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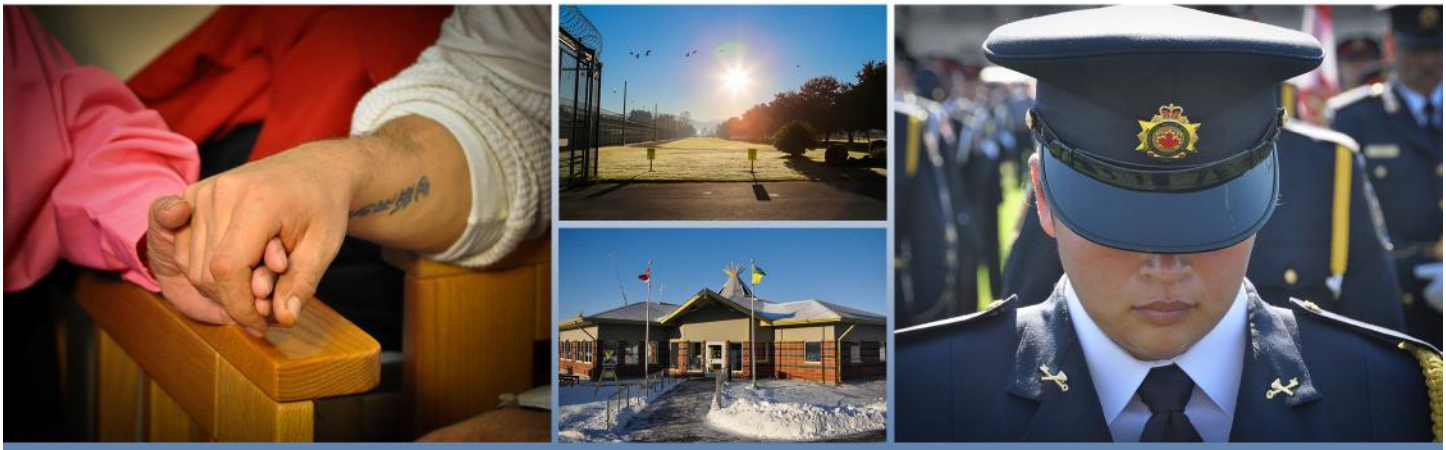

RESEARCH REPORT

Substance use-related overdose among incarceration-exposed individuals: A recent literature compilation and review (with primary focus on North America)

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Substance use-related overdose among incarceration-exposed individuals: A recent literature compilation and review (with primary focus on North America)

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Executive Summary

Key words: *substance use disorders, overdose, opioids, fentanyl, risk factors*

This exploratory review of recent (e.g., post-2016) literature is framed by the wider parameters that correctional populations feature disproportionately elevated levels of severe health problems (e.g., chronic diseases); these include substance use disorders in 50% or more of inmates, commonly co-occurring with other/severe mental health problems. While substance use during incarceration is prevalent, recent studies have found it to be associated with multiple, albeit inconsistent, risk-factors (e.g., socio-demographics, substance use/mental health histories, criminogenic/sentencing factors). A crucial risk for adverse health outcomes is drug-related overdoses (ODs) among incarceration-exposed individuals. While information on ODs during incarceration is limited, recent North American data suggest increasing trends for (both non-fatal and fatal) ODs, with large proportions associated with opioids, but also with other medical/non-medical substances. More specific evidence indicates that over the past decade – reflecting developments in general community settings in North America -- there have been marked increases in the numbers/rates of opioid-related ODs involving synthetic opioids (i.e., fentanyl/fentanyl-analogues) in correctional populations. Various study data indicate that the proliferation of fentanyl has profoundly impacted non-medical drug use ecologies in Canadian correctional settings; in the federal correctional system, the majority of recent fatal ODs has been opioid- (e.g., fentanyl-) related, with similar trends for US-based settings.

Further robust epidemiological evidence shows that individuals released from incarceration into the community are at vastly elevated risk of all-cause mortality, especially within the immediate post-release period. Here, substance use-related factors – and specifically, OD fatalities increasingly involving synthetic opioids – are identified as the leading, specific risk factor for death among recently incarceration-exposed populations released into the community.

Risk factors for substance-related mortality post-release also vary inconsistently, with some indicating age, race/ethnicity, substance use histories or patterns, mental health/trauma, care-engagement and/or criminal justice-related factors as possible co-variates. Valuable recent conceptual/integrative work on OD-risk and outcome dynamics in incarcerated populations suggest for it to be not well-understood through isolated individual factors, but rather emerging from a complex interplay of systemic/structural/setting-, individual- and other factors within correctional environments. Some of these are distinctly amplified by fentanyl's particular pharmaco-behavioral dynamics (e.g., high potency, common un-known/-intentional exposure, rapid OD onset, challenges for OD reversal).

There is a diverse body of evidence regarding interventions towards reduced OD incidence and outcomes in correctional populations. Extensive evidence suggests that levels of engagement in medication-assisted treatment for opioid use disorder (MOUD; i.e., with different formulation options) have recently increased in correctional populations and is protective for OD to some degree; however, MOUD access, delivery and especially continuity for post-release/community-based care remain a challenge. Naloxone is part of standard institutional emergency OD-responses; its distribution to inmates at release appears to reduce opioid-related ODs, yet North

American data on outcomes is limited. While a couple of initial Overdose Prevention Site (OPS) measures have been implemented in CSC institutions with interim evaluation signals for OD-related risk reductions among inmates who accessed it, the potential for system-wide expansion or its impacts is unclear. Other interventions to reduce OD-related risks and outcomes available in general community settings (e.g., ‘drug checking’, ‘safer opioid supply’ programming) are currently not implemented in correctional settings but may be worth considering for adaptation and experimental assessment towards improved intervention responses.

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Introduction

Substance use is a leading risk factor for burden of disease and related health and social harms (Chen et al., 2022; GBD 2021 Risk Factors Collaborators, 2024). Over the past decade, vast increases in drug-related overdose deaths (ODs; primarily related to synthetic opioids, e.g., fentanyl) have resulted in a major public health crisis, emerging as the leading cause of unnatural deaths while adversely affecting life-expectancy in North American general populations (Ciccarone, 2021; Fischer, 2023; Fischer et al., 2019; Manchikanti et al., 2022). Correctional populations are characterized by a wide range of elevated levels of (e.g., chronic) diseases, including substance use and mental health problems, and specifically drug-related overdose (Kinner & Young, 2018; Kouyoumdjian et al., 2016). Understanding and providing effective interventions for the phenomenon of drug overdose among correctional populations is a distinctly complex challenge for multiple reasons, which include systemic/environmental, behavioral and individual factors (extending to both correctional settings and post-release contexts). This exploratory literature review aimed to identify, structure and summarize key recent literature focusing on substance use and specifically drug-related overdose (including related risk-factors/co-variates at different levels, with particular attention to synthetic opioids) and related interventions in correctional populations/settings with main focus on Canada (North America). The review primarily focused on recent (i.e., post-2016 to 2024) literature on related topics, identified by targeted searches in main databases, with a principal focus on (e.g., systematic) reviews where available, and/or (good quality) individual studies and complementary other (e.g., grey literature) data as appropriate. Based on these main parameters, the literature/data identified were topically organized, and narratively integrated and summarized.

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Results

II. Adverse health status and outcomes in correctional populations

Incarceration-exposed populations experience disproportionately high levels of health problems and/or diseases (morbidity) as well as mortality when compared with general populations (Kinner & Young, 2018; Kouyoumdjian et al., 2016). Elevated rates of morbidity among correctional inmates are observed for a variety of chronic diseases, including mental health (MH) and/or substance use disorders (SUD); communicable diseases, such as tuberculosis; blood-borne/sexually transmitted infections (e.g., HIV/Hepatitis C, chlamydia and gonorrhea) and other chronic diseases (e.g., cardio-vascular, diabetes, respiratory) or injuries (e.g., traumatic brain injury) (Wanamaker, Filoso, Mahboob, Gendron, & Johnson, 2024; Kinner & Young, 2018; Kouyoumdjian et al., 2016). A recent umbrella review (17 meta-analyses; 2002-2023) examining mental and physical health conditions in prison populations found a 6-month prevalence of 11.4% (95% Confidence Interval [CI]: 9.9–12.8) for major depression, 9.8% (95% CI: 6.8–13.2) for post-traumatic stress disorder, and 3.7% (95% CI: 3.2–4.1) for psychotic illness in men and women combined. On admission, 23.8% (95% CI: 21.0–26.7) met criteria for alcohol use disorder and 38.9% (95% CI: 31.5-46.2) for SUD. Half of those with major depression or psychotic illness also indicated a co-morbid SUD (Favril et al., 2024). A systematic review on the global prevalence of comorbid serious mental health (MH) and SUDs among prisoners (50 datasets/24,915 people; 1980 – 2021) found that 3.5% (95% CI: 2.2–5.0) had current non-affective psychosis with any comorbid SUD, representing 49.2% of people with non-affective psychosis, and 9.1% (95% CI: 5.6–13.3) had major depression and comorbid SUD, representing 51.6% of people with major depression (Baranyi et al., 2022). Both those with current non-affective psychosis (odds ratio [OR]: 1.7, 95% CI: 1.4–2.2) and people with major depression (OR: 1.6, 95% CI: 1.3–2.0) were significantly more likely to have SUD. An earlier systematic review/meta-analysis comprising 24 studies/18,388 prisoners (1966-2015) estimated a (12-month) prevalence of alcohol use disorder of 24% (95% CI: 21–27); the pooled prevalence estimate for SUD in male prisoners was 30% (95% CI: 22–38) and, in female prisoners, 51% (95% CI: 43–58); the review results observed heterogeneity by sex as well as increasing SUD rates in more recent years (Fazel et al., 2017).

A recent study among offenders from 10 provincial prisons in British Columbia

(*n*=47,117; 2009 – 2017) based on intake screening found the annual prevalence of any MH and/or SUD increased from 61% (2009) to 75% (2017), specifically including five-fold increases in methamphetamine use disorder (6%-29%) and heroin use disorder (11%-26%) (Butler et al., 2022). Co-occurring MH and SUDs markedly increased from 15% to 32%. Among Canadian federal prison (CSC) inmates, earlier intake diagnostic data had found that >70% of men offenders met criteria for at least one mental disorder, with highest prevalence for alcohol & substance use disorders (49.6%), anti-social personality disorder (44.1%) and anxiety disorder (29.5%). Among women inmates, four in five (79.2%) met criteria for a current mental disorder, including alcohol/substance use disorder (76.0%), anxiety disorder (54.2%) and anti-social personality disorder (49.4%) (Beaudette & Stewart, 2016; Brown, Barker, McMillan, Norman, Derkzen, & Stewart, 2018). Two-thirds or more of both men and woman inmates diagnosed with a mental disorder were also found to have a co-occurring mental disorder (commonly SUD).

In addition, a multi-national study (1,471,526 prisoners/10,534,441 person-years) released from incarceration in eight countries (1980–2018) comprised a total of 75,427 deaths examined the all-cause crude mortality rate (CMR) in the first week following release (1,612 deaths [95% CI: 1,048–2,287]). The CMR was higher during the first week following release than during all other time periods (Incidence Rate Ratio [IRR] week 2: 1.5 [95% CI: 1.2–1.8], weeks 3–4: 2.0 [95% CI: 1.5–2.6], and weeks 9–12: 2.2 [95% CI: 1.6–3.0]); the highest rate of cause-specific mortality in the first week was due to alcohol and other drug poisoning (CMR: 657 [95%CI: 332–1076]) (Borschmann et al., 2024).

III. Drug use and related factors during incarceration

While many correctional systems generally aspire to be ‘drug free’ environments, drug use does not spontaneously cease upon inmates’ admission but commonly occurs even during incarceration. Based on recent review data, 20% to 45% of prisoners worldwide are estimated to use drugs during incarceration (Kinner & Rich, 2018; Mundt et al., 2018; Norman, 2023). In addition, in Europe, 3–10% of prisoners report that they first initiated drug use while incarcerated (Bukten et al., 2020; Kinner & Rich, 2018). A recent study documented a drug use prevalence of 35% among 1,499 Norwegian prisoners (Bukten et al., 2020). Among respondents of the 2022 National Health Survey of prison inmates in the Canadian federal correctional

system, 29% (*n*=413) reported that they had used drugs in federal prison within the last 6 months; of those who reported any drug use, 78% reported smoking drugs, 63% reported snorting drugs, and 12% reported injection drugs in the last 6 months (Wanamaker et al., 2024).

A limited amount of recent empirical data examined characteristics of individuals involved in substance use during incarceration. While a few variables of association have been consistently identified across studies, other findings have been inconsistent and provide for a heterogeneous picture. Select factors of association documented include socio-demographic factors, such as age. For example, in their assessment of drug use in US correctional facilities, Rowell-Cunsolo et al. (2016) found that inmates of younger age were significantly more likely to engage in substance use than older inmates (Rowell-Cunsolo et al., 2016). This association has been confirmed by a number of other international studies (Baltieri, 2014; Rowell-Cunsolo et al., 2016; Sánchez et al., 2018). Additional research evidence has pointed to other socio-demographic indicators, including marital and employment status, racial identity, and level of education as co-variates of drug use during incarceration (Connor & Tewksbury, 2016; McKendy et al., 2021). Further evidence indicates health status and/or history variables is associated with substance use during incarceration including, for example, history of experiencing or witnessing violence, psychotic symptoms, separation from parents during childhood (Baltieri, 2014; Borrill et al., 2003; Rowell-Cunsolo et al., 2016; Sánchez et al., 2018). Substantive evidence indicates that a pre-prison history of drug/alcohol use is a strong predictor of continuous in-prison drug use (Bukten et al., 2020; Nevárez-Sida et al., 2012; Rowell-Cunsolo et al., 2016; Sánchez et al., 2018). Furthermore, results indicate associations between offenders' criminogenic characteristics, such as criminal history, length of sentence and/or incarceration or prison misconduct/gang affiliation and substance use during incarceration (Baltieri, 2014; Connor & Tewksbury, 2016; Rowell-Cunsolo et al., 2016).

Beyond the mostly cross-sectional studies for associations, few studies have examined factors associated with continuous drug use while incarcerated. There is one exception which is based on a UK-based admission cohort (Plugge et al., 2009) of *n*=111 women with daily drug use in the six months pre-imprisonment, compared to a group of participants with continuous drug use inside prison (*n*=24) and those without (*n*=87) on socio-demographic and clinical

variables did not indicate inter-group differences. Another prospective cohort study (*n*=354) with injection drug use (IDU)-involved correctional inmates found younger age and incarceration history to be positively associated with in-prison continuation of drug use (Cunningham et al., 2018). In a recent, Belgium-based study among a random, multi-prison sample of *n*=1,326 adult (123 women) prisoners, 719 (54%) had used drugs in the year pre-incarceration; 462 (35%) reported ongoing drug use during incarceration with strong associations (OR=6.77, 95% CI: 5.16–8.89) between use before and during imprisonment (Favril, 2023). In multi-variate analysis, factors independently associated with continuous substance use (versus cessation) included: young age, treatment history, polydrug use, and poor mental health; in sub-analysis, drug use initiation during imprisonment was related to incarceration history and low education status.

IV. Drug-related overdoses during incarceration

IV.1. Drug-related overdoses during incarceration (Canada-based data)

There are select data available on drug-related OD incidents in the Canadian federal correctional system. McKendy et al. (2021) based on institutional data, examined the total of (fatal and non-fatal; *n*=530) drug OD incidents which occurred between fiscal years [FY] 2012/13 and 2018/19 in the federal correctional system; of the OD total, 28 were fatal (McKendy et al., 2021). The annual number of OD incidents steadily increased during the observation period, from 40 OD incidents (2012/13) to 110 (2018/19; this last year excluded fatal OD incidents). Over the 7-year period, the majority of ODs (56%) involved opioids (89% of fatal incidents). The most commonly involved types of opioids were fentanyl (23%), heroin (14%), and methadone/suboxone (10%), with fentanyl showing markedly increasing proportions (3% in 2012/13 to 47% in 2017/18) of ODs over time. The second most common substance category involved were non-opioid prescription medications (e.g., anti-convulsant or -depressants; 34% of cases), followed by psychostimulants (e.g., cocaine, amphetamines; 12% of cases). While almost all (95%) of opioid-related ODs were considered ‘un-intentional’, this was the case for only a smaller proportion (63%) among other substance types. The analyses identified select defining characteristics for OD-involved individuals: Most (95%) were male, younger ages (average: 35.7 years), with White (59%) and Indigenous (35%) individuals slightly overrepresented. Individuals who experienced an OD served a medium sentence of 2.1 years, with a median time of 1.1 years spent since their most recent admission; they were more likely to serve time for robbery and have

a ‘security threat’ flag, and more likely classified as ‘medium’/‘maximum’ security than the general inmate population. Furthermore, respective majorities of OD-involved inmates indicated at least one MH condition (70%), a substance use history (97%) and a link between substance use and their criminal offending history (81%) (McKendy et al., 2021).

Filoso et al. (2023) extended the examination of (non-fatal only) OD incidents in the federal correctional system for FYs 2018/19 – 2021/22; during this period, the numbers of annual OD incidents increased from 110 (2018/19) to 174 (2019/20), then decreased again in subsequent FYs, i.e. 131 (2020/21) and 123 (2021/22) (Filoso, Boon, & Chen, 2024). Specifically, in 2021/22, 64.2% of ODs involved non-opioid/non-stimulant substances, 25.2% opioids and 14.6% psychostimulants. Among opioids, the most common were methadone/suboxone (51.6%) followed by fentanyl (45.2%). Key characteristics of non-fatal OD victims (e.g., mostly White or Indigenous, male, in their 30s; suicidal history; medium security, serving a sentence for homicide or robbery) identified were similar to McKendy et al.’s (2021) analysis (CSC, 2024a; McKendy et al., 2021).

Limited basic information exists on recent fatal ODs during incarceration in CSC institutions. Annual death-reports/other sources indicate that in the decade of FYs 2011/12 and 2021/22, a total of 46 fatal ODs occurred during incarceration, ranging from an annual low of 1 OD death (2020/21 and 2021/22, respectively) to a high of 8 OD deaths in 2015/16 (CSC, 2024a; The Globe and Mail, 2023). Overall, the average OD death rate among federal inmates over this period is crudely estimated to be higher than that observed in the Canadian general population for comparable time periods (Government of Canada, no date). The vast majority (89%) of fatal OD incidents identified by McKendy et al. (2021) involved opioids and were non-intentional (McKendy et al., 2021).

IV.2. Drug (fentanyl)-related overdoses during incarceration (US-based data)

While elevated levels of substance use are also documented for the US correctional systems, and previously estimates suggested that up to one-third of heroin users were incarcerated annually, Kaplowitz et al. (2021) found that there was no single fentanyl-related OD documented for inside US correctional institutions for the period 2013-2021 in the medical

literature (Kaplowitz et al., 2021). Their investigative review of fentanyl-related OD incidents during incarceration in the US, primarily based on media/lay press data, however, identified a total of 90 reported events comprising a total of 179 (76 fatal/103 non-fatal) fentanyl-related ODs for the same period. For 77% of events, fentanyl-involvement in the OD was reported by the source, yet only a minority were toxicology-confirmed. There was some information on the entry routes of fentanyl into the correctional facility in a third (37%) of reports, which included details from correctional staff, visitors and inmates. Naloxone administration was reported for 22% of events. The investigators suspected an overall much higher load of fentanyl-related ODs in the US correctional systems, but attributed the discrepancies to a lack of systematic monitoring as well as the intent to maintain the perception of corrections as being 'safe' and 'drug-free'. The authors supported these assumptions with reporting on a single fentanyl-OD in one US-county in 2019, while local criminal justice officials reported on the administration of 129 naloxone doses to 70 individuals (Kaplowitz et al., 2021). A single-center, retrospective cohort study of *n*=130 inmates in Ohio correctional institutions with a drug-(medication-) related overdose attended to at a medical facility (October 2011 to October 2014) included 100 intentional and 7 unintentional overdoses, 3 adverse drug reactions, and 20 unknown intentions (Fuh et al., 2016). The most commonly identified drug was phenytoin (an anti-convulsant; *n*=29, 22%); while anti-convulsant medications were the most common drug class, anti-convulsant, anti-depressant and cardiovascular medications accounted for equal numbers of intensive care events. Most patients (61%) requiring care for ODs were minimum and medium security prisoners.

V. Incarceration-related drug overdoses and associated factors

V.1. Incarceration-related drug overdoses and associated factors (review-based evidence)

A couple of seminal reviews have examined the association between incarceration exposure and OD outcomes. Mital et al. (2020) conducted a scoping review of 18 original studies (post-2001) from North America (Mital et al., 2020). In summary, (1) six studies assessed incarceration history as a risk factor for OD, with four finding a significantly higher risk of OD among individuals with an incarceration history compared to those without; (2) nine studies examined the rate of OD compared to the general population; of these, eight found a significantly

higher risk of fatal OD among those with an incarceration history and three found the highest risk of death in the period immediately following release; (3) six studies identified demographic, SU and MH, and incarceration-related risk factors for OD among formerly incarcerated individuals; and (4) four studies assessed the proportion of OD deaths, with a range of 5% to 57% of deaths due to OD among formerly incarcerated individuals (Mital et al., 2020). Cooper et al.'s (2023) scoping review of 45 record-linkage studies (2011-2021) examined the risk of OD deaths among adult prisoners released from incarceration in different countries (Cooper et al., 2023). The review identified a pooled drug-related standardized mortality ratio (SMR) of 27.07 (95% CI: 13.32-55.02) for OD death for the first two weeks after release, 10.17 (95% CI: 3.74–27.66) for the first 3–4 weeks and 15.58 (95% CI: 7.05–34.40) for the first year after release; it found an overall pooled SMR for OD death of 6.99 (95% CI: 4.13–11.83) for any time after release, indicating markedly elevated risk in the immediate time after release, but with risk remaining high for extended periods of time (Cooper et al., 2023).

Mital et al.'s (2020) comprehensive, North America-focused review reported details on four types of risk relationships, and related factors, between incarceration and OD (Mital et al., 2020): 1) Prior incarceration as a risk factor for OD, 2) Risk of OD among formerly incarcerated individuals, 3) Factors associated with increased OD risk among formerly incarcerated individuals, and 4) OD as a cause of mortality among formerly incarcerated individuals. Of studies on the history of incarceration as a risk factor for OD, several compared the risk of non-fatal OD in IDU samples among those with and without incarceration history, with most finding a significant relationship for non-fatal OD. For example, recent data included a cross-sectional study (2012) of 543 IDUs utilizing needle exchange services (NES) in Wisconsin; those who experienced an OD were more likely to have an incarceration history (adjusted OR [aOR]:2.40 [95% CI: 1.70-3.50]) (Barocas et al., 2015). A study of *n*=2,515 community-recruited primary heroin users in Vancouver (1996-2010) found those with an incarceration history had an increased odds of non-fatal OD in the past six months (OR: 2.13 [95% CI: 1.89-2.40]) (S. A. Kinner et al., 2012). Among *n*=443 NES clients in Seattle, past-year incarceration (5+ days) was independently associated with opioid OD (aOR: 1.88 [95% CI: 1.04-3.40]) when adjusting for demographics, substance use, and other behavioral risks (Jenkins et al., 2011). A later study which retrospectively examined all fatal opioid ODs (*n*=1,399) in Allegheny County, PA (2008-

2014) found that 55% occurred among individuals with a history of incarceration (Hacker et al., 2018).

2) Risk of OD among formerly incarcerated individuals: Several (9) studies retrospectively compared the risk of OD in formerly incarcerated individuals to the general (i.e., non-incarceration) population; eight studies found a significantly higher risk of fatal OD among those with incarceration; three used stratified analyses to assess OD death-risk over time. For example, in Rhode Island (2014-2015), no significant differences were found in the rates of fentanyl-involved OD deaths between those with and without incarceration history (Brinkley-Rubinstein, Macmadu, et al., 2018). Among n=82,780 corrections-released individuals in Philadelphia (2010- 2016), recently incarceration-exposed individuals had a 5.29 times higher risk of OD death than persons without recent incarceration exposure who were of matched age, sex, and race/ethnicity; the highest risk of OD was observed immediately after release (≤2 weeks; SMR: 36.91 [95% CI: 29.92-43.90] (Pizzicato et al., 2018). Among 229,274 incarceration-released individuals in North Carolina (2000-2015), the OR for OD fatality was 40.5 (95% CI: 29.7-51.3) less than two weeks after release compared to the general population (overall SMR: 8.3 [95% CI: 7.8-8.7] (Ranapurwala et al., 2018). Among a total of 6,978 drug-toxicity deaths (2006-2013) in Ontario, Canada, formerly incarcerated individuals compared to the general population, had an SMR of 11.59 (95% CI: 6.38-16.79) less than one-year post-release (Groot et al., 2016). An SMR of 10.33 (95% CI: 6.61, 11.10) for OD death was identified for *n*=76,280 individuals released from Washington State corrections (1999-2009) compared to the general state population (Binswanger et al., 2013). The total of incarceration-exposed people (*n*=155,272), compared to the general population, in New York City (2001-2005) featured a total SMR of 2.2 (95% CI: 1.9-2.5) for OD deaths; the highest OD risk was within 1−2 weeks of release (SMR 8.0; 95% CI: 5.2-11.8) (Lim et al., 2012). Among all individuals (*n*=23,510) incarcerated in Georgia on June 30, 1991, those who died within 15 years post-release were at multifold elevated mortality risk due to OD death (SMR 3.48; 95% CI: 2.76-4.33) compared to the general population (Spaulding et al., 2015).

3) Factors associated with increased OD risk among formerly incarcerated individuals: Several (6) studies examined risk factors for OD among formerly incarcerated individuals,

finding mixed results for various demographic, SU and MH, and associated incarceration-related characteristics. For example, increased OD risk was found for females (as compared to males) in one study, but no difference observed in two others (Binswanger et al., 2013; Lim et al., 2012; Pizzicato et al., 2018) . Non-Hispanic white race/ethnicity was associated with increased risk compared to Hispanic, American-Indian, and other race/ethnicities, but findings were mixed for those of African-American race (Binswanger et al., 2013, 2016; Pizzicato et al., 2018; Ranapurwala et al., 2018). Findings related to age were inconsistent; some studies reported an association between older age and fatal OD risk among formerly incarcerated individuals, whereas one study found younger age to be associated with OD risk (Binswanger et al., 2013; Kinner et al., 2012; Pizzicato et al., 2018; Ranapurwala et al., 2018). For other socio-demographic factors, having children was identified as a protective factor in one study, homelessness was identified as a risk factor in another (Binswanger et al., 2016; Lim et al., 2012). Substance use-related characteristics associated with increased OD risk included: screening positive for any SUD; drug injection; polydrug use; and daily drug use (Binswanger et al., 2016; Kinner et al., 2012). Lifetime MOUD-engagement was found to be protective against OD risk, whereas no relationship was observed for receipt of non-pharmacological SUD treatment and OD risk (Binswanger et al., 2016; Kinner et al., 2012; Pizzicato et al., 2018). MH characteristics associated with increased OD risk included histories of serious mental illness and panic disorder; two studies found that receipt of MH treatment in prison, compared to no treatment, was associated with increased risk of fatal ODs (Binswanger et al., 2016; Pizzicato et al., 2018). Findings describing the relationship between OD and incarceration length and/or frequency were mixed (Binswanger et al., 2013, 2016; Lim et al., 2012; Pizzicato et al., 2018; Ranapurwala et al., 2018).

4) OD as a cause of mortality among formerly incarcerated individuals. Four cohort studies assessed OD as a cause of death among formerly incarcerated individuals, with the proportions ranging from 5% to 57% of deaths. For examples of recent studies, among individuals (*n*=1,350) released from corrections in the state of Connecticut living with HIV (2007-2014), OD was the second-leading cause of death (15%) after HIV/AIDS (46%); among those experiencing OD death or accidental injury, time to death was shorter compared to HIV/AIDS-related causes (Loeliger et al., 2018). Among individuals who died within six weeks

of release from New York City jails (2011-2012, opioid OD was the leading cause of death (37%), followed by chronic disease (25%) and assault-related trauma (20%) (Alex et al., 2017).

V.2. Recent studies on the association between incarceration and OD (US studies)

In a study of *n*=4,246 individuals released from prison in Massachusetts between 2015–2020, 2237 (5.1%) experienced an opioid-related OD in the first 90 days post-release (Yamkovoy et al., 2024). In predictive decision-tree modelling, the variables contributing most to OD deaths included: incarceration time spent prior to release, involuntary commitment (incarcerated for treatment), number of prior incarcerations, age, sex, race/ethnicity; analysis stratified by race/ethnicity found additional predictive variables, including markers of poverty (for White non-Hispanics) and low education level (for Black non-Hispanics). Of 229,274 inmates released from North Carolina prisons (2000-2015), 1,329 died from opioid-related OD post-release; the opioid-related OD risk was 40 (95% CI: 30-51) at 2-weeks, 11 (95% CI: 9.5-12) at 1-year, and 8.3 (95% CI: 7.8-8.7) times as high at total follow-up as compared with general North Carolina residents. At greatest risk for opioid OD were inmates within the first 2 weeks after release, ages 26 to 50, male, White, with 2+ previous incarcerations, and receiving in-prison MH and SUD treatment (Ranapurwala et al., 2018). In a study extension (2016-2018), opioid-related OD rates decreased by 10.1% in North Carolina's general population but increased by 32% among inmates released from corrections; the highest opioid OD rate was attributable to synthetic narcotics (e.g., fentanyl/analogues), compared to half or less for other opioids, with synthetic opioid-related OD risk among former inmates of 50.3 (95% CI: 30.9-69.6), 20.2 (95% CI: 17.3-23.2), and 18.2 (95% CI: 15.9-20.5) times compared to the general North Carolina population at 2-week, 1-year, and complete follow-up after release, respectively (Ranapurwala et al., 2022). A sub-analysis of the data found that individuals released who had been placed in 'restrictive housing' (or 'solitary confinement'; 130,551/387,913 or 33.7%) 2000-2015 during incarceration, compared to those who were not, were more likely to die in the first year post-release (hazard ratio [HR]: 1.24 [95% CI:1.12-1.38]), including as related to opioid OD in the first 2 weeks post-release (HR:2.27 [95% CI: 1.16-4.43]) (Brinkley-Rubinstein et al., 2019). Among 89,591 persons with criminal justice system involvement for drug/property crimes (2013-2016) in Maryland, 4,108 (4.59%) were hospitalized for a non-fatal opioid overdose, and 519 (0.58%) died from opioid OD (Krawczyk et al., 2020). The strongest risk factors for OD

death were observed to include: older age; white race; histories of inpatient/emergency hospitalization; more arrests; drug charge/arrest; release from incarceration (while notably any incarceration was found to be protective of ODs); specifically, in 2016, fentanyl (compared with other opioids) was involved in the proportionally largest number of ODs (Krawczyk et al., 2020). Among 82,780 individuals released from Philadelphia jails (2010 – 2016), 2,522 (3%) died from any cause, of which 837 (33%) died from OD (Pizzicato et al., 2018). Individuals released had higher OD death risk than non-incarcerated persons (SMR: 5.29 [95% CI: 4.93–5.65]), with greatest risk during the first 2 weeks post-release (SMR: 36.91 [95% CI: 29.92–43.90]); Black, non-Hispanic (HR: 0.17 [95% CI: 0.14–0.19]) and Hispanic individuals (HR: 0.41 [95% CI: 0.34–0.50]) were at lower risk for OD than White, non-Hispanic individuals; those with a serious mental illness (SMI) were at higher risk of OD (HR: 1.54 [95% CI: 1.27–1.87]) than those without (Pizzicato et al., 2018). Among persons who died in Rhode Island with past-year incarceration, the risk of fentanyl-related OD death doubled from 2014 to 2015 (RR: 1.99 [95% CI: 1.11–3.57) (Brinkley-Rubinstein, Macmadu, et al., 2018). Of n=1,399 OD deaths in Allegheny County, PA from 2008-2014, 957 (68.4%) had prior health or justice service exposure; of these, 531 (55.5%) were previously incarcerated, 616 (64.4%) used a MH service, and 702 (73.4%) received SUD services. Of the 211 OD deaths among those with incarceration in the prior year, 54 (25.6%) occurred within 30 days of release (Hacker et al., 2018). Among 699 all-cause deaths of people released from Washington State prisons 1999-2009, independent risk factors for OD mortality included SUD (OR: 2.33 [95% CI: 1.32-4.11]), IDU (OR: 2.43 [95% CI: 1.53-3.86]), panic disorder (OR: 3.87 [95% CI: 1.62-9.21]), psychiatric prescriptions (OR: 2.44 [95% CI: 1.55-3.85]) and problems with opiates/sedatives (OR: 2.81 [95% CI: 1.40-5.63]); SUD treatment during incarceration was protective for all-cause (OR: 0.67 [95% CI: 0.49-0.91]) and OD (OR: 0.57 [95% CI: 0.36-0.90]) mortality (Binswanger et al., 2016).

V.3. Recent studies on the association between incarceration and OD (Australia-based studies)

In a representative sample of 1,307 incarcerated persons (2008-2010) in Queensland (AUS), the crude incidence rate (IR) of non-fatal OD post-release was 47.6 (95% CI: 41.1–55.0) per 1,000 person-years (Keen et al., 2020); it was highest in the first 14 days post-release (IR: 296/1,000 person-years [95% CI: 206–426]). Post-release non-fatal OD was positively

associated with a recent SUD history, MH and SUD dual diagnosis, lifetime histories of IDU and non-fatal OD, benzodiazepine prescriptions post-release, shorter incarceration, and low social support; non-fatal OD risk was lower for people with high-risk alcohol use and while they were incarcerated. In earlier analysis from the same study (1,051 adult prisoners), the incidence of non-fatal OD was highest for 1-3 months post-release (37.8/100 person-years [PY] among people with IDU; 24.5/100 PY among all ex-prisoners); non-fatal OD post-release was higher for people with IDU reporting: unemployment for less than 6 months before prison; removal from family as a child; weekly or more frequent use of benzodiazepines and/or pharmaceutical opiates prior to imprisonment, and a MOUD history; pre-release psychological distress and lifetime MH history (Winter et al., 2015).

V.4. Recent studies on the association between incarceration and OD (Canada-based studies)

Several recent Canada-based studies have assessed associations between OD and incarceration history, mostly focusing on British Columbia (BC) and Ontario-based prison populations. In a random sample of 20% BC residents (*n*=765,690; mean age: 50; 49% male), 5,743 had incarceration exposure (2010-2014) and 634 died from an OD during follow-up (2015-2017), resulting in a mortality rate of 897/100,000 person-years with and 22/100,000 person-years without incarceration exposure, respectively; people with incarceration were 4.04 times (95% CI: 3.23–5.06) more likely to die from OD-related causes (Gan et al., 2021). The association was stronger for females, people without diagnoses of SUD and not prescribed opioids or benzodiazepines ($p<0.001$ each); however, the number or duration of previous incarcerations did not influence OD risk. In a similar retrospective BC-based cohort of 6,106 adult individuals released from prisons (2015-2017), 154 (2.5%) died, with 108 (1.8%) deaths from OD (S. A. Kinner et al., 2021). The incidence rate for all-cause deaths was 16.1 (95% CI: 13.7–18.8) per 1,000 person-years and 11.2 (95% CI: 9.2–13.5) per 1,000 person-years for OD deaths, but with 38.8 (95% CI: 3.2–22.6) in the first 2 weeks post-release; importantly, those with dispensation of opioids for pain had a four-fold hazard for OD death. In a similar cohort study comprised of 6,721 BC individuals incurring 16,809 prison releases (2015-2018), 2.8% of releases experienced at least one OD within 30 days; people who had used community healthcare had a higher hazard of healthcare-attended non-fatal OD (aHR: 2.83 [95% CI: 2.13- 3.78]) and a

lower hazard of fatal OD (aHR: 0.58 [95% CI: 0.28 -1.19]), suggesting protective effects from post-release healthcare engagement for OD fatality risk (McLeod et al., 2021). In a similarly framed cohort of 6,816 BC-based people with incarceration histories (2010-2014) based on 5-year follow-up (2015-2019), 293 (4.3%) had opioid use disorder (OUD) only, 395 (6.8%) had stimulant use disorder only, and 281 (4.1%) had both (Palis et al., 2022). During follow-up, 1,655 people experienced 4,026 overdoses including 3,781 (93.9%) non-fatal ODs, and 245 (6.1%) fatal ODs; the hazard of both fatal OD (HR: 2.39 [95% CI: 1.48-3.86]) and non-fatal OD (HR: 2.45 [95% CI: 1.94-3.11]) was highest among those with co-occurring opioid and stimulant use disorders.

An Ontario-based retrospective study included a total of 8,460 opioid OD deaths (2015-2020), with 2,207 (26.1%) of cases previously exposed to incarceration (Butler et al., 2023). Among the total of incarceration-exposed persons (*n*=129,152), 1.7% died from opioid-OD, resulting in crude opioid-OD fatality rates of 43.6/10,000 person-years (95% CI: 41.8-45.5) compared with 0.95/10,000 person-years (95% CI: 0.93-0.97) for those not exposed to incarceration. The SMR for incarceration-exposed individuals was 31.2 (95% CI: 29.8-32.6); it was 28.1 [95% CI: 26.7-29.5] for males and 77.7 [95% CI: 69.6-85.9] for females. Among the cases of OD deaths which had been incarceration-exposed, 10.6% died within 14 days of release from jail, with highest risk for days 4-to-7 post-release (SMR: 288.1/10 000 person years (95% CI: 227.8-348.1) (Butler et al., 2023). In sub-analysis on 16,177 Black persons exposed to incarceration, 0.9% (*n*=137) died from opioid OD during the observation period, resulting in an opioid-OD death rate of 0.207/100 person-years (SMR: 17.8 [95% CI: 16.4–23.1]) but 1.34/100 person-years in the first two weeks post-release for Black persons with incarceration exposure compared to without, suggesting an inequitable OD death burden (Owusu-Bempah et al., 2023). An earlier Ontario-based study focusing on OD deaths in adults (*n*=6,978; 2006-2013) included 702 deaths which represented approximately 10% of total deaths within one year of release from incarceration, of which 20% (*n*=137) occurred within one week of release while most (77%, *n*=538) involved one or more opioids (Groot et al., 2016).

V.5. Integrative/conceptual frameworks for incarceration-related OD risks

While multiple epidemiological studies have identified individual risk factors influencing

OD outcomes in individuals exposed to incarceration, it has been suggested that these perspectives may be unduly narrow and limiting. Rather, related examinations – and accordingly integrated, coordinated interventions – are needed that aim to understand incarceration as a distinct 'risk environment' comprising multiple factors at different levels that influence OD-related risk dynamics (Brinkley-Rubinstein, Zaller, et al., 2018). Related integrative/conceptual work has been presented by Joudrey et al.'s (Joudrey et al., 2019) evidence-informed 'Post-Release Opioid-Related Overdose Risk Model', based on an iterative process combining literature reviews and expert opinion, presenting several categories of determinants and/or mechanisms influencing OD outcomes among people exposed to incarceration. These, for example, were found to include: -- Underlying factors/setting: Incarcerated individuals are disproportionately characterized by severe chronic diseases (e.g., pain, infectious diseases) and/or trauma/suicidality as known risk factors for both medical/non-medical drug use; -- Intermediate determinants: Individuals with incarceration experience higher levels of disrupted personal/social networks, poverty and stigma, all of which function as adverse social determinants of health. In addition, incarceration commonly leads to interrupted or compromised essential health care (including SUD treatment or interventions); however, the influence of race is unclear, as some types (e.g., opioid) of ODs are associated with White rather than other racial markers. -- Proximate determinants: People experiencing incarceration feature far elevated levels of both SUD and MH (e.g., depression, anxiety, personality disorders, PTSD) problems compared to general populations; co-occurring SUD and MH problems are an additional risk for non-medical drug use. Besides common risk behaviors (e.g., injection and/or solitary drug use), the use of and/or disorders related to opioids in OD events are common; in addition, common involvement in medical or non-medical poly-drug use/poly-pharmacy with other psychotropic substances (e.g., sedatives/benzodiazepines or psychostimulants) elevates OD risks. -- Biological/pharmacological factors: The psychopathology specifically of opioid-related OD involves rapid respiratory depression following exposure; these effects are influenced by varying tolerance levels related to exposure patterns. In incarceration settings, opioid use patterns are commonly interrupted/irregular, resulting in tolerance variations for respiratory depression that make OD (fatality) more likely upon opioid exposure; similarly, the increasing availability of potent synthetic opioids (e.g., fentanyl) has amplified risks for OD (Joudrey et al., 2019).

A similarly conceptualized, integrative framework of risk factors for opioid-related OD among persons with incarceration experience combined literature/evidence reviews and expert (i.e., professionals and people with incarceration experience) opinions (Flam-Ross et al., 2022). Review evidence identified a total of 22 (16 risk/6 protective) significant factors, which were divided into organizing sub-categories (per the WHO's social determinants of health framework), specifically for Risk factors: -- Structural factors: Older age, non-white race, and sex; -- Intermediate factors: SUD and MH treatment (pharmacological or non-pharmacological); restrictive housing placements; incarceration history; incarceration for drug-related crime; time (e.g., <2 weeks) since release; screening for SUD; MH (e.g., panic disorder or serious mental illness) diagnosis; substance (opioids, sedatives, and injection drug use) use; homelessness; other illnesses or hospitalizations. Correspondingly, Protective factors included: -- Structural factors: family network and race; -- Intermediary factors: greater length of incarceration; prescription of medications for opioid use disorder (MOUD); substance use (alcohol, cocaine, other stimulants, and inhalants); previous incarcerations. The expert panel-based assessments resulted in the identification of 21 (14 risk/8 protective) factors for OD among individuals with incarceration, including for risk: -- Structural factors: lack of services in the community; longer time between release and connection to services; being undocumented; sex work involvement; experience of racism; knowledge of imminent re-incarceration. -- Intermediary factors: Unhealthy relationships; lack of self-confidence; receiving bad news; familial or social pressure related to money fear of seeking medical help; returning to the same community after release; negative first experience with healthcare system; having children. -- Protective factors identified included: Structural factors: re-incarceration; presence of a caseworker when accessing services; positive relationship with a probation officer; access to food; -- Intermediary factors: stable environment and safe place to live; family visits during incarceration (Flam-Ross et al., 2022).

A recent, small community-engaged concept mapping approach aimed to identify factors influencing OD experiences following incarceration, based on brainstorming and sorting/rating of evidence input towards cluster maps based on focus groups with people with lived experience of incarceration and SUD (Nall et al., 2024). The process identified 83 unique factors; the concept mapping process resulted in five clusters: (1) Community-Based Prevention, (2) Drug Use and Incarceration, (3) Resources for Treatment for Substance Use, (4) Carceral Factors, and

(5) Stigma and Structural Barriers, indicating community-identified risk factors associated with OD following incarceration relevant for consideration in resource planning and intervention development. A related qualitative study examined perceptions on contributing and protective factors for post-release overdose risk from the perspectives of people who had received MOUD while incarcerated in Massachusetts jails (*n*=38; 2021–2022) using the Risk Environment Framework to guide analyses (Michener et al., 2024). Results suggested that the physical risk environment included loss of opioid tolerance during incarceration, polysubstance use, and the toxicity drug supply as key producers of increased risk for post-release overdose. Social drivers of risk included peer group risk norms—including peer-driven harm reduction practices and interpersonal relationships between drug sellers and buyers—as well as macro-level social determinants of health such as housing insecurity and availability of mental health services. Economic drivers of post-release overdose risk included lack of income generation during incarceration and employment challenges. Participants also discussed several aspects of policy that influence post-release overdose risk, including availability of harm reduction supplies, public health services, and broader MOUD-related policy in this high-risk population.

VI. Fentanyl-related dynamics and effects for OD risks and outcomes

VI.1. Fentanyl-related dynamics and effects for OD risks and outcomes (general)

While correctional settings are known to be distinct environments for substance use and related risks, the general nature of non-medical drug use and harms in North America has significantly changed in recent years, mainly from the recent arrival and expansion of illicit/toxic synthetic opioids ([SOs]; i.e., fentanyl and fentanyl-analogues [F/FA]) (Ciccarone, 2017; Fischer et al., 2019). Based on specific characteristics and properties, SOs have profoundly altered the 'risk environment' for OD-related pathways and outcomes that specifically also include and affect correctional settings and/or populations.

While pharmaceutical-grade fentanyl is a potent prescription opioid analgesic that has been utilized for medical (analgesic) use with occasional reports of non-medical use, illicitly manufactured and distributed SOs (i.e., F/FAs) began to rapidly proliferate on North American drug markets a decade ago (e.g., from 2013-15 onward) (Baldwin et al., 2018; Fischer et al., 2019; Gomes et al., 2018). This proliferation triggered a rapid acceleration of OD deaths in

general populations – for example, in BC and Ontario – with increasing majorities of ODs determined to be F/FA-related; some have interpreted this expansion of SO availability as a 'supply shock' following extensive reduction (e.g., post-2012) in pharmaceutical opioid dispensing levels in North America (Ciccarone, 2021; Fischer et al., 2020; Fischer & Robinson, 2024). Over the past decade, the unprecedented 'public health' crisis of SO-related OD deaths in North America has been responsible for a total of approximately 50,000 OD deaths in Canada since 2016 (8,049 [rate: 20.8/100,000] deaths in 2023) of which more than 85% were caused by F/FA substances; correspondingly – with even greater totals/rates -- there were just under 109,000 OD deaths (rate: 32.4/100,000) in the US in 2022, with more than two-thirds of these OD deaths F/FA-related (Ciccarone, 2021; Fischer, 2023; Manchikanti et al., 2022; Government of Canada, n.d.; CDC, n.d.). This rapid proliferation of F/FAs in general population-based OD deaths has subsequently expanded into correctional settings: For example, in Canada's federal correctional (CSC) system, of 17 confirmed OD deaths between 2017/18 and 2019/20 (3 years), all but one were F/FA-related (Canada, 2024a). In the USA, a recent investigation documented a total of at least 179 overdose events, comprising of 76 fatal and 103 nonfatal fentanyl overdose events in US-based jail and prisons, between 2013 and 2021 (Kaplowitz et al., 2021). More specifically, in the US state of Rhode Island, the risk of death from F/FA-related OD among those with past-year incarceration doubled between 2014 and 2015 alone; among individuals with criminal justice system exposure in Maryland (2013-2016), the annual number of F/FA-deaths quadrupled from 2015 to 2016; in North Carolina, the rate of opioid-related ODs among formerly incarcerated individuals increased by 32%, mostly due to F/FA-related OD deaths, from 2017 to 2018 (Brinkley-Rubinstein, Macmadu, et al., 2018; Krawczyk et al., 2020; Ranapurwala et al., 2022).

F/FA substances feature several distinct characteristics that make for uniquely powerful risk dynamics for OD-related outcomes while bringing equally profound challenges for intervention responses. These properties include, firstly, their excessive psychoactive potency, where F/FAs are 50-100 times more potent than morphine (or 30-50 times more potent than heroin); these qualities consequently make smallest amounts of exposure sufficient to induce respiratory depression (i.e., OD), including possible acute fatality (Cheema et al., 2020; Han et al., 2019; Rauf et al., 2021). For relevant physiological mechanisms, due to their lipophilic

properties, F/FA substances rapidly cross the blood-brain barrier and bind to opioid receptors following exposure for acute pharmaco-biological effects, including OD (Cheema et al., 2020; Han et al., 2019; Rauf et al., 2021). As a consequence, (non-fatal and fatal) F/FA-related ODs not only occur from injection but also commonly from other (e.g., inhalation/ingestion) use routes associated with lower bio-availability. In fact, the majority of recent opioid OD deaths across Canada have arisen from non-injection (e.g., inhalation) use routes, defying longstanding assumptions for non-injection use modes to be protective against OD fatality outcomes [(Fischer et al., n.d.; Palamar et al., 2022). F/FAs' unique pharmacological profiles have also undermined the efficacy of naloxone, the opioid antagonist/antidote medication used for OD reversal, where in cases of F/FA-exposure a single dose has commonly proven insufficient, and multiple doses of administrations are required for resuscitation (Cheema et al., 2020; Pergolizzi Jr et al., 2021; Rauf et al., 2021). SO products also come compressed into very small (e.g., kernel-size) substance amounts; this makes them not only difficult to detect in contexts of use but -- as uniquely relevant for correctional settings -- also 'easy' for clandestine shipping/transporting, smuggling or storage (Caulkins, 2021; Norman, 2023; Pardo et al., 2021). Moreover, F/FA-substances are commonly distributed to end-consumers while mixed in with other drugs, e.g. heroin/cocaine or as counterfeit prescription (e.g., opioid/benzodiazepines/xylazine) pills (2021). This, as a main OD-related risk, means that F/FA use frequently occurs un-knowingly/-intentionally by the user, while putting themselves at unexpected but elevated risk for OD (Hayashi et al., 2021; Kennedy et al., 2024; Latkin et al., 2019).

A recent systematic review (41 studies) summarizing key characteristics of F/FA use, either in comparison with other substance use or intentional with un-intentional use, found that it was more likely to involve male, young and white individuals, with unemployment, low education and homelessness as common markers; F/FA users had more polysubstance use and past OD histories; motivations for F/FA use included high opioid tolerance and/or psychoactive effects and potential to address adverse health symptoms (e.g., withdrawal, pain, mental health problems); F/FA use was also associated with risky (e.g., injection, daily drug and public injection) use behaviors (Tsang et al., 2024).

VI.2. Fentanyl-related dynamics and impacts for drug use and OD in correctional settings

In a unique field and interview-based study involving 587 adult inmates and 131 correctional officers in the provincial jail system in Alberta, Bucerius and & Haggerty (2019) explored the specific effects of fentanyl on dynamics of drug use, inmate relations and security within provincial correctional institutions in Canada relatively early (2016/17) into the F/FA-related OD crisis (Bucerius & Haggerty, 2019). The investigators summarized four main impacts: 1) an increased number of ODs; 2) prison nonetheless remained a comparatively 'safe' place to use drugs; 3) the common combination of F/FA-substances with other drugs available in prison; 4) the prospect of F/FA-drugs being weaponized. For more specific details related to the main result themes, the study found that – also as related to the frequent turnover of inmates due to short stays particularly in the provincial jail system – that drugs were widely and easily available in the correctional institutions. While many respondents did not intend to use F/FA-substances (e.g., for their unpredictable risks for OD), these substances were perceived as omnipresent in the correctional settings, and that F/FA use and ODs commonly occurred, also as fentanyl was typically (but inconsistently) mixed in with other illegal drugs smuggled into the facilities. At the same time, many inmate users considered fentanyl use inside the facility to be a relatively safe event, given institutional monitoring systems but also since its use typically occurred in the presence of others (e.g., inmates) who could assist in instances of an OD event. Beyond risks related to F/FA use, there was heightened fear that fentanyl could be 'weaponized' by and among inmates, e.g. to intently harm or kill other inmates (e.g. in contexts of 'gang' conflicts), for example, by way of lacing food or other ordinary consumption products. As a result, the presence of fentanyl adversely affected the dynamics of social relations inside the correctional environment. These hazard dynamics, in turn, were observed to make some (e.g., maximum security institution-based) inmates generally less tolerant of drugs in the corrections setting. Similarly, the impacts of the increasing presence of F/FA substances for correctional officers included increased fear of possible exposure or contamination, and related health problems, in addition to scares of fentanyl-related poisonings and possible related stress/trauma, disorder or disruption in correctional operations. In turn, it appeared that the fentanyl-related perceptions and experiences opened some correctional staff's views on the value of or

opportunity for novel (e.g., harm reduction-type) interventions (Bucerius & Haggerty, 2019).

Notably, in the 2022 National Health Survey among federal prison system inmates, 64.9% of experience-based responders said that they agree or strongly agree that the drugs available in prison might be contaminated or cut with drugs they do not know about, and about half were concerned about drug use related OD-risks (Wanamaker et al., 2024). A related qualitative, interview-based empirical study examined how fentanyl is interpreted and experienced by correctional officers (*n*=99) across federal prisons in Canada, some in institutions with a high presence of fentanyl (Ricciardelli et al., 2024c). Results suggested that while many correctional officers had responded to an OD during their initial period on the job, most COs who had did not perceive the event to be psychologically traumatic nor were substantially concerned about the presence of fentanyl in their work environment, or they were indifferent. However, this perspective stood in contrast with the approximately 40% of correctional officers who expressed concerns about the presence of fentanyl – suggesting both a "normalization" of fentanyl availability and use in the prison environment as a workplace hazard as well as a general health and social issue.

VII. Interventions for substance use/OD prevention in correctional populations

VII.1. Interventions for substance use/OD prevention in correctional populations (review-based evidence)

Considering the high levels of substance use, and related OD risks and harm (e.g., death) among correctional populations, a variety of interventions have been implemented in correctional systems towards reducing risks for these adverse outcomes. While some of these interventions are pharmacological/medication-based (e.g., medication assisted treatment for OUD [MOUD]/opiate agonist therapy [OAT]), others include psycho-social measures, 'harm reduction' or naloxone more specifically aiming for OD prevention. Several recent, comprehensive (e.g., systematic) reviews have assessed the impacts of related interventions. The scope and nature of findings is rather heterogeneous, with many studies primarily focusing on intervention effects for criminal justice (e.g., recidivism/re-incarceration) outcomes, rather than drug use/OD-related outcomes among correctional populations as are mainly of interest here. MacDonald et al. (2024) systematically reviewed and meta-analyzed 126 international studies

(1980-2023) of controlled interventions among incarceration-exposed individuals to reduce drug-related harms both during and shortly after incarceration (Macdonald et al., 2024). While only 12 studies focused on interventions during incarceration, OAT engagement during incarceration was associated with reduced opioid use (OR: 0.27 [95% CI: 0.07–0.98]), heroin use (OR: 0.29 [95% CI: 0.19–0.46]) and injection drug use (OR: 0.17 [95% CI: 0.10–0.30]) and related risk (e.g., paraphernalia sharing) behaviors, as well as lower all-cause mortality (HR: 0.25 [95% CI: 0.13–0.48]) and fatal suicide (HR: 0.15 [95% CI: 0.04–0.52]). Select data suggested that in-prison needle/syringe provision reduced needle and syringe sharing among program participants (OR: 0.05 [95% CI: 0.10–0.26]). A total of 43 studies focusing on post-release outcomes for drug use; among eight studies, there was no evidence of significant impact of OAT received during incarceration on drug (e.g., opioid, heroin or injection) use, and little to no evidence of benefits of therapeutic communities, psychosocial Interventions or case management on drug use after release from incarceration. OAT-engagement during incarceration showed no effects on non-fatal OD within one month after release (OR: 0.72 [95% CI: 0.12–4.31]); similarly, naloxone provision showed no effect on non-fatal OD at 3-months follow-up (OR: 3.50 [95% CI: 0.72–16.90). People who received OAT in prison had lower all-cause mortality (RR: 0.24 [95% CI: 0.17–0.35]), as well as drug-related deaths (RR: 0.20 [95% CI: 0.12–0.34]) in the first 4 weeks post-release from prison. In two studies, community-based OAT engagement, compared to none, was associated with lower all-cause mortality (RR: .·09 [95% CI: 0.02–0.56]) following release from incarceration (Macdonald et al., 2024).

In another recent systematic review and partial meta-analysis of 20 quasi-/experimental studies (30,119 participants) to assess the effects of opioid-specific MOUD on primary outcomes for current or formerly justice-involved individuals, there was a high heterogeneity of study design/quality (e.g., risk of bias) among included studies (Strange et al., 2022). Mean effects were non-significant for the primary criminal justice (e.g., reincarceration/re-arrest) outcome as well as fatal OD (OR: 0.82 [95% CI: 0.56-1.21]), while for non-fatal OD a significant protective effect (OR: 0.41 [95% CI: 0.18-0.91]) was identified, suggesting that those receiving MOUD had nearly 60% reduced odds of experiencing a non-fatal OD. Another systematic review identified recent studies of re-entry interventions, i.e. interventions initiated during incarceration and continuing post-release, or within 3 months of release, that addressed substance use (Moore et

al., 2020). Of 34 unique interventions, 21 provided substance use treatment whereas 13 facilitated connections to treatment. Of the 13 controlled studies assessing substance use outcomes; 5 studies found reductions in substance use among intervention participants compared to controls, 5 found no inter-group differences in substance use, and 3 found mixed or higher substance use outcomes (Moore et al., 2020).

A systematic review/meta-analysis of randomized controlled trials (RCTs)/quasi-experimental studies (807 inmates/until 2017) on effects of MOUD (e.g., methadone, buprenorphine, naltrexone) in correctional populations on opioid use and related risk outcomes post-release showed that methadone provision during incarceration increased community treatment engagement (OR: 8.69 [95% CI: 2.46-30.75]), reduced illicit opioid use (OR: 0.22 [95% CI: 0.15- 0.32]) and injection drug use (OR: 0.26 [95% CI: 0.12-0.56]) (Moore et al., 2019). While findings from observational studies of methadone-based MOUD were inconsistent, individual buprenorphine- and naltrexone-based studies showed these to be either as effective as methadone or superior in reducing illicit opioid use post-release. A systematic review was conducted that comprised prison-based, pharmaco-therapeutic, psychological and combination interventions (49 studies/2000-2017) for substance use (de Andrade et al., 2018). Approximately half (12) of the psychological interventions (e.g., motivational interviewing, cognitive-behavioral therapy) had positive effects on substance use, while 9 found no difference or had negative results. For pharmacological interventions, MOUD resulted in reduced opioid use post-release in 2 of 3 high-quality studies, reduced heroin use post-release in 8/11 studies; and produced similar reductions for cocaine use (2/4 studies). For extended-release naltrexone (pre/post-release injections), reductions in opioid use and ODs were shown in 2 RCTs; prison-based MOUD with methadone combined with community-based MOUD post-release had lower risk of heroin use and fatal OD than prison-based MOUD only or controls in one RCT (de Andrade et al., 2018). Another systematic review of 46 studies (22 RCTs) among adult individuals with OUD incarcerated or recently released found that participants receiving corrections-based MOUD (e.g., with methadone or buprenorphine/naloxone) had generally lower rates of illicit opioid use, higher adherence to MOUD, as well as fewer non-fatal ODs and lower mortality (Malta et al., 2019). The review also included evidence of select (e.g., UK-based) studies on naloxone kit provision to prisoners at point of community-release suggesting declines in opioid-related OD

deaths among prisoners following release into the community. Another systematic review of (8 RCTs, 6 non-RCT/observational) studies examining the effects of pharmacotherapeutic interventions on substance use-related outcomes in opioid-dependent prisoners found that MOUD (e.g. with methadone, buprenorphine) initiated pre-release was associated with significant post-release treatment engagement and opioid (heroin) use reductions (Crowley & Van Hout, 2017). Prisoners who were MOUD-engaged at discharge had reduced mortality risks in the immediate (e.g., 4 weeks post-release period) but was no evidence for reduced non-fatal OD or continuation of other illicit drug use.

VII.2. Interventions for OD reduction in corrections (individual interventions/studies North America)

VII.2.1. Medication-assisted treatment for OUD in correctional populations

For incarcerated individuals with OUD, medication-assisted treatment (e.g., with methadone, buprenorphine/naloxone [MOUD/OAT]) is the primary intervention to reduce illicit opiate drug use and related adverse (e.g., OD) outcomes (Macdonald et al., 2024; Malta et al., 2019; Moore et al., 2019). There is evidence that OAT-engagement among incarcerated individuals has substantially increased in Canadian correctional systems over the past decade. For example, in Ontario's provincial prison population, the proportions of OAT-involved inmates increased from 2015 to 2018, with 6.9% to 8.4% prescribed methadone; 0.8% to 4.8% buprenorphine/naloxone; and 8.2% to 13.2% either OAT. While methadone-based engagement did not substantially change, buprenorphine/naloxone prescribing increased by a rate of 1.70 times/year (95% CI: 1.47-1.96), significantly higher than increases observed in community-based prescribing: 1.20 (95% CI: 1.19-1.21) (Bodkin et al., 2021). Among twenty-seven physicians providing medical care in provincial jail facilities in Ontario in 2017, 52% reported prescribing methadone and 48% reported prescribing buprenorphine/naloxone to correctional inmates (2017); 19% reported initiating methadone and 11% initiating buprenorphine/naloxone treatment, while, however, reporting multiple systemic and/or operational barriers to initiating OAT during incarcerations (Kouyoumdjian et al., 2018).

Evidence exists related to expanding MOUD-engagement and OD-related effects among (provincial) corrections-exposed individuals. Among 597 drug user cohort participants with

OUD in Vancouver who reported incarceration in the past six months (2005 to 2016), 207 (34.7%) reported 325 episodes of OAT (90.8% continuations and 9.2% new initiations) during incarceration (Bozinoff et al., 2018). For those currently OAT-engaged, OAT utilization while incarcerated was negatively associated with non-fatal OD (aOR: 0.49 [95% CI: 0.29-0.82]) and daily prescription opioid use (aOR: 0.42 [95% CI: 0.20-0.85]); for those not OAT-engaged, no associations were found, underscoring the importance of OAT continuity for protective outcomes. In a study of 9,220 incarcerated individuals (75,649 incarceration-months) in 12 BC-based provincial corrections facilities (2013-2017), both the coverage expansion of provincial health insurance (2015) to include buprenorphine/naloxone-based OAT [aOR: 1.16 [95% CI: 1.13-1.19]) and the public health-emergency declaration for the opioid crisis (2016) (aOR: 1.34 [95% CI: 1.22-1.47]) were associated with an overall 10-fold increase in OAT utilization during incarceration (aOR: 10.10 [95% CI: 8.98-11.37]), mostly from new OAT initiations with buprenorphine/naloxone (Kurz et al., 2022). In a study based on a 20% random sample of the BC's general population, among adults with OUD released from provincial corrections (1,535 people/4,738 release episodes; 2015 to 2018), OAT-engagement while in custody was associated with a reduced risk of non-fatal OD (aHR 0.55 [95% CI: 0.41-0.74]); this effect was observed for both community-initiated OAT continued in jail (aHR: 0.49 [95%CI: 0.36-0.67]) and for corrections-initiated OAT (aHR: 0.58 [95%CI: 0.41-0.82]), while protective effects were greater among women than men (McLeod et al., 2021).

Recent evidence on MOUD utilization and OD-relevant indicators in federal correctional inmates are limited. In Canada's federal CSC system, the provision of institutional OAT (methadone) was originally implemented in 1998; subsequently, OAT provision was expanded to include suboxone (buprenorphine/naloxone)-based OAT (Canada, 2019c). It was made possible for individuals who enter federal custody on OAT to continue their OAT during incarceration; in addition, individuals meeting OUD criteria and program requirements can request to initiate OAT during their federal sentence. Since 2016, suboxone-based OAT (including buccal film and injectable buprenorphine-only [sublocade] options) have increasingly been utilized as first-line OAT with federal inmates. By mid-2019, there were close to 1,600 individuals who received OAT in CSC – an increase of just under 50% from 2016 - representing more than 10% of federal inmates in 2017/2018; by September 2024, there were 3,378 CSC-inmates, or approximately

25% of the total CSC inmate population, reported to be OAT-engaged; 724 of these were on methadone-, 1,996 on suboxone- and 658 sublocade-based OAT (CSC, 2019c; Farrell MacDonald et al., 2022). In a retrospective analysis of male OAT-engaged CSC-inmates (2016-2018), including 1,211 on methadone-based and 729 on suboxone-based OAT, those on methadone were more likely to enter federal corrections on OAT (73.9%/57.4%); report higher rates of opioid-positive urinalysis during incarceration (10.3%/4.9%) and following community release (29.6%/7.7%); majorities in both groups indicated mental health (55.7%/64.1%) and 'severe' substance use (60.8%/56.7%) problems, while very few (1.2%/1.0%) reported institutional OD incidents (Farrell MacDonald et al., 2022). An analysis of *n*=530 OD incidents (2012-13 – 2018/19) in the federal correctional system (55% involving opioids) did not include indicators of OAT involvement (McKendy et al., 2021). In the 2022 National Health Survey of federal prison inmates, among respondents (149) with recent drug use (but not necessarily OUD) not currently receiving treatment, the majority (62.4%) indicated no interest in OAT while a small proportion (18.8%) indicated that they would like to be on OAT (CSC, n.d.).

A mixed-methods study assessed OAT-related experiences in a sample (*n*=46) of federal correctional inmates from seven CSC prisons (January-March 2019) before and after community-release (Russell, Nafeh, et al., 2022; Russell, Pang, et al., 2022). Participants had complex opioid use histories, including in-prison use and related health problems. Experiences with institutional OAT were divergent; those with pre-incarceration OAT engagement did not experience many challenges, whereas those initiating OAT during incarceration reported systemic barriers, such as treatment waitlists and process problems. Most participants preferred buprenorphine/naloxone over methadone, but some reported difficulties accessing it. Participants approaching release were keen to engage with community-based OAT, yet envisaged possible barriers for effective OAT transitions and continuity. Based on follow-up with study participants within one year of community-release, three-quarters (77%) remained OAT-engaged, while 69% had their release suspended and 49% were returned to custody. Key facilitators identified for continuous OAT-engagement included flexibility, positive staff rapports, and treatment structure; whereas for fragmented OAT transitions, financial issues concerning OAT coverage, reintegration and logistical challenges, and inaccessible of 'take-home' OAT medications were common barriers to successful OAT transition from incarceration to the community (Russell,

Nafeh, et al., 2022; Russell, Pang, et al., 2022).

The US has been a notoriously restrictive and challenging environment for medication-based treatment, and related OD prevention efforts, for OUD. While about 25% of incarcerated persons in the US are estimated to meet OUD criteria, less than 10% of US correctional facilities provide continuation or initiation of MOUD during incarceration (but many only in exceptional circumstances, e.g. pregnancy), or linkage to community-based MOUD (Bandara et al., 2021; Martin et al., 2022). An illustrative case study has been the Rhode Island state's Department of Corrections (RIDOC), which, since 2016 established a state-wide comprehensive MOUD program, including OUD screening, MOUD treatment (including all FDA-approved MOUDs: buprenorphine, methadone, and naltrexone), discharge planning/supports and linkage for post-release care (including healthcare insurance coverage for MOUD) for all incarcerated individuals meeting OUD criteria (Green et al., 2018). Within the first year of implementation (2016-2017), there was a 12% decrease in the total of state-wide OD deaths and a 61% decrease in OD deaths among persons within 12-months post-release from incarceration(Green et al., 2018). For further illustration, among a retrospective cohort of *n*=1,600 MOUD participants in RIDOC released from incarceration between 2016 and 2018, 56% were prescribed methadone, 43% buprenorphine, and 1% naltrexone, with 61% MOUD-continued from the community, 30% MOUD-inducted during incarceration, and 9% inducted pre-release (Martin et al., 2022). At 30 days and 12-months post-release, 73% and 86% had continued MOUD engagement, respectively; new MOUD inductions had lower post-release engagement than those who continued from the community. Twelve OD deaths occurred among MOUD participants during the 12-month follow-up, with only one OD death in the first two weeks post-release, underscoring comprehensive MOUD coverage's protective effects for OD for incarceration-exposed individuals (Martin et al., 2022). Similarly, in a retrospective cohort of 15,797 adults/31,382 incarceration episodes with OUD released to the community from New York City jails (2011–2017), 17,119 events were MOUD-related versus 14,263 non-MOUD-related just before community re-entry (Lim et al., 2023). MOUD engagement was associated with misdemeanor charges, being female, injection drug use and homelessness. More than one-hundred (111) OD deaths occurred within 1-year release (crude death rates: 0.49/100 person-years for MOUD and 0.83/100 person-years for non-MOUD; in adjusted analysis, in-jail MOUD

was associated with lower all-cause mortality (aHR: 0.22 [95% CI: 0.11–0.42]) and lower OD mortality risk (aHR: 0.20 [95% CI: 0.08–0.46]) for the first month post-release (Lim et al., 2023). Interruptions in MOUD-care are generally recognized as a primary risk-factor for OUD-related relapse and risk behaviors, including OD, for which incarceration is a common cause, including when individuals in community-based MOUD are incarcerated and/or MOUD-engaged individuals are released from correctional facilities into the community (Haney, 2024). A study including 40 qualitative interviews with incarcerated people and MOUD-engaged in RIDOC reported multiple barriers, including structural and social factors and challenges (e.g., housing, health insurance, transportation, treatment program parameters, social supports) relevant for effective MOUD transition to community-based care post-release, similar to those that have been observed in similar study efforts in Canada (Kaplowitz et al., 2023; Russell, Pang, et al., 2022).

VII.2.2. Other corrections-based interventions for OD risk reduction

Select other interventions to prevent or reduce OD-related harm in the community, to some degree, have found their way into correctional settings. For example, naloxone is an opioid agonist-medication medication used to reverse opioid ODs, and thereby prevents possible death. Naloxone works by binding to opioid receptors and blocking the effects of other opioids (e.g., heroin, oxycodone or fentanyl) and so restores normal respiration and prevents acute OD-related death (Moustaqim-Barrette et al., 2021; Pergolizzi Jr et al., 2021; Rigg, 2023). While naloxone is generally safe, easily administered in different (e.g., injectable or intranasal) formulation and it has been estimated that large numbers of opioid-related ODs have been reversed through its administration in community settings, it has been facing efficacy challenges particularly in contexts of synthetic opioid (e.g., F/FA) use due to the exceptionally high potency of these substances (Moustaqim-Barrette et al., 2020; Pergolizzi Jr et al., 2021; Rigg, 2023). Naloxone has become widely available from being carried by community-based services providers/first responders, but also through ‘take-home’ programming mass-distributed to peers/consumers, usually as portable pouches containing the naloxone vile that can be administered by anyone to revive a person experiencing acute OD effects from opioid exposure (Moustaqim-Barrette et al., 2021; Rigg, 2023). Select international (e.g., UK-based) research has found that distributing naloxone kits to correctional inmates upon community release has been effective towards decreasing opioid OD-related mortality in the immediate period following release (Malta et al.,

2019; Rigg, 2023). While naloxone, by now, is a standard medical emergency tool for OD response across correctional settings, routinely distributing it to offenders with OUD (and training them in its use) as part of community release provisions is increasingly considered a low-cost, standard evidence-based intervention recommended for correctional systems that yet requires systematic expansion and implementation in many places (Brinkley-Rubinstein, Zaller, et al., 2018; Grella et al., 2021; Rigg, 2023). There is, however, only limited research on naloxone availability or utilization and its effects on OD outcomes in correctional settings/populations.

In an earlier mapping review of 19 studies on 'take-home naloxone' programming for correctional populations, issues identified included attitudes towards naloxone distribution among people in or released from custody as well as prison staff; naloxone program process and training, including contacts of prisoners; while major challenges and gaps were identified for assessing health outcomes of naloxone provision in correctional contexts (Horton et al., 2017). A small interview-based study with healthcare staff at two BC-based provincial prisons implementing a take-home naloxone program for inmates identified related emerging issues, including: challenges of engaging and training correctional staff; improving inmate engagement and awareness of the program; and tailoring programming to the unique needs of incarcerated populations (Pearce et al., 2019). Among *n*=530 CSC-based OD incidents (2012/13 to 2018/19), including 55% opioid-involved, naloxone was administered in about half (53%) of cases (McKendy et al., 2021). A Michigan, US-based initiative established vending machines to provide free naloxone within 6 county jails to returning inmates and visitors; the initiative resulted in a 64% increase in the number of naloxone box orders; qualitative interviews with correctional officials revealed that prior naloxone efforts and knowledge about opioids/overdose and naloxone served as facilitators for the project (Victor et al., 2024). Yet, in a recent study with *n*=257 correctional workers in Manitoba focusing on knowledge and attitudes towards naloxone administration in their work with incarcerated populations, respondents perceived great need, but most did not feel adequately trained to administer naloxone, thereby possibly amplifying risk among correctional inmates experiencing ODs (Ricciardelli et al., 2024a).

Another widely available intervention in general community settings to reduce drug use-

related risks (e.g., disease transmission) and OD are supervised consumption and/or overdose prevention sites (SCS/OPS), providing 'safer' use environments for drug use and health protective services (e.g., OD prevention/reversal, risk reduction basic health care and referrals) (Kennedy et al., 2022; Magwood et al., 2020; Zhu et al., 2024). By now, dozens of legally approved and 'un-sanctioned' SCS/OPS sites exist across Canada, with consistent evidence of substantive reductions of drug use-related risk behaviors and OD prevention among those individuals accessing them. While the federal correctional system of Canada had begun to implement prison-based 'needle exchange programs' in select CSC institutions starting in 2018, these programs were reported to face challenges, including resistance by correctional staff (e.g., due to safety concerns) and under-utilization by inmates; it had further been reported that only some of the -- total of 12 -- existing PNEP were actively used (CSC, 2019b; CBC News, 2023; The Globe and Mail, 2023). In 2019, CSC implemented an OPS operated in a designated institution-based space by medical rather than correctional staff in its Drumheller Institution (medium security facility in Alberta), which then featured one of the highest drug OD rates among the federal correctional system (CSC, 2019a; The Globe and Mail, 2023). Interim basic program evaluation data showed that 49 inmates were approved to use the OPS service, and 30 inmates had used it on 798 occasions between July 2019 and February 2020, without any OPS-based/on-site OD events (Leonard, n.d.; The Globe and Mail, 2023; The Globe and Mail, 2022). While correctional health care and officers originally had mostly negative views towards the program, these organizational perspectives gradually changed towards increasing acceptance and support; inmates utilizing the OPS reported that they felt safer and better supported/less stigmatized with their addiction issues, and that they engaged in fewer risk behaviors (e.g., needle sharing) (Leonard, n.d.; The Globe and Mail, 2023; The Globe and Mail, 2022). While systematic/long-term impact assessment data are not available, the implementation of at least one other OPS in a federal correctional institution (Springhill/Nova Scotia) has been documented; a couple of others have reportedly either been established or planned (CSC, 2019a).

A recent study to examine perspectives on and challenges associated with OPS in prisons collected input from federal correctional officers (n=134) in Canada on OPS in prison and associated harm reduction measures through a longitudinal, semi-structured interview design (Ricciardelli et al., 2024b). Participants described multiple challenges and complications with

OPS policy, implementation, and safety concerns; namely, that OPS hinder correctional rehabilitation, recovery from substance misuse, and effective reintegration post-release. While some correctional officers express understanding and support for harm reduction initiatives such as the OPS, they called for clear directives and policies to support hesitant staff in facilitating this public health measure in prison settings.

VII.2.3. Other OD-preventive interventions currently unavailable in correctional settings

There are select other interventions aiming for OD prevention which are currently in existence and utilized in community-based settings in North America, but not available in correctional settings for a variety of reasons, including some briefly noted here. One such other intervention includes 'drug checking' services/programs (e.g., for drug content, properties, toxicity/contaminants) developed for 'point-of-care' or 'take-home' ('test strips') applications (Crepeault et al., 2023; Green et al., 2020; Ti et al., 2020). In a recent comprehensive review including 90 'drug checking' studies, most focused on monitoring data of drug markets/drug composition of samples tested (70%) as the primary domain, followed by behaviors related to drug checking services (34%), including intent to use, actual use and drug disposals, and only some related to outcomes related to models of drug checking services (19%), including the detection of -- both unexpected and/or expected -- substances or drugs of concern (Maghsoudi et al., 2022). While the drug-analytical capacities of 'drug checking'-devices have been improved and they have produced valuable related surveillance-type data on drug markets/supply/composition details, other data suggest that they are commonly utilized by only small minorities and/or infrequently by people involved in drug use; moreover, they have been associated with both positive and negative risk behavior outcomes for specifically relevant for OD, leaving their feasibility and behavior change-related effect potential for OD prevention unclear or limited (Bailey et al., 2023; Ti et al., 2020; Tilhou et al., 2023). Particular, setting-specific issues for implementation of 'drug-checking' services in correctional settings for OD prevention might entail that inmates would need to not only need to reveal but also surrender (typically clandestine/illicit while limited) drug products available to them for checking purposes.

Another distinct intervention specifically aiming to reduce primary OD risks, including deaths, especially geared to toxic SOs has been the implementation of 'safer drug supply' and specifically 'safer opioid supply' (SOS) distribution/programming over the past decade (Fischer & Robinson, 2023; Ledlie et al., 2024; McNeil et al., 2022). SOS-initiatives generally provide individuals at high-risk for non-medical opioid overdose with a variety of pharmaceutical-grade opioids (e.g., morphine, hydromorphone, fentanyl) usually based on prescription by a physician or nurse practitioner, with the primary aim to reduce at-risk consumers' illicit/synthetic drug exposure and related OD risks. SOS delivery has been facilitated through different distribution channels and mechanisms, including health/addiction care-, SCS/OPS- or community-based or even biometric machine dispensing (Bardwell et al., 2021, 2023; Fischer & Robinson, 2023). Initial, earlier SOS-program efforts (e.g., 2015-onward) were 'rogue', small and mostly improvised (e.g., based on 'off-label' medication prescribing); more recently, there has been regulatory guidance and government sanctioning towards formalizing SOS programming (e.g., BC's 'Risk Mitigation Guidance' policies 2020 and onward) (Fischer & Robinson, 2023; Nguyen et al., 2024; Slaunwhite et al., 2024). While the scale-up of SOS program implementation has been limited and to date only involves minorities of at-risk users where offered, and systematic evaluative evidence on SOS interventions is only emerging/limited, a recent scoping review (24 studies/sources) identified general findings of lower/reduced rates of opioid toxicities, improved physical and mental health, and improved quality of life among SOS-involved clients (Ledlie et al., 2024). A recent ecological study on BC's SOS policy (January 1, 2016 to March 31, 2022) found it to be associated with population-level increases in rates of opioid prescriptions (2,619.6/100,000 [95% CI: 1,322.1-3,917.0/100,000]) and hospitalization rates for opioid poisonings (3.2/100,000 [95% CI: 0.9-5.6/100,000]) but no changes in population rates of opioid toxicity deaths (1.6/100,000 [95% CI: −1.3 to 4.5/100,000]) (Nguyen et al., 2024). Conversely, matched cohort analysis involving SOS-recipients in BC (*n*=5,882, 27 March 2020-31 August 2021), SOS dispensations of one or more days were associated with reduced all-cause mortality (aOR: 0.39 [95% CI: 0.25-0.60]) and OD-related mortality (0.45 [95% CI: 0.27-0.75]) in the subsequent week, with further increases in protective effects associated with more frequent SOS dispensing days/week; however, SOS receipt did not modify the odds of all-cause or OD-related acute care visits (Slaunwhite et al., 2024). At the same time, SOS programming has produced some controversy and concerns, especially in regards to

possible diversion of SOS-provided substances (e.g., for trading/selling and/or use initiations by others) and that they may inhibit or hinder participants in seeking more ‘rehabilitation’-oriented treatment when receiving SOS prescriptions (Fischer & Robinson, 2023; Kahan, 2024; Nguyen et al., 2024). There may be potential and value for health in correctional settings to consider adaptive implementation of SOS as an OD-prevention measure for inmates with known OUD/risky opioid use, or alternatively to provide linkages to SOS-programming at time of release into community with the primary goal to prevent relapse to and use of toxic substances with high risk for OD during this period of elevated vulnerability. Related implementation might be helped by recent regulatory frameworks sanctioning SOS programming as a medical/health intervention. At the same time, the provision of high-potency opioid medications to select inmates during incarceration may entail organizational practice and safety concerns and/or related other adverse dynamics.

Discussion

Conclusions

As documented in this literature review, incarceration-exposed individuals are a vulnerable sub-group in which chronic diseases are prevalent, including substance use and/or mental health disorders. While correctional institutions are officially 'drug-free' environments, ongoing drug use during incarceration is prevalent, with overdose being a relatively common outcome, while only limited evidence on related details is available. There is evidence that the recently growing availability and risk dynamics of toxic synthetic opioids (e.g., fentanyl) have also translated to correctional environments, and increasingly contributed to overdoses. Notably, in the 2022 National Health Survey of federal prison inmates, of those with experience-based responses, two-thirds (64.9%) expressed worry that the drugs available in prison might be contaminated or cut with unknown other drugs and almost half (46.7%) expressed concerns about overdosing from drugs available in prison (Wanamaker et al., 2024). Substantially more evidence is available on drug-related overdose in incarceration-exposed individuals following release into the community, which is disproportionately common – and a primary cause of unnatural deaths – in the immediate period following release. For interventions, most correctional systems now offer medication-supported treatment for OUD, for which there is some evidence of protective effects for overdose during and following incarceration. However, other overdose-preventive measures available in community settings are either unavailable or under-developed in correctional systems and may warrant setting-tailored consideration for adoption. The transition of release from incarceration into the community represents a highly vulnerable period in which substance use-related care – and overdose-relevant protections -- commonly break down. There is an indication that the overdose fatality burden in correctional populations is even higher than in the general community, underscoring the need for both improved understanding of overdose-related risks and dynamics as well as improved, evidence-based interventions to reduce the risks for and burden of overdose in this vulnerable population and distinct risk environment of corrections.

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