

# Health Risks in a Street Population Using Illegal Drugs in Norway 2010 to 2012, with a Long-Term Follow-up Regarding Mortality and Morbidity, As Well As Local and National Harm Reduction Measures

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## Research article

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# Abstract

**Background** Mapping the heterogeneity of high-risk drug users is necessary to target harm reduction measures and drug policy. The aim of this study was to find if and how risk factors of adverse health outcomes varied for subgroups among illicit drug users from 2010 to 2012 and explore whether harm reduction measures, low-threshold services and treatment met such health risks from 2010 to 2019.

**Methods** We interviewed 413 drug users at low-threshold facilities in three Norwegian cities from 2010 to 2012, and 351 respondents had a full dataset. The inclusion criterion was use of amphetamines, cocaine, heroin or opioids during the previous 12 months. Latent profile analysis was applied to establish subgroups with different health risk profiles. City-specific as well as national drug-induced deaths (2010-18) and injecting-related infectious diseases (2010-2019) were applied as outcomes. Harm reduction measures, low-threshold services and treatment in Norway from 2010 to 2019 are described.

**Results** Reporting amphetamines (68%), heroin (60%) and opioids (65%) last 30 days were frequent, while reporting of cocaine was not (14%). Frequent use, injecting and co-use of amphetamines, heroin, and other opioids (prescribed or illicit) was high. The latent profile analysis separated users into five subgroups. Time since debut of use of amphetamines, cocaine, heroin or opioids varied between groups, as did types of psychoactive substances used and dependence. Injecting practices varied from 51% to 97% in the subgroups. Harm reduction measures in Norway since 2010 have been targeted to reduce the high level of injecting practices and their health consequences. However, drug-induced deaths at the national level and in the cities of the interviewees did not decline up to 2018. HIV among people who inject drugs at the national level declined from 2010 to 2019, while Hepatitis B did not, and the result for Hepatitis C was inconclusive.

**Conclusions** Even though harm reduction measures for high-risk drug users in Norway have been targeted to reduce the high level of injecting practices and other health risks found in five subgroups in our sample from 2010 to 2012, further measures to reduce such risks and their health consequences must be tailored.

## 1 Background

Illicit drug use is an important contributor to the global burden of disease (1). Use of psychoactive substances involves considerable risks to drug users and those around them. The harms associated with illicit drug use are multiple: overdose and premature death, diseases, crime and family breakdown (2). Babor et al. (2019) summarise five classes of morbidity and mortality for the drug user: overdose, other injury, non-communicable diseases, mental disorders, and infectious diseases. Risk factors mentioned for these health harms include gender (higher risks for males), age (depending on the type of harm), length of experience of drug use, frequency of drug use (daily or almost daily use), poverty, homelessness, concurrent use of substances (polydrug use), impaired physical health, depression, a previous history of non-fatal overdose, both prescribed and non-prescribed opioid use, type of drug, route of administration

(injecting drug use), multiple daily injections, stigma, social exclusion, services, harms on the social level, and unemployment (2–5).

To meet these risks, harm reduction services and treatment in Norway have long included evidence-based measures (2). Examples are: A needle/syringe programme started in Oslo 1988. Specialised drug treatment for drug dependence was increased in the early 1990s, opioid substitution treatment (OST) was established in 1998, and a medically supervised injection centre has been run in the capital Oslo since 2005. A national strategy towards drug overdose death was established in 2014 by the Norwegian Directorate of Health, and a second injection centre was set up in 2016 (6, 7).

The aim of this study was to establish knowledge of the heterogeneity of health risks among high-risk drug users from 2010 to 2012 and explore whether harm reduction measures, low-threshold services and treatment met such health risks for the outcomes drug-induced deaths (2010–2018) and injecting-related infectious diseases (2010–2019).

## 2 Methods

### 2.1 Study population

We recruited a convenience sample of 413 drug users from low-threshold health and social service facilities, shelters and designated cafes in three Norwegian cities: in 2010 in Arendal (population (pop). 42,000), from 2011 to 2012 in Tromsø (pop. 71,000), and in 2012 in Oslo (pop. 625,000) (8). Respondents were recruited by local social workers and administrative staff at the service facilities. Structured, face-to-face interviews were carried out by the researchers and trained students. Subjects who completed the interview were awarded NOK 200 (approximately US \$25). Users of amphetamines, cocaine, heroin or other opioids (prescribed or not) during the previous 12 months were included. Amphetamines include amphetamine and methamphetamine because both are almost solely sold as powder and it is difficult to distinguish one from the other. The term “other opioids” than heroin includes all other natural, semisynthetic and synthetic types of opiates and opioids, prescribed or not. A list of opioid names was presented in the questionnaire. Some participants were enrolled in outpatient substance use treatment. Since crack cocaine and crystal meth are seldom used in the Norwegian setting (9), these substances were not specified in the survey.

The term high-risk drug users (HRDU) has been employed for the sample. This term refers to persons with recurrent use that causes them actual harm, including dependence, disease and/or premature death, or places the person at high risk for such adverse outcomes (9).

### 2.2 Variables

The number of days of drug use and whether the drug was injected or not in the previous 30 days for amphetamines, cocaine, heroin or other opioids (prescribed or not) was recorded. Additionally, respondents were asked for the number of days using alcohol, hashish (marihuana), gamma-

hydroxybutyrate (GHB) or gamma-butyrolactone (GBL), ecstasy, lysergic acid diethylamide (LSD), inhalants and sedatives (obtained illicitly or legally) during the previous 30 days. Use of non-prescribed opioids over the previous 30 days was also recorded, albeit not how many days such opioids were used. Cut-off for a dichotomy of substance use was primarily set to more than 25 days per month (26–30 days, daily or almost daily use). Some of the substances were used infrequently and, thus, lower cut-offs had to be employed (see Table 1) to be able to run adjusted analyses (see below).

Table 1  
Sample description allowing non-response. Substance use, demographic and socioeconomic characteristics

<b>Health risks</b>	<b>All (non-responders excluded for each variable), n = 413</b>	<b>All non-responders excluded, n = 351</b>
Substance use characteristics		
Amphetamines use 26 days or more <sup>1</sup> , per cent	24.1	24.2
Cocaine use last 30 days (yes/no), per cent	14.0	14.8
Heroin use 26 days or more <sup>1</sup> , per cent	31.6	35.0
Opioid use 26 days <sup>1</sup> , per cent	46.6	44.4
Use of opioids not prescribed last 30 days (yes/no), per cent	27.6	29.3
Hashish use 26 days or more <sup>1</sup> , per cent	40.0	39.9
Sedatives use 26 days or more <sup>1</sup> , per cent	39.3	40.2
Alcohol use 9 days or more <sup>1</sup> , per cent	20.8	21.7
Polydrug use last 30 days, mean number of drugs	3.5	3.6
Injected drugs in past 30 days, per cent	74.6	77.2
Years of drug use, mean	25.0	24.5
SDS <sup>2</sup> , mean	7.1	7.2
Demographic and socioeconomic characteristics		
Gender, female, per cent	23.7	23.7
Age above 40 years, per cent	62.2	59.5
Education higher than minimum	17.8	17.8
Currently in education or an occupation, per cent	7.5	8.0
Own housing, per cent	45.5	44.7
<sup>1</sup> During previous 30 days <sup>2</sup> Severity of Dependence Scale		

Polydrug use was defined as the number of psychoactive substances mentioned above, excluding alcohol, for more than one day during the previous 30 days. The one-day limit was employed to avoid inclusion of accidental use.

Years of drug use were estimated by the difference between the user's age group at the time of the interview (middle of a five-year group) and the age of the earliest drug introduction for amphetamines, cocaine, heroin or other opioids.

The Severity of Dependence Scale (SDS) was included (10). Forward and backward translations of the SDS between English and Norwegian were conducted. The SDS included five standardised questions to estimate the total individual dependence score described by a continuous variable, with values from zero to 15 as a proxy measure of a drug user's perceived degree of drug dependence.

Demographic and socioeconomic data for each respondent were recorded, including gender, age group, years of education, employment or education status and type of living arrangements (own housing or not).

All the variables, including gender, age and socioeconomic status, are mentioned as health risks in the literature (2, 4). In the definitions above, female gender, currently in education or an occupation and own housing are protective factors, while the others are risk factors.

## **2.3 Data analyses**

Latent profile analysis (LPA) was applied for psychoactive substance use and drug-related behaviours (11). Latent profile analysis is a technique that aims to recover hidden groups from observed data. LPA is applied to reduce a sample with many variables (some must be continuous) to a few subgroups with similar variable values. Due to the high number of variables included, the variable distributions were based on one parameter each to achieve solutions. Dichotomous variables (binomial distribution) were applied, as well as some Poisson distributed variables, which were in accordance with the observations (number of substances in polydrug use, SDS score, and years of drug use). Demographic and socioeconomic characteristics within the five subgroups achieved by latent profile analysis were estimated separately.

As part of the method, the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) were applied as primary criteria for choosing the number of subgroups, albeit the size of the subgroups should not become too small. An additional criterion was that the interpretation of the subgroups had to be meaningful for the aim of the study. Unadjusted analysis of significance for differences between the subgroups was carried out by logistic and linear regression.

Non-response was two to three per cent for each variable, except SDS, with nine per cent non-response. The latent profile analysis was run excluding all persons with non-response on any variable. Sample values based on non-response for each variable are shown in Table 1, as well as sample values when all non-responders are excluded.

Trends for the number of drug-induced deaths in the three cities and nationally and infectious diseases nationally were estimated by linear regression (12, 13). Trends for population rates were not applied since the population increased by 16% from 2010 to 2019 in the three municipalities, while the population of people who inject drugs (PWID), the dominating group of high-risk drug users, has been stable (14, 15).

For the analyses, we used Stata version 15 (StataCorp, College Station, TX, USA). Statistical significance was set at  $p < 0.05$ .

## **2.4 Harm reduction and treatment 2010 to 2019 in Norway**

Information on harm reduction and treatment from 2010 to 2019 was found in reports, guidelines and scientific literature (6, 7, 16, 17).

## **2.5 Drug-induced deaths and infectious diseases**

Drug-induced deaths are reported to the Norwegian Cause of Death Registry for 2010 to 2019 (12). All positive cases of infectious diseases transmitted by contaminated needles and gear are reported to the national surveillance system for communicable diseases (MSIS) (13). The system is based on medical-microbiological laboratories and physicians reporting all cases of certain communicable diseases to MSIS.

## **3 Results**

### **3.1 Reported psychoactive substance use and aspects of drug use**

Last 30 days use of amphetamines was reported by 68.7% of the sample (of which 87.1% injected these drugs), heroin by 59.6% (of which 92.6% injected), opioids by 66.4% (of which 87.1% injected), and cocaine by 14.0% (of which 32.7% injected cocaine). Last 30 days use of opioids without a prescription was 27.8% (of which 55.0% injected opioids). On average, 74.6% of the sample injected drugs. Co-use of these drugs was common. Among those who used amphetamines in the last 30 days, 66.7% used heroin, and 61.5% used opioids. Among those who had used heroin, 76.9% used amphetamines, and 71.1% used opioids. Among those who used opioids, 63.6% used amphetamines, and 63.9% used heroin. Among those who used opioids without a prescription, 82.0% used amphetamines and 86.5% used heroin. Polydrug use was also associated with a high level of injecting. Among those who used four or more drugs in the last 30 days, 95% injected at least one substance.

A substantial proportion of the sample reported daily or almost daily use of amphetamines; heroin, opioids, hashish or sedatives (see Table 1). The low frequency of cocaine use implicated a cut-off at “use or not (yes/no)” in the analysis. The cut-off for alcohol was set at “twice a week or more” (nine times or more per 30 days). Mean number of years since debut of either amphetamine, cocaine, heroin or opioids was 25 years, implying an ageing sample. This was supported by the fact that 62.2% of the sample was

older than 40 years. The sample was 23.7% women. Other frequencies and means for aspects of substance use are reported in Table 1.

Last 30 days reports of GHB/GBL was 15.7% (mainly used 1–3 days, 11.9%), ecstasy and LSD by 4.6%, and inhalants by 1.7%. These figures were so low that the psychoactive substances were excluded from the latent profile analysis, except by inclusion in the variable polydrug use.

The sub-sample in which all non-responders were excluded (n = 351) may have had some elevated risks compared to the total sample (n = 413). Heroin use, use of opioids not prescribed, and drug injection had higher estimates in the sub-sample, albeit not significantly different (second column of Table 1).

## 3.2 Latent profile analysis

AIC and BIC were smaller for five subgroups than four or fewer (Table 2). The number of respondents in some subgroups were rather small, with five subgroups (Table 3). Thus, we did not perform the analysis with six subgroups. Demographic and socioeconomic characteristics within the five subgroups achieved by latent profile analysis are shown in Table 4. The following subgroups emerged:

Table 2  
AIC and BIC for latent profile models. N = 351

	<b>Log likelihood</b>	<b>Df</b>	<b>AIC</b>	<b>BIC</b>
Two groups	-4874.4	25	9798.9	9895.4
Three groups	-4770.7	38	9617.4	9764.2
Four groups	-4716.7	51	9535.5	9732.4
Five groups	-4668.1	64	9464.2	9711.3

Table 3

Substance use risk profiles within five subgroups achieved by latent profile analysis. Latent profile marginal means. N = 351

Health risks: substance use characteristics	Subgroup one 15.6%, n = 56	Subgroup two 23.7%, n = 84	Subgroup three 29.7%, n = 100	Subgroup four 19.1%, n = 69	Subgroup five 12.0%, n = 42
Amphetamines use 26 days or more <sup>1</sup> , per cent	22.8 (11.9–39.3)	16.8 (9.0–29.2)	23.3 (14.6–35.2)	46.9 (33.7–6.6)*	6.8 (1.6–24.9)*
Cocaine use last 30 days, per cent	1.4 (0.0–21.3)	14.5 (8.0–25.0)*	7.6 (2.7–19.4)	38.4 (26.2–52.3)*	13.1 (5.2–29.0)
Heroin use 26 days or more <sup>1</sup> , per cent	0.0 (0.0–1.0) <sup>3</sup>	7.2 (2.3–20.4)*	39.0 (27.0–52.5)	89.2 (67.7–97.0)*	39.4 (24.1–57.1)
Opioid use 26 days or more <sup>1</sup> , per cent	57.6 (41.4–72.3)	49.8 (37.7–61.9)	58.5 (46.6–69.6)	18.2 (9.2–32.9)*	23.7 (12.2–41.0)*
Use of opioids not prescribed <sup>1</sup> , per cent	6.7 (1.8–21.7)*	19.9 (11.5–32.2)	28.6 (18.8–40.9)	47.3 (34.2–60.8)*	50.7 (34.0–67.3)*
Hashish use 26 days or more <sup>1</sup> , per cent	42.5 (28.5–57.7)	37.9 (26.8–50.4)*	54.9 (44.0–65.3)	22.3 (11.1–39.7)*	31.4 (8.2–48.4)*
Sedatives use 26 days or more <sup>1</sup> , per cent	21.5 (11.0–37.9)*	23.7 (14.8–35.6)*	61.7 (50.2–72.1)	34.4 (22.1–49.1)*	52.9 (35.3–69.7)
Alcohol use 9 days or more <sup>1</sup> , per cent of days	15.7 (7.0–31.7)*	30.0 (20.2–42.1)	31.5 (22.4–42.4)	22.3 (11.1–39.7)*	15.7 (6.9–31.7)*
Polydrug use last 30 days, mean number of drugs	2.5 (2.0–2.9)*	3.2 (2.8–3.7)*	3.7 (3.3–4.2)	4.3 (3.8–4.8)*	4.0 (3.3–4.6)
Injected drugs in past 30 days, per cent	50.7 (34.5–64.9)*	70.2 (57.9–80.1)*	83.3 (70.2–91.3)	97.3 (85.9–99.5)*	79.9 (63.6–90.0)
Years of drug use, mean	32.3 (29.9–34.7)*	16.8 (15.4–18.2)*	34.3 (32.8–35.9)	22.0 (19.9–24.1)*	9.1 (7.9–10.3)*

<sup>1</sup> During previous 30 days <sup>2</sup> Severity of Dependence Scale <sup>3</sup> No confidence interval or significance can be calculated when no variation is present \* Significance, unadjusted result from regression analysis with subgroup 3 as reference group

Health risks: substance use characteristics	Subgroup one	Subgroup two	Subgroup three	Subgroup four	Subgroup five
	15.6%, n = 56	23.7%, n = 84	29.7%, n = 100	19.1%, n = 69	12.0%, n = 42
SDS <sup>2</sup> , mean	2.9 (1.8-4.0)*	5.5 (4.7-6.3)*	8.3 (7.6-9.0)	9.3 (8.4-10.1)*	9.9 (8.8-11.0)*

<sup>1</sup> During previous 30 days <sup>2</sup> Severity of Dependence Scale <sup>3</sup> No confidence interval or significance can be calculated when no variation is present \* Significance, unadjusted result from regression analysis with subgroup 3 as reference group

Table 4

Demographic and socioeconomic characteristics within the five subgroups achieved by latent profile analysis. Per cent

Health risks: demographic and socioeconomic characteristics	Subgroup one	Subgroup two	Subgroup three	Subgroup four	Subgroup five
	15.6%, n = 56	23.7%, n = 84	29.7%, n = 100	19.1%, n = 69	12.0%, n = 42
Gender, female	14.3	23.8	15.0	29.0*	47.6*
Age above 40 years	92.9	25.0*	99.0	49.3*	7.1 <sup>1</sup> *
Education higher than minimum	19.6	16.7	16.7	17.4	16.7
Currently in education or an occupation	14.3*	8.3	3.0	7.3	11.9
Own housing	57.1	56.0	51.0	17.4*	35.7

<sup>1</sup> 52% were 18–24 and 74% were 18–29 years of age \*Significantly different from subgroup 3, using multinomial logistic regression method

1. *Older opioid users, low level of risk factors, 15.6% of the sample:* Long duration, low dependence, no heroin use, high opioid use, low opioid use not prescribed, low polydrug use, 50% inject, 93% above 40 years of age, low proportion of women
2. *Injecting opioid users, medium level of risk factors, 23.7% of the sample:* Medium duration, medium dependence, little heroin use, high opioid use, some opioid use not prescribed, low polydrug use, 70% inject, medium age, medium proportion of women
3. *Older heroin/opioid injectors, high level of risk factors, 29.7% of the sample:* Long duration, high dependence, medium heroin use, high opioid use, high opioid use not prescribed, high sedative use, medium polydrug use, 83% inject, 99% above 40 years of age, low proportion of women
4. *Heroin/opioid/stimulant injectors, high level of risk factors, 19.1% of the sample:* Medium duration, high dependence, high heroin use, low opioid use, high opioid use not prescribed, high stimulant use, high polydrug use, 97% inject, medium age, medium proportion of women

5. *Young injectors, high level of risk factors, 12.0% of the sample*: Short duration, high dependence, medium heroin use, low opioid use, high opioid use not prescribed, high sedative use, low use of amphetamines, medium/high polydrug use, 80% inject, 52% 18–24 years, 74% 18–29 years of age, 48% women

Education higher than minimum was the only factor that did not vary between subgroup three and at least one of the other subgroups (Table 4).

### **3.3 Harm reduction and treatment 2010 to 2019 in Norway**

The harm reduction goals within Norway's alcohol and drug policy as defined in a 2011–2012 white paper included the prevention of harms such as overdoses and drug-related infectious diseases (18). A national strategy towards drug overdose death was established in 2014 by the Norwegian Directorate of Health, working with the 14 municipalities mostly affected by overdose death (7). The strategy included: 1) take-home nasal spray naloxone distribution to drug users and their next of kin in ten per cent of the municipalities. It has also lately been distributed in prisons, in police cars and to security guards, 2) a "Switch" campaign to change injection to less risky practices (smoking of heroin), and 3) general advice to users and others to reduce risky behaviour.

Drug treatment in Norway encompasses a range of services including assessment, detoxification, stabilisation, short- and long-term residential treatments and medication-assisted treatment, such as opioid substitution treatment (OST) (16). The number of patients in OST has steadily increased since 1998 when such treatment was established, while entrance to OST has declined since 2010 (17).

Many municipalities and NGOs have run low-threshold health services for drug users, as well as social arenas like designated cafes, etc. In 2017, 22% of the municipalities had a needle and syringe exchange (16). A medically supervised injection centre has been run in the capital Oslo since 2005, and a new one was established in the second largest city of Norway (Bergen) in 2016 (16).

### **3.4 Mortality and morbidity 2010 to 2019**

Drug overdose deaths on a national basis have not been reduced since 2010 (19). The test for trends using linear regression showed a yearly, not significant, increase of 3.8 deaths ( $p = 0.14$ ) 2010 to 2018. The three cities included in the study had no significant decrease in drug-induced deaths either ( $p = 0.80$ ). Cause of death changed from mainly heroin to mainly other opioids.

On a national basis, new cases of HIV by injection practice were reduced from 2010 to 2019 ( $p = 0.012$ ). Acute Hepatitis B did not decrease ( $p = 0.246$ ). The duty to report Hepatitis C changed from only acute cases from 2000 to 2007, to all cases thereafter (HCV-RNA & anti-HCV, 2008–2014 and HCV-RNA and HCV core antigen from 2015). This means the registry cannot supply figures to estimate a trend for acute cases.

## **4 Discussion**

## 4.1 Summary of main findings

Frequent use, injecting and co-use of amphetamines, heroin and other opioids (prescribed or illicit) was high from 2010 to 2012. The latent profile analysis separated users into five subgroups, where the time since debut of drug use and age were important characteristics of the subgroups, as well as types of psychoactive substances used and dependence. Injecting practices varied from 51–97% in the subgroups.

Despite the implementation of effective harm reduction measures and treatment, drug-induced deaths had not been reduced locally or nationally during a follow-up period from 2010 to 2018. New cases of HIV were reduced in 2019 on a national level, while new cases of Hepatitis B were not. It was not possible to determine whether new cases of Hepatitis C were reduced.

## 4.2 Comparisons to other studies

The high prevalence of substance use and injecting practices has also been reported in later studies of high-risk drug use populations in seven cities in Norway in 2013 and 2017 (20, 21). This means the high-risk drug-using population found in this study was still present in the following decade. In the 2017 study, 72% reported injecting practices in the last four weeks before the interview, keeping the risk of drug-induced deaths and infectious diseases at a high level. More than half of the sample injected amphetamines, 32% heroin, and 69% reported injecting of opioids (the latter figure may include double counting of persons) (20).

Other studies using latent profile analysis among high-risk drug users have investigated the relationships between risk factors and outcomes like mortality and morbidity. Different study populations and variables have been employed, which implies that the established subgroups and their risk patterns vary between studies. Thus, direct comparisons of such results with this study were difficult. An important finding, however, was that more tailored prevention measures and treatment were needed (22–25).

## 4.3 Latent profile findings

In our study, we found heterogeneity in health risks of high-risk drug users. Age and years of drug use separated the study participants into three levels of age/time since drug use debut.

Two subgroups included persons who were mainly above 40 years of age with many years since drug use debut (subgroups one and three, Table 3). Subgroup one included persons most likely in OST (methadone and buprenorphine can only be prescribed within the frame of OST in Norway) and otherwise with low level of self-reported health risks and a low level of dependence. Persons in this group have most likely benefited from the measures present before and at the time of the survey. The other subgroup (subgroup three) included heroin/opioid injectors with a high or medium level of other risk factors, implying a need for better-tailored measures. Both subgroups had a high level of own housing, indicating contact with and help from the municipality health services (Table 4). Targeting older high-risk drug users with heroin/opioid injecting practises still seems necessary.

The two subgroups with a medium age/medium years since drug debut (subgroups two and four) also had different levels of risk factors. Subgroup two, injecting opioid users, had a medium level of risk factors, and some were likely in OST since many used opioids and few used opioids not prescribed. This subgroup likely benefited from the measures present. Subgroup four, injectors of heroin, opioids not prescribed and/or stimulants, was the group with highest levels of risks in the whole sample (Table 3), and thus had likely not benefited in the same way. A coordinated action combining all levels and types of harm reduction measures and treatment seems necessary for this group.

Finally, subgroup five, with younger drug users and ten years on average since drug use debut, had a high level of health risks. It was noteworthy to find a high level of frequent heroin use, opioids not prescribed, sedatives and polydrug use among younger high-risk drug users, with a potential long trajectory of drug use ahead of them. Women constituted almost half of this subgroup and therefore had the same risk for inclusion as men.

The high level of injecting was alarming for the whole sample. In addition, three subgroups of all ages, constituting 60% of the sample, had likely not benefited adequately from the measures present at the time of the interview (2010-12) and had a high level of risky drug use and dependence.

## **4.4 Harm reduction and treatment from 2010 to 2019 in Norway**

Since 2010 to 2012 when this study was carried out, efforts to reduce injecting practices and its consequences have been emphasised even more than the previous years (7). In general, the measures have been adequate for the health risk situation among high-risk drug users in our sample (2). However, evidence-based measures do not necessarily help all at risk, just a large enough proportion to reach significant results.

The municipalities where the study was carried out did not reduce their efforts to prevent drug-induced deaths and infectious diseases from 2010 to 2019. According to municipality webpages, local health and social services, as well as other low-threshold measures and treatment, continued.

## **4.5 Mortality and morbidity 2010 to 2019**

Drug overdose deaths (drug-induced deaths) have not been reduced since 2010, neither nationally nor in the three municipalities where our study was carried out (19). We do not know, however, whether such deaths would have been higher without the measures present.

The lack of decrease in drug-induced deaths from 2010 to 2018 and the fact that cause of death has changed from mainly heroin to mainly other opioids may reflect two possibly overlapping changes. High-risk drug users may have changed their drug-taking habits, or many of those at risk are in different arenas than the street population for whom the measures have proved successful. The need for harm reduction for those in different arenas was not necessarily met by measures aiming to help the street population of

high-risk drug users. Opioid dependence among disability pensioners and persons on the edge of the workforce are examples of such groups (26).

The three subgroups with the highest level of health risks in our sample from 2010 to 2012, altogether 60% of the sample, had varying time since drug use debut and thus likely had varying experience with use of harm reduction measures and treatment. The heavy health risk practices call for many types of support, from further training to switch from injecting to smoking, to improvement of the social environment and housing, daily activities or work with close follow-up. Babor et al. (2019) mention heroin substitution (now to open in Oslo and Bergen) and peer self-help organisations (found in Norway, but not highly advocated) as effective to reduce health risks. In addition, psychosocial treatment, contingency management and therapeutic communities are mentioned by Babor et al. (2019) as effective tools in addition to the ones already mentioned to reduce health risks. Such treatment is also found in Norway but may be more heavily advocated. Recently (2020), two injection rooms opened for smoking of heroin, a less risky way of consumption than injecting.

Lack of success to reduce drug-induced deaths may be due to a need for (even) more tailored harm reduction measures and treatment, both for the street-based population of high-risk drug users, and for others at risk. The health authorities continue their efforts in this area (27).

Reduction of infectious diseases transmitted by contaminated needles and gear may have been more successful (13), even though new cases of Hepatitis B did not decline, and it was not possible to decide about the trends for new cases of Hepatitis C. The Ministry of Health and Care launched a strategy in 2018 to eliminate Hepatitis C, which included an active search for people with previous or present risks factors and treatment for those infected (28).

## **4.6 Limitations and strengths**

The self-reported data in this study are only as accurate as the drug users' recollections, presentations and perceptions of their own situations. Therefore, these data might be biased by time and implicit goals. However, the information provided by the respondents represents the core of what occupies them daily. It has been found that drug use may be underreported due to fear of social stigma or exaggerated in order to receive sympathy or treatment (29, 30). Nevertheless, there is no obvious reason why this potential bias would not affect all the subgroups in this study. Therefore, the comparisons between subgroups are likely valid. The respondents had nothing to gain by exaggerating or altering facts in this study. The reliability and validity of self-reported drug use have previously been found to be good (30, 31).

The study did not include all the known health risks mentioned in the introduction because the interview was scheduled to take 15 to 20 minutes to increase respondents' abilities to participate. We think the list comprises many important health risks.

Although not chosen by randomised methods, the sample was recruited at sites that represented the diversity of the local services available to high-risk drug users in Norway. Both public and non-governmental services were represented. All findings must be interpreted in the context of a convenience

sample, similar to the majority of previous studies of high-risk drug users. Caution should be exercised when generalising these findings to the general high-risk population.

The ecological study design was not optimal for drawing a conclusion about the effectiveness of harm reduction and treatment measures in the Norwegian setting from 2010 to 2019. A better design would be a broad cohort study with individual longitudinal follow-up information on drug-induced deaths and infectious diseases, use of harm reduction measures and low-threshold services in the three municipalities, as well as enrolment in OST and other specialised drug treatment. Such studies need resources over a long period; however, resources were not available. In addition, loss of follow-up may be high in such studies.

## 4.8 Future research needs

The data in our study were collected from 2010 to 2012. A new, similar and more recent quantitative study with the same variables is necessary. A study from 2017 has not published comparable findings, yet gives information on the general situation of illicit substance use and injecting in Norway (20). A qualitative study, especially among young high-risk drug users, is most wanted to understand why prevention measures do not work and how harm reduction measures and treatment can be tailored to meet their needs. In addition, new studies should be carried out to find groups at risk for drug-induced deaths, groups with needs that are not met by the established prevention and harm reduction measures.

## Conclusion

Harm reduction measures in Norway since 2010 have been targeted to reduce the high level of injecting practices found in this survey from 2010 to 2012. Regardless of this, the drug-induced deaths did not decline from 2010 to 2018. HIV among PWID at the population level declined from 2010 to 2019, while Hepatitis B did not. Further tailoring of risk reduction measures for all vulnerable groups is necessary.

## Abbreviations

AIC

Akaike Information Criterion

BIC

Bayesian Information Criterion

HIV

Human immunodeficiency virus

HRDU

High-risk drug users

LPA

Latent profile analysis

OST

Opioid substitution treatment

PWID

People who inject drugs  
SDS  
Severity of Dependence Scale

## Declarations

Ethical approval and consent to participate: The Norwegian Social Science Data Services approved that informed consent was not necessary since the dataset was anonymous (32). The questionnaire had to include the information that participation was voluntary, that the interviewee could refuse to answer individual questions and that the survey was anonymous. The National Committee for Research Ethics in the Social Sciences and the Humanities (NESH) approved the project (33).

Consent for publication: Not applicable

Availability of data and materials: On reasonable request to the corresponding author. The questionnaire is included as supplementary material.

Competing interest: The authors declare that there are no competing interests.

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Authors' contributions: EJA organised the data collection, did the final statistical analysis, edited and supplemented the final manuscript. AM did the first statistical analysis and wrote the first version of the manuscript. ML and BOE commented on all versions of the manuscript. AM, ML and BOE read and approved the final manuscript.

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- [QuestionnaireEnglishversion.docx](#)