Drug use and re-imprisonment: A prospective study of the Norwegian Offender Mental Health and Addiction (NorMA) cohort

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ABSTRACT

Background: Re-imprisonments are common among people in prison who use drugs. This study aims to describe sociodemographic factors, mental health and level of pre-prison substance use in a cohort of people in prison, and to investigate re-imprisonment during follow-up according to their level of pre-prison drug use.
Methods: This was a prospective study using baseline data from the Norwegian Offender Mental Health and Addiction (NorMA) cohort (*n* = 733) recruited in 2013–2014 linked to data from the Norwegian Prison Registry and the Norwegian Cause of Death Registry. Self-reported drug use before imprisonment was measured at baseline using the Drug Use Disorder Identification Test (DUDIT). The outcome of interest was re-imprisonment examined using Cox regression. We excluded 32 persons because they were not released before the study ended. The study sample included 701 persons, with a total time-at-risk of 2479 person-years.
Results: Almost half of the study sample reported high-risk drug use before imprisonment (DUDIT score >24). During the study period, 43% (*n* = 267) were re-imprisoned. People with high-risk use had a hazard ratio (HR) of 4.20 (95% CI: 2.95–5.97) of re-imprisonment compared with people with low-risk use (DUDIT score <6). Older age and more education than primary school were associated with a reduced risk of re-imprisonment.
Conclusion: Compared with low-risk use, high-risk drug use is highly prevalent among people in prison and is associated with higher rates of re-imprisonment. This highlights the need for screening and treatment of drug use disorders among people in prisons.

1. Introduction

Worldwide, more than 11 million people are incarcerated on any given day, with a global average of 140 people incarcerated per 100 000 citizens (Helen and Walmsley, 2021). The prison population represents a diverse group of people, but often carries a larger burden of socioeconomic disparities (Revold, 2015), health problems (WHO 2014; Fazel and Baillargeon, 2011; Friestad and Kjelsberg, 2009; UNODC 2019; Fazel et al., 2016) and history of physical and sexual abuse (Lundgren et al., 2013) compared with the general population. Drug use disorders (DUDs) are also more prevalent among the prison population (Fazel et al., 2017; Carpentier et al., 2018; WHO, 2014). In a recent systematic review of DUDs in the prison population, Fazel and colleagues found an overall pooled prevalence of DUD among 30% (95% CI: 22–38%) of men and 51% (95% CI: 43–58%) of women (Fazel et al., 2017).

DUDs among people in prison are associated with a range of negative post-release consequences, including mortality (Chang et al., 2015) and especially overdose death in the immediate period af-

ter release (Bukten et al., 2017). In addition, re-arrest and re-imprisonment are frequent problems among the drug using prison population (Håkansson and Berglund, 2012; Gjersing and Bretteville-Jensen, 2021; Grahn et al., 2020; Thomas et al., 2015), particularly among people who resume drug use after release (Larney et al., 2012; Winter et al., 2019). Winter et al. found injecting drug use (IDU) resumption after release from prison to more than double the risk of re-imprisonment (Winter et al., 2019).

As in the global prison population, the proportion of people with harmful drug use and mental health problems is higher in the Norwegian prison population than in the general population (Revold, 2015; Cramer, 2014). Drug-related crime is a common reason for imprisonment; 29% of the prison population had drug-related crime as the main reason for their imprisonment (Statistics Norway, 2021) and 40% of all sentences are related to drug and alcohol use (Bukten et al., 2021).

The causal mechanisms linking drug use and crime and whether this association can be attributed to factors related to the social conditions among people with DUD has been debated (Link and Hamilton, 2017). Much of the current research includes samples of people with high-risk drug use and people who were previously imprisoned, which does

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not make up a representative sample of the overall prison population (Bennett et al., 2008). The absence of proper comparison groups, including people with no or low-risk drug use makes it difficult to study the independent effect of drug use compared with other relevant covariates.

This study adds to current knowledge by being the first to investigate re-imprisonment according to three different levels of pre-prison drug use, including low-risk drug use and adjusting for relevant sociodemographic factors. Furthermore, as prison populations can vary substantially between countries and across time, local, up-to-date knowledge of the characteristics of the prison population is important in order to sufficiently inform decision and policy makers. By linking baseline survey data to the Norwegian Prison Registry and the Norwegian Cause of Death Registry, we were able to observe any new imprisonments and account for persons who died during the observation period.

1.1. Aims

This study aims to: 1) describe sociodemographic, health, and drug use characteristics of the NorMA cohort, 2) explore reimprisonment during the observation period, and 3) determine the association between level of drug use (low risk, harmful, or high risk) and reimprisonment while controlling for sociodemographic characteristics.

2. Material and methods

2.1. Setting and participants

Norway has one of the world's lowest imprisonment rates, with an average of 3218 individuals imprisoned in 2019, equal to an imprisonment rate of 60 per 100,000 of national population (Directorate of the Norwegian Correctional Service 2020a). The mean length of sentences is 323 days, though most are released after two-thirds time served (Directorate of the Norwegian Correctional Service 2020b). Hence, as 85% of people in prison serve sentences less than a year and 50% serve less than three months, the yearly turn-over is high and in 2016 the total number of people imprisoned during 2016 was 13 528 (Directorate of the Norwegian Correctional Service, 2017). Women constitute a minority in Norwegian prisons, with an annual proportion of approximately six percent. Almost two-thirds of prisons are high security prisons. The five-year recidivism rate among persons released from Norwegian prisons is 32%, with higher recidivism among persons released from high security prisons than low security prisons (44% versus 23%) (Kristoffersen, 2020).

The NorMA study recruitment took place in 57 prison units (of 63 eligible), from 1 June 2013 to 31 July 2014. The questionnaires were administered by the study investigators and distributed on the day of the visit. The questionnaire took 30 to 60 min to complete and was available in five languages, including Norwegian, English, Russian, French and German. Participants were not offered reimbursement for participating. The survey data includes baseline data on mental health and drug use, as well as on demographics and other background information. For a more thorough description of the methodology and study design of the NorMA study please see Bukten et al. (2015). 1499 people returned the questionnaire.

A total of 733 participants were enrolled in the NorMA cohort at baseline. The only exclusion criteria for the NorMA cohort was the absence of, or declining to state, a Norwegian Personal Identification Number (PIN). This excluded foreign citizens without permanent or temporary residency to Norway, such as those on tourist visas or undocumented immigrants. In order to study re-imprisonment, we excluded 32 persons who were still in prison at the end of the study observation period (31. December 2019), leaving a total study population of 701 people (Fig. 1). A previous study of the external validity of the NorMA cohort found it to be representative of those in the Norwegian

prison population who possess a Norwegian PIN in terms of age, gender, re-offending, length of imprisonments and drug use related crime (Lokdam et al., 2021).

2.2. Design and data sources

This was a prospective cohort study. We used data from the NorMA study, combining survey data and prospective registry data from the Norwegian Prison Registry and the Norwegian Cause of Death registry on the NorMA cohort. Survey and registry data was linked by the 11-digit personal identification numbers (PIN) provided by the NorMA cohort participants.

The Norwegian Prison Registry was established in 1992 to serve a range of administrative and statistical purposes. The registry includes data from all Norwegian prisons on sentences, prison entry and exit dates, sentence length, offense data, security level, participation in programmes and other variables for the activities related to imprisonment. The registry is administered by the Norwegian Correctional Service (Directorate of the Norwegian Correctional Service). The cohort was also linked to the Norwegian Cause of Death Registry to account for deaths in the cohort during follow-up.

2.3. Measures

The main exposure was pre-prison drug use measured by the Drug Use Disorder Identification Test (DUDIT) (Berman et al., 2005). The DUDIT was included in the baseline survey and participants were asked to recall their drug use in the year leading up to their imprisonment. The DUDIT contains 11 items with scores ranging from zero to 44. A score of six or more is considered an affirmative score for both genders, indicating a harmful use of drugs. Scores of 25 or more indicate drug use dependence for both genders and are considered high-risk scores (Berman et al., 2005). Following these cut-offs, throughout this study we define persons as having 'low-risk use' if they score below 6, 'harmful use' if they score between 6 and 24 and 'high-risk use' if scoring 25 or more.

Validation studies of the DUDIT recommend adjusted cut-off scores for women, depending on the population studied (Berman et al., 2005; Basedow et al., 2021; Durbeej et al., 2010; Hildebrand, 2015). The NorMA cohort contains few women ($n = 51$, 6%) and previous research on the full NorMA sample found similar patterns of drug use among men and women (Pape et al., 2020; Bukten et al., 2016). Based on this, and because this study mainly focusses on high-risk drug use, which has the same cut-off for both genders, we chose to use the standard cut-off categories.

Baseline imprisonment refers to the imprisonment a participant was serving when recruited to the study. The length of the baseline imprisonment was the time from entry date to date of release.

Our main outcome of interest was re-imprisonment during follow-up. A detailed description of all measures can be found in the Supplementary Table 1.

2.4. Analysis

Statistical analyses were performed in Stata (Version 16). We performed descriptive analysis on the NorMA cohort with baseline survey data and prison registry data, presenting frequencies and proportions, as well as means and standard error where relevant. Time-at-risk was defined as the first day following release from the baseline imprisonment until either (1) re-imprisonment, (2) the end of the study observation period (31st December 2019) or (3) death. We used crude Kaplan-Meier curves to describe time to re-imprisonment using complete case data stratified on drug use by 'low-risk', 'harmful' or 'high-risk' DUDIT score. Using Cox regression on imputed data, we performed a time-to-event analysis of the effect of DUDIT score on time to re-imprisonment.
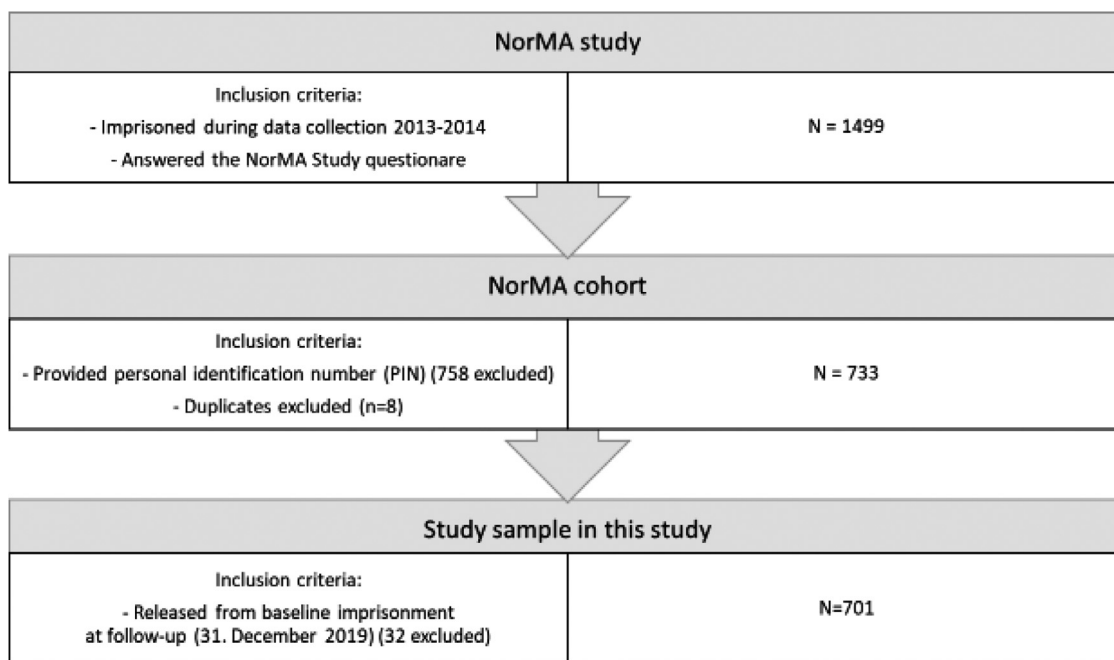
Fig. 1. Flowchart.

The Cox regression model included potential confounders identified using a directed acyclic graph (DAG) (see supplementary material). Additional step-wise reduction of insignificant estimates in the model did not change the estimates and the full model was kept.

2.5. Missing data

The level of missing data in the baseline material ranged from 0% to 19%, with 324 (46%) complete cases. Our exposure variable, the sum score of all DUDIT items, had 11% missing. Our outcome variable, re-imprisonment, did not have any missing data. A detailed list of missing data is shown in Table 1. As the missingness of the variables in our regression analysis was not considered missing completely at random (MCAR), we pre-processed the data by imputing all variables with missing data using multiple imputation by chained equations (MICE). In line with the Treatment and Reporting of Missing Data in Observational Studies framework by Lee et al. (2021) our imputation model included the variables from our regression analysis (Lee et al., 2021): exposure, outcome and potential confounders (sex, age, education, foster care and problems in childhood).

Several diagnostics of the imputation model were performed. First, the imputed values were compared by visual inspection with observed values in all imputations. We also assessed the percentage of persons assigned to each exposure group (low-risk/harmful/high-risk on the DU-DIT). Then, we conducted three sets of sensitivity analyses to examine the effect of changes to the imputation model on the estimates from the regression analysis. The sensitivity analyses are described in detail in the supplementary material. MICE was conducted in Stata (Version 16) using 'mi impute' with 100 imputations and 1000 iterations. The estimates were pooled using the Stata function 'mi estimate' based on Rubin's rules (Rubin, 1987).

2.6. Ethics

The NorMA study was approved by the Norwegian Committee of Research Ethics (REK 2012/297). It was also approved by the Ministry of Justice and Public Security and by the Directorate of the Norwegian Correctional Services, the national prison authorities in Norway. The PINs were provided by the participants following written informed consent. We used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) cohort checklist when writing our report (von Elm et al., 2007).

3. Results

3.1. Cohort characteristics

Among the study sample ($n = 701$) there were 225 (36.2%) persons reporting low-risk drug use (Score of <6), 115 (18.5%) persons reporting harmful drug use (Score of 6–24) and 281 persons (45.2%) reporting high-risk drug use (Score of >24), while 80 (11.4%) were missing (Table 1). The sample consisted of 43 females (6.9%). The mean age of all participants at baseline was 35.3 years (SE=0.5). There were 49 participants who died during follow-up, with the highest mortality among the group reporting high-risk use (10.0%). Compared with persons reporting low-risk and harmful use, those reporting high-risk use reported more socio-demographic problems such as unstable accommodation, less education and more drug-use related problems characterized by daily polydrug use (82.9%) and daily IDU (50.2%) in the six months leading up to their imprisonment. The high-risk group also had more imprisonments before baseline (mean=5.7, SE=0.4) and more had drug-use-related sentences in their baseline imprisonment (65.8%).

3.2. Re-imprisonment

The total time at risk for all 701 participants was 905,372 days, equivalent to 2479 person-years and an average of 3.5 person-years per participant. Two-fifths of the people (267, 43.0%) in the cohort were re-imprisoned within the follow-up period, with a mean time to first re-imprisonment of 651 days (SE=26.9). When stratifying on drug use, we excluded the 80 persons with missing items on DUDIT, leaving 621 persons with 2021 person-years at risk. Among persons reporting high-risk drug use, almost seven in ten returned to prison, and they returned sooner than persons reporting low-risk use (mean days to re-imprisonment: 610 days vs. 879 days). More than half of persons reporting high-risk use had returned to prison within 1000 days, compared

Table 1

Demographic characteristics (n, %), by reported DUDIT score, total and missing (*n* = 701).

	Low risk 225 (36.2)	Harmful 115 (18.5)	High-risk 281 (45.2)	Total 621 (88.6)	Missing 80 (11.4)
Demographics					
Sex, male	208 (92.4)	109 (94.8)	261 (92.9)	578 (93.1)	0 (0.0)
Age at baseline (Mean (SE)	39.5 (0.9)	31.8 (0.9)	33.5 (0.5)	35.3 (0.5)	0 (0.0)
Born in a Nordic country	172 (76.4)	99 (86.1)	255 (90.7)	526 (84.7)	11 (1.8)
Education: More than primary school	161 (71.6)	58 (50.4)	140 (49.8)	359 (57.8)	4 (0.6)
Occupation: Work or education before incarceration	147 (65.3)	52 (45.2)	54 (19.2)	253 (40.7)	11 (1.8)
Problems in childhood	49 (21.8)	38 (33.0)	130 (46.3)	217 (34.9)	16 (2.6)
Foster care	32 (14.2)	23 (20.0)	68 (24.2)	123 (19.8)	9 (1.4)
Unstable housing	26 (11.6)	20 (17.4)	109 (38.8)	155 (25.0)	18 (2.9)
Drug use					
Age at first drug use (mean, SD)	19.7 (0.9)	17.1 (0.6)	15.3 (0.3)	16.3 (0.3)	181 (29.1)
Poly-drug use	0 (0.0)	27 (23.5)	233 (82.9)	260 (41.9)	11 (1.8)
IDU					21 (3.4)
Daily/almost daily	0 (0.0)	7 (6.1)	141 (50.2)	148 (23.8)	
1–2 times per week	0 (0.0)	8 (7.0)	25 (8.9)	33 (5.3)	
1–3 times per month	0 (0.0)	11 (9.6)	8 (2.8)	19 (3.1)	
Mental health					
Severe mental stress (HSCL-10 >18.5)	58 (25.8)	35 (30.4)	136 (48.4)	229 (36.9)	116 (18.7)
Imprisonment					
Previously imprisoned	101 (44.9)	84 (73.0)	248 (88.3)	433 (69.7)	1 (0.2)
No. of imprisonments before baseline, mean (SD)	1.2 (0.1)	3.1 (0.4)	5.7 (0.4)	3.6 (0.2)	1 (0.2)
Drug-use related crime	31 (13.8)	55 (47.8)	185 (65.8)	271 (43.6)	0 (0.0)
B&B	6 (2.7)	42 (36.5)	164 (58.4)	212 (34.1)	0 (0.0)
Driving under influence	26 (11.6)	33 (28.7)	109 (38.8)	168 (27.1)	0 (0.0)
Convictions, mean (SE)	2.5 (0.2)	4.3 (0.4)	6.6 (0.3)	4.7 (0.2)	0 (0.0)
Length of baseline sentence					
<6	80 (35.6)	48 (41.7)	77 (27.4)	205 (33.0)	0 (0.0)
6–12	28 (12.4)	18 (15.7)	88 (31.3)	134 (21.6)	0 (0.0)
12<	117 (52.0)	49 (42.6)	116 (41.3)	282 (45.4)	0 (0.0)
Follow-up status					
Dead during follow-up	13 (5.8)	8 (7.0)	28 (10.0)	49 (7.9)	0 (0.0)
Re-imprisonments					
0	187 (83.1)	73 (63.5)	94 (33.5)	354 (57.0)	0 (0.0)
1	21 (9.3)	14 (12.2)	68 (24.2)	103 (16.6)	0 (0.0)
2	13 (5.8)	16 (13.9)	57 (20.3)	86 (13.8)	0 (0.0)
3+	4 (1.8)	12 (10.4)	62 (22.1)	78 (12.6)	0 (0.0)
Time to first re-imprisonment, days (SE)	878.8 (77.2)	678.5 (70.2)	609.7 (34.3)	650.7 (26.9)	0 (0.0)

Table 2

Univariate and adjusted Cox regression analysis on polled MICE data, with hazard ratios, 95 % confidence intervals (CI) and p-values, *n* = 701.

	Univariate HR (95% CI)	*P*	Adjusted HR (95% CI)	*P*
Level of drug use				
Harmful use	2.20 (1.44–3.37)	<0.001	1.80 (1.17–2.78)	0.008
High-risk use	5.06 (3.61–7.09)	<0.001	4.20 (2.95–5.97)	<0.001
Sociodemographic				
Age	0.98 (0.96–0.99)	<0.001	0.98 (0.97–1.04)	<0.001
Female	0.67 (0.42–1.06)	0.090	0.65 (0.40–0.99)	0.070
Problems in childhood	1.05 (0.83–1.34)	0.666	1.05 (0.83–1.35)	0.669
Education: More than primary school	0.69 (0.55–0.87)	0.002	0.76 (0.60–0.97)	0.025
Foster care	1.31 (1.00–1.70)	0.050	1.22 (0.93–1.61)	0.147

with one in four among those reporting harmful use and less than one in ten among persons reporting low-risk use (Fig. 2).

The adjusted Cox regression model is shown in Table 2. Compared with people with low-risk use, people with high-risk use had four times higher HR for re-imprisonments (HR=4.20, *P*=<0.001) and people with harmful use had 80% higher HR for re-imprisonments (*P* = 0.008) (Table 2). Higher age (HR=0.98, *P*=<0.001) and having more education than primary school (HR=0.76, *P*-value=0.025) were protective factors against re-imprisonment. We found no significant effect of gender, 'problems in childhood' or 'foster care' in the adjusted model.

4. Discussion

In this study of a representative sample of the Norwegian prison population (Lokdam et al., 2021), the majority of participants reported harmful or high-risk drug use before imprisonment. Persons reporting high-risk drug use had a high prevalence of IDU, polydrug use and severe mental stress. They also had a high burden of social problems and previous prison experience.

By combining survey and registry data and adjusting for other risk factors for re-imprisonment, our study was able to investigate the independent effect of drug use on re-imprisonment. Our results showed that both harmful and high-risk drug use were associated with increased risk of re-imprisonment. Furthermore, older age and having more education than primary school was protective against re-imprisonment. Our findings are in line with previous research on criminal offending and imprisonment among people with high-risk drug use (Gjersing and Bretteville-Jensen, 2021; Thomas et al., 2015; Winter et al., 2019; Link and Hamilton, 2017; Bennett et al., 2008; Phillips, 2010; Bennett and Ed-
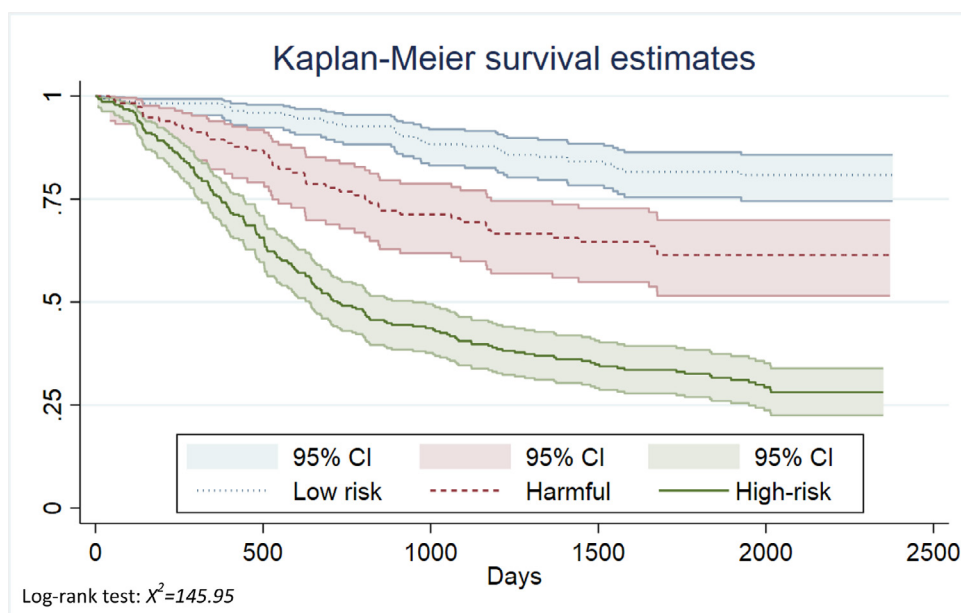
Fig. 2. Kaplan-Meier curves of days to re-imprisoned, by low-risk, harmful or high-risk drug use. 95% confidence intervals (CI), $n = 621$. Total time at risk= 803 878 days.

wards, 2015; Pierce et al., 2015). In a recent study using a large sample of adults assessed for risky drug use or SUD, Grahn and colleagues (Grahn et al., 2020) found higher Addiction Severity Index Composite Score (ASI CS) for use of drugs other than alcohol to be the strongest predictor for re-imprisonment across both genders (Grahn et al., 2020). Their regression model included parental narcotic problems, physical abuse, ASI CS on both narcotics and alcohol use, education and age. Their findings indicated that addiction severity could decrease the explanatory impact of the lifetime stressors. Hence, other risk factors had less importance if the drug use is more severe.

The mechanisms linking drugs and crime are often categorized as economic, pharmacological or lifestyle mechanisms and are complex and intertwined; drug use causes crime and crime causes drug use (Bennett and Holloway, 2009). In terms of recidivism, post-release drug use can act as a push factor, driving individuals into new criminal activities, and simultaneously be a barrier for re-entry to society because it complicates participation in re-entry activities such as education, school or treatment (Phillips, 2010; Larney et al., 2018). Our study did not examine the intricate causal mechanisms explaining the association between drug use and re-imprisonment. However, in addition to risky drug use being associated with more imprisonment, younger age and low level of education were also found to be positively associated with re-imprisonment. These findings are consistent with previous research on recidivism in the prison population in general (Skarðhamar and Telle, 2009) and the drug-using prison population in particular (Håkansson and Berglund, 2012; Grahn et al., 2020; Winter et al., 2019; Link and Hamilton, 2017).

Our results confirm that the complex vulnerabilities of people in prisons with high-risk drug use require interventions that integrate social, economic and health-related support to prevent further criminal activity and re-imprisonment.

4.1. Strengths and limitations

Our data included a unique combination of longitudinal registry data and high-quality baseline survey data collected from a representative cohort. Using national registry data makes our loss to follow-up negligible. Another strength of our study is the use of the standardized tool DUDIT validated in the prison population (Durbeej et al., 2010; Coulton et al., 2012) for our main exposure, drug use.

However, self-report data on drug use before imprisonment may have some limitations concerning validity and reliability. The original DUDIT instruments were modified to assess the year before incarceration and the validity of the responses may thus have been hampered by recall bias. However, using registry data on imprisonment and convictions reduces the limitations of recall bias related to crime and imprisonments.

The use of registry data indicates that our results are generalizable to the prison population that have Norwegian PINs, which excludes approximately 20–25% of the people imprisoned daily in Norway (Lokdam et al., 2021). From previous research on those in Norwegian prisons without PINs, we have seen that they have fewer drug-use-related convictions, a finding which might indicate that this group has fewer problems with drug use compared with people in prisons with Norwegian PINs (Lokdam et al., 2021). The challenge of follow-up of non-registered citizens applies to most longitudinal research using registry data and is not unique to this study. However, this should be taken into consideration when interpreting our results.

4.2. Implications

The high proportion of people with drug-use problems in prisons presents both a challenge and an important opportunity for public health interventions (Fazel and Baillargeon, 2011; Viggiani, 2007; James Woodall et al., 2014). Public health interventions and DUD treatment in prisons have been shown to reduce recidivism to drug use and imprisonment (Larney et al., 2012; De Andrade et al., 2018; Taxman and Mun, 2018) with potential benefit for both the individual and society. People with high-risk drug use often have a complex combination of risk factors, social and economic problems. Together with findings from other studies, our findings imply that interventions aimed at addressing harmful and high-risk drug use are crucial in order to rehabilitate people in prison with DUD and prevent re-imprisonment.

In Norway, people in prison have the right to access universal health care and to take part in health care interventions adjusted to their individual needs. However, limited treatment capacity and lack of systematic screening of DUD in Norwegian prisons (Oslo Economics, 2020), maintains a gap between the needs of people with DUD in prisons and the actual access and availability of treatment and rehabilitating interventions. Systematic screening of all people entering prison should therefore be based on standardized tests such as the DUDIT. Validation

studies of brief DUDIT screeners have found that short versions have performed well at detecting high-risk drug use in the prison population, and their use can thus be recommended in the prison setting (Pape et al., 2022). Screening and treatment should also be available to people with DUD serving shorter sentences.

5. Conclusion

Our results showed that half of the NorMA cohort reported high-risk drug use before their baseline imprisonment. Persons reporting high-risk drug use had four times the risk of re-imprisonment compared with those reporting low-risk use. This association persisted even when adjusting for socio-demographic variables, indicating the high burden of vulnerability related to high-risk drug use.

Contributors

All authors contributed to the interpretation of the results and editing of the manuscript.

Author disclosure section

Role of funding source

Declaration of Competing Interest

No conflict declared.

CRediT authorship contribution statement

Nicoline Toresen Lokdam: Formal analysis, Writing – original draft, Writing – review & editing. **Marianne Riksheim Stavseth:** Writing – original draft, Writing – review & editing. **Anne Bukten:** Writing – original draft, Writing – review & editing.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dadr.2022.100127.

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