengths of this study

- This is the first study describing the rates of opioid agonist treatment prescribing in a prison population over time and during the opioid overdose crisis.
- We used whole population prescribing rates for people in prisons and in the community.

Limitations of this study

- We lack data on the prevalence of opioid use disorder to determine opioid agonist treatment coverage for people with opioid use disorder.

Keywords:

Opioid-Related Disorders, Addiction Medicine, Prisons, Prisoners, Opiate Substitution Treatment

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Background

There is a substantial burden of opioid-related morbidity and mortality in people who experience incarceration in Canada.[1-4] Research consistently identifies high rates of substance use disorders in this population,[5-10] and a majority of people report recent drug use at the time of admission to custody,[7,8,11-14] including use of opioids,[12] and a substantial proportion use drugs in custody.[8,13,15-17] Reliable estimates of opioid use disorder prevalence among incarcerated and non-incarcerated people in Ontario are not available. This represents an important information gap and barrier to planning, delivery, and evaluation of efforts address opioid related harms in this setting. One Ontario study of adult males incarcerated in a provincial prison in 2009 found that 10.4% reported injection non-heroin opioid use in the year prior to incarceration, while 4.4% reported injection heroin use during the same time period.[12] This is an order of magnitude higher than Jacka et al's estimate that 0.63% of the entire Ontario population used any drug intravenously in 2011.[18] People who experience incarceration commonly engage in behaviours such as injecting drugs,[5,11,12,14,16,19-24] sharing needles and other paraphernalia,[5,19,21,24-26] and polysubstance use,[7,11] which increase the risk of harms such as overdose and bloodborne infections. Further, evidence from Ontario reveals that the risk of death from overdose is high in this population compared to the general population, in particular at the time of release.[1,2] Not only do people in prison have higher rates of illicit substance use, but people who use drugs have higher rates of incarceration in the context of the criminalization of drug use.[27]

Opioid agonist treatment (OAT) is the first line treatment for opioid use disorder (OUD), and the standard of care across Canada.[28] OAT provides a long-acting opioid medication that binds to opioid receptors and prevents drug cravings and opioid withdrawal symptoms. OAT reduces both all-cause and overdose mortality.[29] In incarcerated populations, OAT reduces HIV transmission and complications, hepatitis C transmission and complications, and mortality after release, and improves a host of other health, social, and psychological outcomes.[30-33] Implementation of a state-wide correctional OAT program in Rhode Island produced a 60.5% reduction in overdose mortality rates within 1 year of release from prison.[34] OAT may also positively impact recidivism, but available evidence is limited in quantity and quality.[35]

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Though challenges to access remain, OAT is widely available in the community and is being rapidly scaled in response to the current opioid overdose crisis. Canadian and international law confers an obligation to provide equivalent care in prison. The United Nations Standard Minimum Rules for the Treatment of Prisoners, also known as the Nelson Mandela Rules, were adopted by the UN General Assembly in 2015 and call for prison health care services that are comparable to community services and continuity of care from the community to prison and back again.[36] Despite the burden of opioid-related morbidity and mortality, evidence of OAT effectiveness, and the principle of equivalence, access to OAT in correctional facilities is often limited. A recent qualitative study of OAT prescribing in provincial correctional facilities in Ontario demonstrated that many physicians working in this setting do not prescribe OAT, and a minority initiate OAT for patients in custody.[37] Quantitative data from Vancouver, British Columbia revealed that among 597 recently incarcerated people with opioid use disorder, only 35% were prescribed OAT while in custody, and less that 10% of those prescribed OAT in custody were new initations.[38]

Information on OAT use in people in prison is important to understand whether this population has access to this evidence-based treatment, which could mitigate the risk of harms for people who experience incarceration. We aimed to describe rates of OAT prescribing in provincial prisons in Ontario, Canada between 2015 and 2018, and compared these rates with rates of OAT prescribing in the community.

Methods

Context

Provincial prisons in Canada hold adults aged 18 years and older who are awaiting trial or sentencing, or who are sentenced to less than 2 years in prison. In Ontario, provincial prisons are publicly funded and administered by the Ministry of the Solicitor General. We use the term “provincial prison” to represent all provincial correctional facilities, and “people who experience incarceration” to represent the population of those who experience detention and incarceration in provincial prisons, and “in custody” to refer to the time while in a provincial prison.

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For Ontario residents, hospitalizations and medically necessary physician services are paid for through the public health insurance system, the Ontario Health Insurance Plan (OHIP), including while in provincial prison. In custody, prescribed medications are paid for by the Ministry of the Solicitor General. In the community, a subset of OHIP-eligible people are eligible for coverage of prescribed medication costs through the Ontario Drug Benefit (ODB) program, including people aged 65 years or older, and people who receive benefits based on financial need and employment status or disability.

Regarding health care in Ontario provincial prisons, people are routinely assessed by a nurse on admission, which includes a history of prescribed medications and substance use. They are then seen by a physician or nurse practitioner in the ensuing weeks or sooner if medically indicated. The physician or nurse practitioner may order prescribed medications without seeing a patient, e.g., at the time of admission for continuity of medication, or after assessing the patient. The model of care in Ontario prisons requires that every facility have at least one OAT prescriber but does not require all primary care physicians to prescribe OAT, which may represent a barrier to accessing OAT. As this study was a review of administrative health data, patients and the public were not consulted in the development of this study.

Data Sources

The Ministry of the Solicitor General provided quarterly snapshot data between 2015 and 2018 on the number and proportion of people in each provincial prison who were prescribed buprenorphine/naloxone and methadone, which were the two forms of OAT available during the period under study. These snapshots were aggregate cross-sectional data of people prescribed these treatments on a single day. These data are routinely reported by health care staff in each provincial prison to the Ministry of the Solicitor General. The Ministry of the Solicitor General also provided data on the number of people in each prison. Data were not available by age-group or gender. One prison closed in 2018 but data for that prison were included up to that date (i.e., excluding the last two time periods).

We accessed data on OAT use rates and proportions in the community between 2015 and 2018 using publicly available data from the Narcotics Monitoring System (NMS), which

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included people ages 15 and older who received methadone or buprenorphine/naloxone in Ontario between January 1 2015 and December 31 2018. The NMS is administered by Ontario's Ministry of Health and collects information from dispensers on all prescribed monitored drugs dispensed to people in the community in Ontario (i.e., not including people in hospital or in provincial prisons), including buprenorphine/naloxone and methadone. We accessed these data through the Ontario Prescription Opioid Tool, which is a publicly available tool that presents data on the number and rates of people prescribed all opioids, including OAT, in Ontario.[39] These data are available as counts (absolute number of prescriptions) and a rate per 1000 population on a monthly and yearly basis. Yearly data are available by sex, and by age groups. Age groups are 0-14, 15-24, 25-44, 45-64, and 65+ years of age. Data for OAT were presented for ages 15 and older and so our analyses use data for age 15 and older.

We obtained study approval from the Hamilton Integrated Research Ethics Board (#5878). Consistent with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans- TCPS 2 (2018), we did not obtain individual consent for study participation; we accessed only aggregate data and it would not be feasible to identify or contact those whose data we used.[40]

Statistical Analysis

We describe the rates of prescribed OAT as the percent of people in the applicable study population prescribed OAT in the time period of data capture (prevalence rates expressed as percent or per population size). We also estimated the rate of change in OAT prescribing prevalence between February 2015 and September 2018 across provincial prisons and the rate of change in prescribing in the community over the same time period. Rates of change were expressed as prevalence rate ratios (PRR) per year and were estimated using Poisson regression with robust standard errors. Prevalence rates of opioid agonist prescribing for all of Ontario were graphed by time. We performed simple Wald contrasts to determine if the PRRs for OAT prescribing, using pooled data across prisons, were significantly different (α level of .05) from the overall provincial rates of change, in the 2015 to 2018 time period.

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Following prior work on variations in prescribing practices across provincial prisons, we also explored variability in OAT prescribing across prisons and over time. [37] We used box-plot graphs, which present the median prescribing rate, the 25th and 75th percentiles for prescribing rates and markers for prisons with prescribing rates outside this range. Hypothesis tests assessed if the observed differences in prescribing rates across prisons were statistically significant as a main effect. These were conducted as overall significance tests for a main effect in prescribing rate across prison (global test for all prisons being different from the overall mean rate). Tests for overall differences across prisons were performed using negative binomial regression controlling for time of reporting. For tests of statistical significance, α was set at .05. Analyses were performed using Stata software, version 16 (StataCorp).

Patient and Public Involvement

Three of the authors have clinical practices caring for people who are currently or formerly incarcerated. The research question emerged from their patient's experiences of trying to access OAT while incarcerated. There was no formal patient or public involvement in the project design, data collection, or analysis.

Results

We examined data for 26 provincial prisons. We had cross-sectional prescribing data for provincial prisons at two time points in 2015, four time points in 2016, four time points in 2017, and two time points in 2018. During the period under study, the cross-sectional population size for the included provincial prisons ranged from 11 people in the smallest prison to 1,096, and the total population across the 26 provincial prisons ranged between 7,140 and 8,122.

Over the study period and across provincial prisons, the total percentage of people treated with methadone ranged between 6.9% and 8.4%, with buprenorphine/naloxone ranged between 0.8% and 4.8%, and with either treatment ranged between 8.2% and 13.2% (Figure 1).

As shown in Table 1, methadone prescribing did not increase significantly in the prison population between 2015 and 2018, and decreased by a factor of 0.99 per year in the

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whole population. In contrast, buprenorphine/naloxone prescribing increased significantly in provincial prisons as well as in the whole population: the prevalence rate increased in provincial prisons by a factor of 1.70 per year, which was significantly higher than the increase in prescribing for the whole population, where the prevalence rate increased by 1.20 times per year.

The percentage of people prescribed OAT was variable across provincial prisons, as shown in Figure 2. Methadone prescribing across prisons was fairly consistent over the time period. Buprenorphine/naloxone prescribing across prisons increased over the time period with the median prevalence, and 25th and 75th percentiles all increasing over the period under study. Relative to the overall pattern for methadone, buprenorphine/naloxone prescribing was more variable across prisons, with several prisons being outliers with prescribing rates far higher than those seen in the lower 75% of all prisons.

The difference in prescribing prevalence between prisons was statistically significant, as a main effect for prison, and beyond variability by chance. Results for the global tests contrasting prevalence across all 26 prisons relative to the provincial average in prisons (testing as a main effect) were statistically significant ($p<0.001$;25df) in all cases. Results from likelihood ratio tests for prisons after controlling for date of data collection were similarly statistically significant for all three models for methadone, buprenorphine/naloxone and overall OAT ($p<0.001$;25df). The same modeling confirmed that there was no statistically significant trend over time in for methadone prescribing, during this time window (there was no trend treating date as a continuous variable or for reporting date treated as categorical). All analyses found significant effects for both date (i.e., trend over time) and across prisons (as a categorical main effect) for buprenorphine/naloxone prescribing and any OAT prescribing.

Discussion

This study demonstrates that rates of OAT prescribing increased over the study period in provincial prisons. This may reflect increased need over time, as opioid-related emergency department visits and mortality in Ontario increased year-over-year from 2015 to 2018 and hospitalizations increased every year but one from 2015 to 2018.[41] It

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may also reflect changes in accessibility or acceptance of OAT in Ontario prisons. We also found there were highly variable rates of OAT prescribing across provincial prisons for the same time period, which is unlikely to be solely attributable to variation in patient eligibility for and interest in treatment. Some of the difference in rates of OAT prescribing between prisons may reflect regional variability in community prescribing, which we did not assess in this study.

This study has several limitations. Information on OAT prescribing was only available as quarterly point-in-time data. These data do not differentiate between initiation of OAT and continuation of OAT in provincial prison, and this information would be relevant for developing interventions to improve OAT access and quality in prisons. In the absence of individual-level clinical data, we are unable to examine characteristics of individuals treated over time or assess whether there was continuity of OAT on admission and release. We are also not able to understand whether people have access to OAT, e.g., whether people were offered OAT on admission if indicated, or indicators of high-quality OAT, such as whether dose was increased in a timely fashion and whether a therapeutic dose was achieved. Further information from charts and from people in prisons would provide additional information. Information on OAT receipt and OAT coverage in the community was available in age groups that did not match the age group of the incarcerated population; community data was presented for the age group of 15 years of age and older, while the incarcerated population was ages 18 and up.

A recent study of Berlin prisons examined similar questions regarding prevalence of OAT prescribing.[42] They found that 6.8% of the incarcerated population was on OAT. We found a substantially higher prevalence rate, which may be due to differing need between these two contexts. Our study adds to that by including data over a several year period, for a large population, in North America during opioid overdose crisis, and compares across institutions and with community. In comparison theirs is very recent and only examines a single point in time; however, they were able to determine the prevalence of opioid dependence and thus look at treatment coverage.

Describing the rates and variability in OAT prescribing in prisons provides stakeholders with a starting point to understand and address gaps in access to evidence-based first line treatment for opioid use disorder within the provincial prison system. While it is

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encouraging to see an upward trend in correctional OAT prescribing in this population, the degree to which treatment needs are being met in this setting remains unclear as we lack data on the prevalence of opioid use disorder in people in Ontario provincial prisons. To support health system and treatment planning, research is needed to determine the prevalence of opioid use disorder and to describe OAT access, initiation and continuity for people who experience incarceration. Such work would be facilitated through the use of clinical data as well as administrative data, and the lack of an electronic medical record in Ontario provincial prisons is a current barrier to data collection and analysis. In addition, research should explore differences between prisons that may prevent or promote access to high quality OAT, and facilitators to OAT access in other jurisdictions that have successfully improved OAT access.

Research and public health interventions should also consider the structural forces that create an environment where people who use drugs are more likely to experience incarceration. Criminalization of drug use ipso facto leads to incarceration, and structural factors such as homelessness, poverty, racism, and colonization create conditions that further increase the risk of incarceration. Lack of access to OAT in prison in turn exacerbates the health effects of structural oppression. Increasing OAT access may also reduce the likelihood of subsequent incarceration.[43]

This study demonstrates that OAT prescribing increased substantially between 2015 and 2018 in provincial prisons in Ontario, Canada. Furthermore, there was significant variation in prescribing prevalence between different prisons. Future research is needed on opioid use disorder prevalence in people in prisons and on institutional and systems level factors that promote or inhibit access to OAT. In the meantime, health and correctional staff and administration should work to support universal access to high quality OAT for people with opioid use disorder in provincial prison and after release. Supporting treatment for opioid use disorder could prevent the substantial burden and harms associated with opioid use in this population.

Author Contributions

FK conceived and supervised the investigation and contributed to study design. SB directed the statistical analyses and contributed to study design. CB contributed to study

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design and wrote the first draft of the manuscript. LK and FK contributed to data acquisition. FK, SB, CB LK, and LR contributed to interpretation of analyses, critically reviewed and revised the manuscript, and approved the final version.

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Competing Interests

L. Regenstreif received honoraria from Indivior for giving presentations on Sublocade and for Advisory Board participation on Sublocade and Suboxone film. We have no other competing interests to disclose.

Ethics

This study was approved by the Hamilton Integrated Research Ethics Board (#5878).

Data sharing statement

We are not able to share data because of restrictions specified in our Research Agreement with the Ministry of the Solicitor General. To request access to data, interested persons could contact mcscsresearch@ontario.ca.

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Figure 1. Percentage of people prescribed OAT in provincial prisons and in the whole population in Ontario, 2015 to 2018 by OAT type

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Table 1. Prevalence rate ratio of trends in prescribed methadone, buprenorphine/ naloxone or either in Ontario, Canada, 2015 to 2018

	Provincial prison population*				Whole population				Are PRRs different?
	PRR	95% CI		p value for trend	PRR	95% CI		p value for trend	
Methadone	1.01	0.94	1.09	0.77	0.99	0.99	0.999	0.034	p=0.078
Buprenorphine/ naloxone	1.70	1.47	1.96	0.000	1.20	1.19	1.21	0.000	p<0.001
Any OAT	1.12	1.04	1.21	0.003	1.04	1.04	1.04	0.000	p<0.001

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Figure 2. Boxplots* of percent of people prescribed methadone, buprenorphine/ naloxone or either per quarter across provincial prisons in Ontario, 2015 to 2018
*The centre line indicates the median prevalence of prescribing, and the box shows the range in rates for the 25th and 75th percentiles for prevalence of prescribing; dots indicate provincial prisons with extreme prevalence rates.

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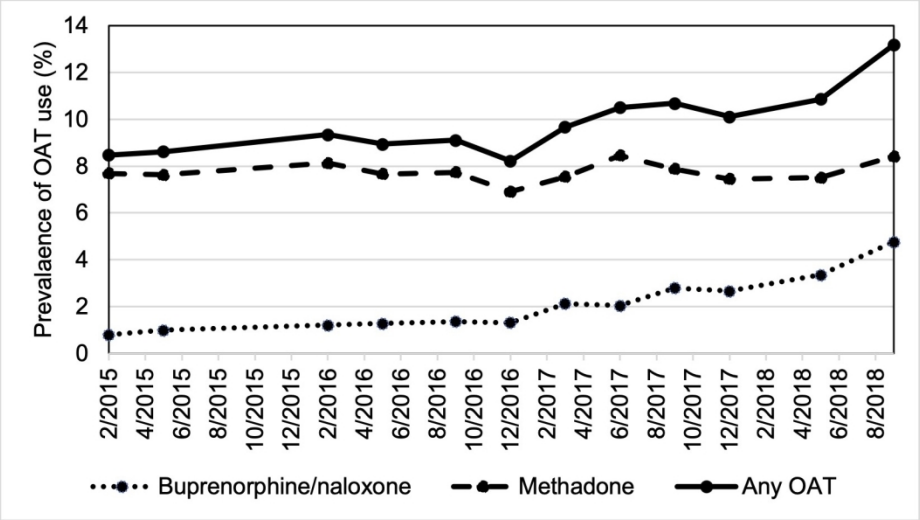
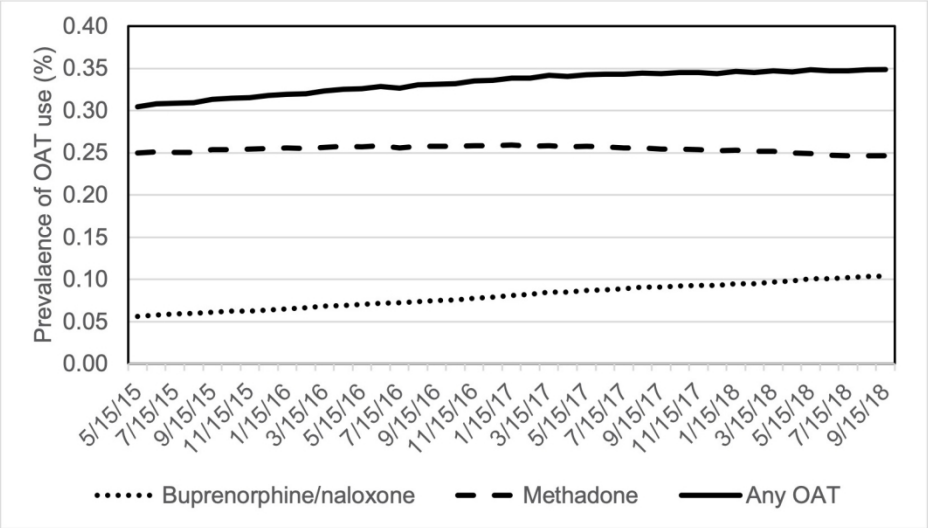


Ontario provincial prisons



Ontario whole population

Figure 1. Percentage of people prescribed OAT in provincial prisons and in the whole population in Ontario, 2015 to 2018 by OAT type

632x753mm (72 x 72 DPI)

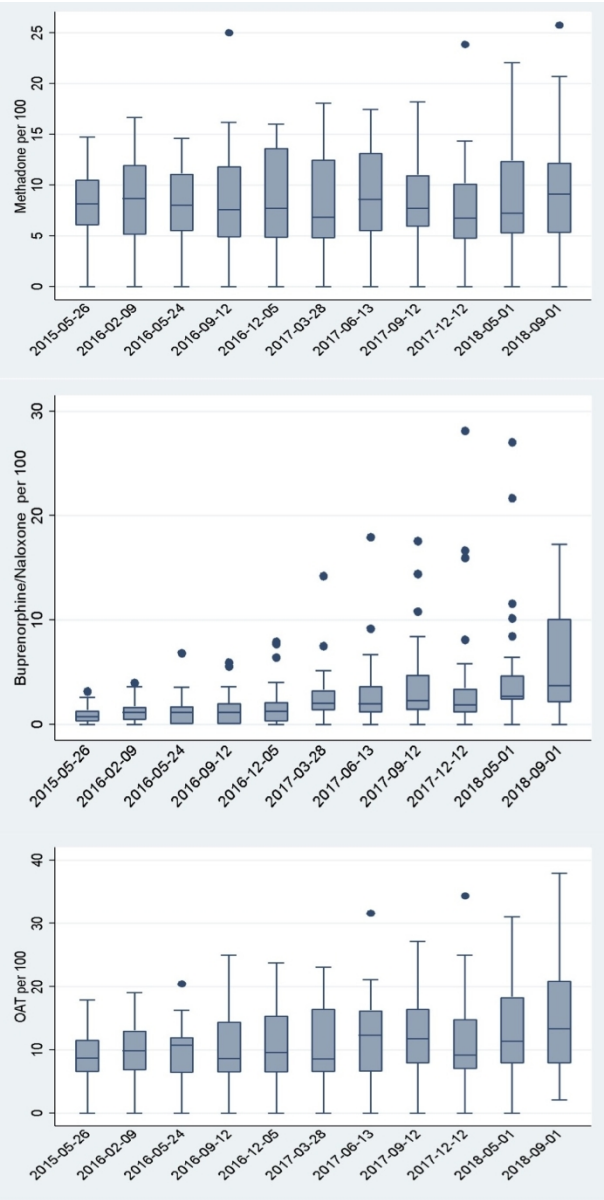


Figure 2. Boxplots* of percent of people prescribed methadone, buprenorphine/naloxone or either per quarter across provincial prisons in Ontario, 2015 to 2018
*The centre line indicates the median prevalence of prescribing, and the box shows the range in rates for the 25th and 75th percentiles for prevalence of prescribing; dots indicate provincial prisons with extreme prevalence rates.

397x788mm (72 x 72 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6,7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6,7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6,7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4,6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6,7
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	6,7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7,8
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5,6,7
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	8,12,13,14

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Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8.12.13.14
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8,9
Discussion			
Key results	18	Summarise key results with reference to study objectives	9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9,10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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