Ambulance-attended opioid overdoses: an examination into overdose locations and the role of a safe injection facility

ABSTRACT

Background: Although the United States and numerous other countries are amidst an opioid overdose crisis, access to safe injection facilities remains limited.

Methods: We used prospective data from ambulance journals in Oslo, Norway to describe the patterns, severity, and outcomes of opioid overdoses, and compared these characteristics among various overdose locations. We also examined what role a safe injection facility may have had on these overdoses.

Results: Based on 48,825 ambulance calls, 1054 were for opioid overdoses from 465 individuals during 2014 and 2015. The rate of calls for overdoses was 1 out of 48 of the total ambulance calls. Males made up the majority of the sample (n=368, 79%) and the median age was 35 (range 18-96). Overdoses occurred in public locations (n=530, 50.3%), the safe injection facility (n=353, 33.5%), in private homes (n=83, 7.9%), and other locations (n=88, 8.3%). Patients from the safe injection facility and private homes had similarly severe initial clinical symptoms (Glasgow Coma Scale median =3 and respiratory frequency median=4 breaths per minute) when compared to other locations, yet the majority from the safe injection facility did not require further ambulance transport to the hospital (n=302, 85.6%). Those that overdosed in public locations (OR=1.66, 95% CI= 1.17-2.35), and when the facility was closed (OR=1.4, 95% CI= 1.04-1.89), were more likely to receive transport for further treatment.

Conclusions: Our findings suggest that the opening hours at the safe injection facility and the overdose location may impact the likelihood of ambulance transport for further treatment.

Key words: Safe injection facility, opioid overdoses, overdose, pre-hospital treatment, ambulance, supervised injection facility

INTRODUCTION

Globally there were over 100,000 opioid overdose deaths in 2014 [1], with approximately half of these occurring in the United States [2]. Since 2000, the United States has experienced a 200% increase in the rate of opioid overdose deaths [2], including those related to pharmaceutical opioids [3, 4]. In Norway, nonfatal opioid overdoses are common [5], and overdose mortality rates are among the highest in Europe [6]. While people who use opioids in Norway are a heterogeneous group, the majority use heroin [7]. Further, injection is the primary mode of administration for opioid use [8]. The former United States Surgeon General has called for action to address addiction in America, citing that the tools needed are available [9, 10]. While the United States has embraced some treatment and harm reduction practices, such as increased access to opioid maintenance treatment, needle exchange programs, and bystander-administered naloxone [11], supervised injection facilities (SIF) do not currently exist in the United States.

Supervised injection facilities, or safer injection facilities emerged in the 1980s in Europe as an environment where people who inject drugs (PWID) could ingest illicit drugs, access hygienic equipment, learn safe injecting techniques, and be monitored by staff who are trained to intervene in the event of an overdose [12]. Consistent evidence supports the positive role SIFs have on improving various conditions for PWID [13, 14]. Specifically, SIF have been found to reduce overdose mortality [15], attract high-risk PWID [16], decrease syringe sharing [17], decrease public injecting [18], improve engagement in treatment programs [19, 20], with no increase in criminal activity or drug trafficking in the areas surrounding the SIF [14] or risky behavior [21]. Safe injection facilities have also been found to reduce the demand on ambulance services [22]. However, despite the mounting evidence supporting SIF, opposition [23] and uncertainty over the legality [24] result in limited SIF access throughout most of the world.

While it has been argued that location matters in regards to overdosing [25, 26], few have investigated the pre-hospital characteristics of those overdosing within a safe injection facility. An examination of these patients compared with those who overdosed in other types of locations can be useful in further establishing the relative benefits of overdosing in a staffed location. Given that many who have died of an overdose had been in contact with ambulance services in the year before they died [27], the use of ambulance data can be an important tool for exploring overdose events. Our aims were to use ambulance data as a proxy source to describe the demographic, clinical, and temporal characteristics of opioid overdoses. Using these findings, we aimed to examine what role location (including the SIF) may have on the outcome of ambulance-attended overdoses.

METHODS

Case Finding

We prospectively identified patients that had been treated with naloxone for a suspected opioid overdose by Oslo Emergency Medical Services (EMS) from January 1, 2014 to December 31, 2015. Out of the five ambulance stations in the city, the Oslo City Center station uses 80% of the total naloxone used in the service, and was therefore the focus for participant recruitment.

Ambulance charts were included if the patient was over the age of 18 and had been administered naloxone by either a bystander or EMS staff. All patients who fit this criteria were given an information sheet by EMS staff after receiving standard treatment. The sheet included information about their voluntary participation, and participants could opt out of the study at any time. We identified 1055 cases to include; however one person withdrew the chart from the study. There was no compensation given for participation in the study.

Ambulance protocol for a suspected opioid overdose (reduced consciousness, miosis, and reduced respiration) includes assisting ventilation and the administration of naloxone. The ambulance staff use 1-mL ampules of 0.4mg/mL naloxone for intramuscular or intravenous use. Patients in cardiac arrest, even if opioid overdose is the suspected cause should not receive naloxone [28]. This means that fatal opioid overdoses in Oslo are not included in our material. The disposition of a patient was based on the clinical impression and judgement of the EMS staff.

The Oslo EMS operate with a paper-based chart system. Patient charts where naloxone was administered and the patient had been informed about the study were set aside by EMS staff and then entered into a database by a study assistant. The data collector received study- specific training, and data was extracted manually using pre-defined criteria. Missing data was not imputed. Ambiguous data was discussed and decided between study assistant and research team. No interrater reliability assessment was performed. The electronic data management system used was VieDoc version 4 ™ (PCG Solutions, Uppsala, Sweden). This system has a complete audit trail. Risk-based monitoring and source data verification of key variables was conducted by the study team prior to analysis.

Safe Injection Facility in Oslo

A safe injection facility was opened in 2005 in Oslo, and operates in close proximity to the Oslo Accident and Emergency Outpatient Clinic. The facility has spots for injecting and smoking is not permitted. Clients have access to hygienic equipment and referrals for primary health care services which exist in the same building. They are open seven days a week, from 9:00-21:30 Monday thru Friday and from 12:00-16:00 on Saturday and Sunday. The facility is staffed with people from various educational backgrounds who are all trained to recognize and respond to an overdose, however a nurse is always on duty.

According to the SIF, the majority of their clients are male (approximately 75%) and in their late 30's. During the two-year study period, there were over 70,000 injections that took place at the SIF with 603 reported overdoses (less than 1% of the injections that took place at the facility). Although the SIF distributes naloxone for bystander administration[29], they do not administer it in the event of an overdose. Protocol within the SIF for an overdose is to call the ambulance and begin with bag-mask ventilation. The facility offers monitoring of overdose victims if they do not wish to be transported for further care at the hospital and offers post-overdose counseling.

Measures

The Oslo EMS routinely record various data from patients. From the patient records we extracted: demographic variables (date of birth, sex), overdose data (time and location), initial clinical data (Glasgow Coma Scale (GCS), pupil size, and respiratory rate), and subsequent disposition. The Glasgow Coma Scale is scored between 3 and 15, and includes an assessment of eye, verbal, and motor response. Although the GCS was developed for evaluation of head injury patients, it is widely accepted for evaluating consciousness in general [30]. The patient is scored a 3 if totally unresponsive, a 4 to 8 if they respond to pain, a 9 to 14 if they respond to voice, and a 15 for full responsiveness.

The location of the overdose was coded as eight distinct variables: public outdoor places (e.g. parks), public places indoor (e.g. public restrooms or indoor parking garages), the SIF, overnight shelters, medical facilities, private homes, and unknown. Disposition following ambulance care was categorized as transported to further medical treatment or not transferred.

Data Analyses

Descriptive statistics are presented for the main variables. Medians were reported for data that was not normally distributed. Chi-square tests were used to compare frequencies, and Fisher's Exact Test was reported when expected cell frequencies were less than five. The Mann Whitney U-test was used to compare each overdose location. Kruskal-Wallis tests were used to compare continuous variables (Glasgow Coma Scale scores, respiratory rates, age, and time of the overdose) among each of the various locations. Due to the low number of cases for some of the categories, the location variable was consolidated into four categories for most analyses (SIF, public locations, private homes, and other (overnight shelters, medical facilities, and unknown locations)). A logistic regression analysis was done to explore predictors for being transported for further medical treatment. Overdoses that occurred in the SIF were removed from the logistic regression model so to not violate independence. Variables with a p-value of <0.1 were included in the adjusted model. A p-value of less than 5% was considered significant. Statistical analysis was preformed using SPSS software version 22.

Ethics

This study received approval from the Regional Committees for Medical and Health Research Ethics (REC 2014/140). All data was de-identified before analysis. Patients were treated according to standard ambulance protocols. Participation was voluntary and patients were able to withdraw from the study at any time. The study is in accordance with the Declaration of Helsinki.

RESULTS

Demographic data

Based on 48,825 EMS dispatches from January 1, 2014 to December 31, 2015 we identified 1054 cases of opioid overdoses from 465 individuals (Table 1). Of the station's total dispatches in 2014 and 2015, 2.2% (n=508) and 2.1% (n=546) were overdoses registered for inclusion respectively. Males made up the majority of the sample (n=368, 79.1%) and the median age was 35 (range 18-96). For all of the overdose cases, one half occurred in public locations (n=530, 50.3%), one third in the SIF (n=353, 33.5%), and the remaining occurred in private homes (n=83, 7.9%) and other locations (n=88, 8.3%) (Table 1).

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The age and sex of the patients from each location is displayed in Table 1. There was a difference in the patient's age for the various overdose locations, with patients picked up from the SIF being older (median age 41, $p<0.001$) and those picked up in public locations being younger (median age 33, $p<0.001$) when compared to the other groups together. There was not a difference in sex between the various locations ($p=0.31$), with most of the sites displaying approximately an 80%-20% male to female distribution.

Clinical characteristics

The initial clinical characteristics observed by EMS staff showed that patients from the SIF generally had the most severe overdose symptoms (Table 1). Approximately half of the patients (n=493, 46.8%) had the lowest possible score (GCS= 3) upon EMS arrival. Patients had lower GCS scores when found in the SIF (GCS median 3, $p=0.046$) and in private homes (GCS median 3, $p=0.001$) (Table 1).

There was a difference in the initial respiratory rate for the patients among the various locations ($p<0.001$). The lowest respiratory rates were found in the SIF (median=4 breaths per minute). Higher rates were seen when the victim was found in public locations (median=8 breaths per minute, $p<0.001$) or in other locations (median=10 breaths per minute, $p<0.001$). The majority of the patients had small pupils upon initial assessment (n=894, 84.8%). There was a difference in pupil size for patients from the SIF ($p=0.04$), with these patients having the highest percent of small pupils (n=305, 86.4%).

Patient disposition

The majority of patients did not receive additional care following EMS treatment (n=643, 61%) (Table 1). However, there were significantly more patients who did not receive additional care when they overdosed at the SIF ($p<0.001$). For patients that overdosed at the SIF, the majority required no further transport (n=302, 85.6%), whereas over half of the patients were taken for further treatment from public locations (n=278, 52.5%) (Table 1).

Temporal patterns

Collectively, overdoses occurred most frequently on Tuesdays (n=183, 17.4%) and least frequently on Sundays (n=109, 10.4%) (Table 2). Among the various locations, the only significant difference in ambulance call-outs was seen on Saturday at the SIF ($p<0.001$). The SIF had one of their lowest rates for the week on Saturday (n=32, 21.8%) whereas public locations (n=88, 59.9%) had among their highest for the week (Table 2).

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A seasonal peak was observed in the summer, yet at this time the SIF had their lowest rates of the year, and public locations had their highest. The most overdoses occurred during the summer and vacation months of June (n=144, 13.7 %) and July (n=148, 14.1%, and the least in March (n=59, 5.6%). This peak was particularly pronounced for overdoses that occurred in public locations in June, accounting for 64% of the total overdoses that month. Private homes did not experience a significant monthly difference (p=0.63). Overdoses generally followed sleep-wake patterns, with the highest frequency occurring in the afternoon between 14:00-17.00.

For overdoses that occurred in the city during SIF opening hours (n=720), nearly half (n=346, 48.1% were at the SIF. In an adjusted model predicting factors associated with receiving further medical treatment, overdosing when the SIF was closed, and in public locations was significant (Table 3). Patients had a 40% increased odds of receiving transport when the SIF was closed (OR=1.40, 95% CI= 1.04-1.89) (Table 3). Those that overdosed in a public location were also more likely to receive transport when compared to private homes (OR=1.66, 95% CI= 1.17, 2.35) (Table 3).

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DISCUSSION

This study found that one third of the total opioid overdoses attended by EMS occurred at the safe injection facility. This was particularly pronounced during SIF opening hours, with half of the overdoses occurring there while they were open. The clinical characteristics showed that patients from the SIF had more severe overdose symptoms upon ambulance arrival, yet they were more likely to be left at the scene. The SIF opening hours may have impacted the likelihood of receiving ambulance transport, with a 40% increased odds of transport when the facility was closed.

The dangers of overdosing in public locations are well known. Public injectors face an increased risk of nonfatal overdoses [31, 32], increased morbidity [33], and an increased likelihood to participate in risky injecting and sexual behavior [34]. Similar to a study in Sydney that found a decline in ambulance overdose call-outs during SIF opening hours [22], our study found a reduction in overdoses in public locations during SIF opening hours. Further, those that overdosed in public locations were more likely to receive ambulance transport as opposed to being stable with pre-hospital discharge.

The increase in overdoses in public locations observed during the summer months may be a result of the Norwegian climate and the likelihood to use drugs outdoors during the mild summers, and indoors during the extreme winters. The summer months may also experience drug tourism, where nonresidents come into the city to use drugs, but have less contact with preventative services and overdose in public places [7]. Regular staff from these facilities may also be on vacation, with temporary staff as replacement. While these seasonal accounts may contribute to the temporal variation observed, it may also be due to access during SIF opening hours.

We found that patients from the SIF had more severe initial clinical symptoms (GCS score and respiratory rate) when compared to other locations. This may be explained by the trained facility staffs' ability to monitor the overdose prior to calling the ambulance, thus raising the threshold for calling. Staff from SIF are trained to recognize the signs of an overdose [35] which may result in delaying calling until they determine that the situation is critical. This may also be due to risk compensation, wherein SIF clients take a riskier dose, knowing that they will be rescued by staff in the event of an overdose.

Although many of the overdoses happened at the SIF, the majority of these patients were not transferred for further treatment. This indicates that they were assessed to be stable following ambulance treatment, as it would be against ambulance protocol to leave an unstable patient. Similar to a previous ambulance study in Oslo, a high proportion of those treated for an opioid overdose did not receive further transport for additional treatment [36]. While pre-hospital treatment of overdoses appears to be safe for opioid overdose patients, with no effect on short-term mortality [36-38], it also gives an indication of the stability of the patient. Safe injection facilities do not appear to encourage high risk behavior [39], and the SIF in this study appears to have a role in the ambulance assessment on transport. Only 15% from the SIF were transported onwards, and more patients received ambulance transport when the SIF was closed. More research is needed to explore the possible collaborative nature between the SIF and ambulance services in post-overdose management.

The ambulance data from this study display some notable differences in patient characteristics among various ambulance pick-up locations. Similar to other SIF worldwide, the SIF in Oslo has never experienced a fatality [14], thus supporting the relative safety of overdosing in these locations. Others have described the educational role of SIF staff [40], but this study adds to the possible potential for trained staff to monitor patients immediately after the overdose, as well as an opportunity to connect them with services in the future (since many were not transported from their facility). This study also illustrates that when the SIF is closed, other resources, such as emergency transport and the hospital, were used more frequently. This may point towards potential societal cost savings from SIF.

Limitations

This study relied on ambulance paper charts from one of the five ambulance centers in Oslo, and therefore did not capture all overdoses attended by ambulance services in the city. However, the use of the City Centre location captured a majority of the opioid overdose events, given the naloxone ordering pattern. By using data that is routinely recorded by EMS staff, the data is subject to missing or incomplete record keeping, however no systematic missing patterns are suspected. Additionally, by relying on EMS staff to put aside charts after treating an overdose, the study is subject to missing some cases that could have been included in the study. Lastly, by exploring only non-fatal events we did not capture circumstances surrounding the more severe, deadly overdoses. However, despite the limitations, the data provided remains to be a reliable prevalence estimate, although likely a conservative estimate. We consider the observed associations between location and overdose patterns as reliable due to a sizable study population included.

Conclusion

Many countries are facing an opioid overdose epidemic. The circumstances leading to an overdose are complex, and require the application of evidence-based approaches to respond to the current crisis. The findings from this study acknowledge the legitimate role that safe injection facilities have, not only in providing a safer place to use drugs, but their potential in observing and monitoring patients prior to and following an overdose.

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