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Pilot survey of prescription opioid use patterns and engagement with harm-reduction strategies in emergency department patients

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ABSTRACT

Background: The United States is experiencing an opioid epidemic. The aim of this pilot study was to describe patterns of prescription opioid medication (POM) use, examine factors associated with opioid misuse and overdose, and assess knowledge of take-home naloxone, and other harm-reduction strategies as well as participation in medications for opioid use disorder (MOUD) among emergency department (ED) patients that have been prescribed opioid medications.
Methods: This was a pilot survey of a convenience sample of adult ED patients with a past opioid prescription at one urban tertiary care hospital. The survey asked participants about patterns of opioid consumption, risk factors associated with opioid misuse, and knowledge of harm-reduction strategies. The survey tool consisted of mixed open- and closed-ended questions. Reported daily POM consumption was converted to milligram morphine equivalents (MME). Responses to survey questions were compared with daily MME in order to generate hypotheses for future research.
Results: 50 individuals completed a survey. Of these, 56% reported taking opioids daily, and 24% reported greater than 100 MME daily opioid consumption. Many subjects reported history of psychiatric illness (34%) and previous substance abuse treatment (24%). The majority of patients (66%) were not aware of take-home naloxone programs to treat opioid overdose.
Conclusions: In this pilot survey of ED patients with a pain-related chief complaint, many respondents reported risk factors for opioid misuse, and the majority of participants were unaware of the existence of important harm-reduction strategies, such as take-home naloxone programs, even among those with the highest daily POM use.

1. Introduction

The United States is experiencing an opioid epidemic, fueled in part by prescription opioid medications (POM).[1] The development and growth of the epidemic of opioid overdose in the United States (US) has been persuasively linked to increases in opioid prescribing by healthcare providers, among other factors.[1] All opioid analgesics in the US require a prescription. Starting in the 1990s and continuing through 2010, POM sales, opioid-related substance abuse treatment admissions, and opioid-related deaths increased dramatically in parallel, as an extraordinary number of Americans were exposed to POM.[2,3] Even after attempts in recent years to regulate and decrease opioid prescribing, the numbers of POM prescribed still remain much higher than in the 1990s.[3] In 2019, 3.7% of United States household residents over the age of 12 misused a POM in the past year.[4] There were nearly 500,000 opioid-related Emergency Department (ED) visits in 2011 with medical emergencies due to nonmedical use of pharmaceutical opiates increasing 183% from 2004 to 2011.[5] ED visits related to opioid overdose subsequently increased by 34.5% between 2016 and 2017.[6] Drug overdoses are a leading cause of injury-related fatality in the country, and have contributed to a decrease in the life expectancy for Americans for two years in a row.[7] The CDC reported nearly 50,000 deaths due to opioid overdose in 2019[8] with POMs implicated in over 14,000 of these deaths.[9] Some research suggests that the majority of people that die from a POM overdose obtained the opioid medication from a healthcare provider.[10] The ED in the US sometimes is the sole location for primary care for patients with low socioeconomic status and thus ED prescriptions for opioids may contribute substantially to POM misuse and overdose. ED patients in the US are typically prescribed opioids for acute pain/injury but given that the ED serves as the sole source of primary care for some patients, some patients may receive opioid prescriptions in the ED for chronic pain or to refill an existing prescription.

1.1. Objective

The objective of this pilot study was to (1) describe the POM use patterns and engagement with harm-reduction strategies among ED patients

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that have been prescribed opioid medications. This study also (2) examined factors associated with higher reported daily milligram morphine equivalent (MME), as a surrogate marker of increased risk for opioid morbidity and mortality. Higher daily POM MME has been shown to be associated with increased risk of overdose death in multiple studies.[11–13] We also (3) assessed knowledge of take-home naloxone and other harm reduction strategies and participation in medications for opioid use disorder (MOUD) among patients prescribed opioid medications. This was a pilot study conceived to inform future research related to high-risk POM use in ED patients in one hospital setting.

2. Methods

2.1. Setting and participants

This was a pilot survey conducted in the ED of an urban, tertiary-care hospital from 2015 to 2016. The survey was developed by the study investigators and informed by extensive literature review.[2,3,5,10–13] English-speaking ED patients >18 years were screened for inclusion if they had previously been prescribed an opioid medication from our institution; non-English speakers and those < 18 years were excluded. Patients not previously prescribed an opioid from our institution were excluded to ensure complete medical record accuracy. All participants provided written informed consent and were reimbursed with gift cards for participation. A certificate of confidentiality was obtained from NIH/NIDA (CC-DA-16-024) to protect sensitive information regarding drug use collected during the course of the study. The study was approved by the institutional program for protection of human subjects. Patient inclusion/exclusion criteria were confirmed by trained research associates.

2.2. Measurements

The survey collected the following information: basic demographics (age, sex), patterns of POM use (mean self-reported MME), comorbid conditions including mental health and substance abuse conditions, psychosocial context of opioid use, sources of POM and knowledge of overdose prevention strategies. The survey instrument can be viewed in Appendix 1. Subjects answered questions regarding dose and strength of typical POM use. The reported opioid medications were converted to daily self-reported MME using standard conversion tables.[14] When subjects described a range of doses, the average between the lowest and highest doses was used to represent the patient's self-reported MME. Because daily MME has been established to predict complications of POM use in a dose-dependent fashion,[11–13] we used self-reported MME as a surrogate marker for unsafe POM use. The relationship between self-reported MME and other characteristics reported on the survey was examined in order to inform factors that may be associated with high-risk POM use in ED patients for future research. The survey was verbally administered by trained research associates.

2.3. Statistical analysis

As this was a pilot study conceived to generate hypothesis for future ED-based research on patterns of POM use, no formal sample size calculation was performed. Descriptive statistics were performed. We used the Shapiro Wilk test to evaluate the normality of distribution of self-reported MME data for different survey responses and determined that the self-reported MME distribution was not normal. Therefore, in order to examine relationship between different survey responses and self-reported MME, the Mann Whitney *U* test was performed. SPSS version 24 (IBM, Armonk, NY) was used for all statistical analyses.

3. Results

3.1. Study population

50 ED patients completed surveys, of whom 60% were female and the mean age was 49 years. The majority (32/50 or 64%) of subjects were visiting the ED for a pain-related chief complaint. Mean self-reported daily opioid consumption was 145 MME. See Table 1 for a summary of the study population demographic characteristics.

3.2. Patterns of POM use

Forty-six subjects (46/50, 92%) were able to estimate the dose and type of opioids that they took on days that they take opioid medications in order to estimate self-reported MME (Fig. 1). The mean daily opioid consumption was 146 self-reported MME (SD: 307.1). Women had a mean daily opioid consumption of 138 self-reported MME, and men had a mean daily opioid consumption of 157 self-reported MME. Thirty-seven subjects (37/50, 74%) reported taking a POM prior to arrival to the ED. Nearly a quarter of those that provided estimates of their daily opioid use (11/46, 24%) reported taking >200 self-reported MME on days that they consume opioids. Twenty-eight respondents (28/50, 56%) reported taking opioids daily. Among those taking opioids daily, the mean daily opioid consumption was 215 self-reported MME, compared with 46 self-reported MME daily among respondents that did not take opioids daily. Three subjects (3/50, 6%) reported seeking emergency medical services in the past for an opioid overdose. All 50 patients reported taking POMs primarily to treat pain, and one patient additionally reported taking POMs primarily to treat or prevent withdrawal.

3.3. Comorbid illness

Chronic painful conditions were common among the subjects surveyed. Twenty-nine subjects (29/50, 58%) reported that pain interferes with their activities of daily living often or very often. Although the survey was not designed to prospectively capture the incidence of sickle cell disease, ten subjects (10/50, 20%) reported sickle cell disease as their reason for using POMs in response to open-ended questions. The mean daily opioid consumption in patients with sickle cell disease was 260 self-reported MME. Sixteen subjects also reported a history of psychiatric illness, (16/50, 32%), and daily opioid consumption in this group was reported as 117 self-reported MME.

3.4. Substance abuse history and shame/cravings associated with substance abuse

Nearly a quarter of subjects (12/50, 24%) reported a history of substance abuse treatment in the past, and these patients reported a mean

Table 1
Characteristics of subjects.

Mean Age (years)	49 (range: 22–78)
Female gender n (%)	30 (60%)
Pain-related ED visit n (%)	32 (64%)
Opioid PTA n (%)	37 (74%)
Daily Opioid Use n (%)	28 (56%)
Mean self-reported daily opioid consumption (MME)	146 (SD: 307.1)
Opioid consumption >200 self-reported MME/day n (%)	11 (24%)
Prior Mental Illness n (%)	17 (34%)
Prior Treatment for Substance Abuse n (%)	12 (24%)
Prior Drug Overdose n (%)	3 (6%)

Not all subjects answered all survey items, percentages are reported as number of subjects reporting a characteristic out of those that answered a particular survey item.
Definitions: PTA – Prior to arrival (within 24 h of time to ED arrival)

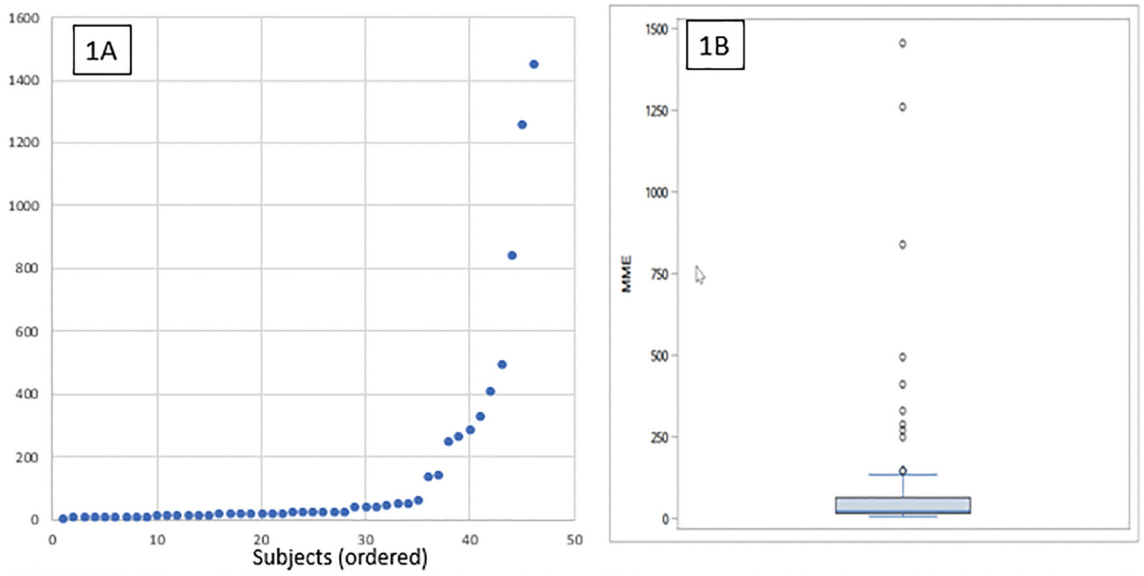

Fig. 1. a. Self-Reported Daily Opioid Consumption in Milligram Morphine Equivalents (MME). Fig. 1a Legend: X-axis: subjects, ordered from lowest to highest self-reported MME. Y-axis: MME. Fig. 1b. Self-Reported Daily Opioid Consumption in Milligram Morphine Equivalents (MME) – Box and Whisker Plot. Fig. 1b Legend: X-axis: Study Subjects, Y-axis: MME. Box denotes data interquartile range, whiskers denote minimum and maximum and open circles denote outlying data points.

daily opioid consumption of 256 self-reported MME. Eight subjects (8/50, 16%) reported smoking tobacco, and mean daily opioid consumption of smokers was 328.13 self-reported MME, compared with 107.02 self-reported MME in nonsmokers. Nine subjects (9/50, 18%) reported that they felt shame at times related to their opioid use, and daily opioid consumption among these respondents was 259 self-reported MME. Forty-five subjects (45/50, 90%) denied ever feeling a craving for opioid medications.

3.5. Sources of POM

Four subjects (4/50, 8%) reported receiving POMs from more than 2 providers in the past 6 months and mean reported daily opioid consumption in these patients was 31 self-reported MME. Eight subjects (8/50, 16%) reported receiving a prescription for POMs from an emergency physician within the past month, and reported mean daily opioid consumption in these respondents was 23 self-reported MME.

3.6. Harm-reduction strategies

Thirty-three (33/50, 66%) respondents were not aware of the take-home naloxone programs to treat opioid overdose. Of the 9 subjects taking >200 self-reported MME daily, only 3 patients were aware of take-home naloxone programs. Thirty-one subjects (31/50, 62%) were aware of prescription drug monitoring programs (PDMP) to track controlled substance prescriptions. One patient reported being engaged in MOUD with methadone, none reported being engaged in MOUD with buprenorphine.

3.7. Factors associated with higher opioid consumption

Exploratory analysis was performed to examine if characteristics identified in survey questions were related to differences in daily opioid consumption in self-reported MME. An ED visit for a pain-related complaint was associated with a higher daily opioid consumption in self-reported MME compared to a non-pain-related ED visit (166 vs 11, $p = 0.003$). Opioid consumption prior to arrival at the ED was associated with a higher daily self-reported MME (215 vs 48, $p = 0.011$). Among those taking opioids daily, the mean daily opioid consumption was 215 self-reported MME, compared with 46 self-reported MME daily among respondents that did not take opioids daily ($p = 0.036$). Cigarette smokers reported a mean daily opioid consumption of 328 self-reported MME, compared to 107 self-reported MME in non-smokers ($p = 0.038$). For a summary of this exploratory analysis, see Table 2. The question responses that were associated with the highest self-reported MME were a positive history of drug or alcohol use in the past 24 h, smoking cigarettes and a history of sickle cell disease.

4. Discussion

The results from this single-center pilot survey of ED patients with prior opioid prescriptions suggests daily POM use patterns in the majority (>50%), substantial comorbid illness, and overall poor knowledge

Table 2
Relationship between subject characteristics and reported opioid consumption.

Comparison Group	Sample size (n)	Mean MME	*P*-value
Male vs. female			0.092
Male	18	138	
Female	27	165	
Pain-related visits vs. non-pain related visits			0.003
Pain-related visit	17	111	
Not pain-related visit	29	166	
Opioid use prior to arrival vs. no opioid use			0.011
Opioid use prior to arrival	36	181	
No opioid use prior to arrival	10	16	
Daily opioid use vs. non-daily use			0.036
Daily opioid use	27	215	
Less than daily frequency of opioid use	18	48	
History of psychiatric illness vs. not			0.853
History of psychiatric illness	16	116	
No history of psychiatric illness	33	160	
Cigarette smoking vs not			0.038
Reports current cigarette smoking	8	328	
Denies current cigarette smoking	38	107	
History of substance use disorder vs. not			0.543
History of treatment for substance use disorder	11	256	
No history of treatment for substance use disorder	34	71	

Significance of differences between mean self-reported MME values in different comparison groups ($\alpha = 0.05$). 46/50 subjects were able to estimate their daily opioid consumption; these analyses include only those that estimated daily opioid consumptions.

(~two-thirds of respondents) of harm-reduction strategies especially among those at highest risk by virtue of self-reported MME daily use. These results suggest vast opportunity for more cautious opioid prescribing among ED patients. They also suggest that more patient-level education is needed to increase knowledge of harm-reduction strategies in at-risk patients.

4.1. Risk factors for complications of POM exposure

Exposure to POMs is associated with a variety of complications, including but not limited to nonmedical use or abuse, development of opioid use disorder (OUD), opioid overdose, and death. Long-term administration of opioids has been associated with clinically meaningful risk for the development of abuse or addiction.[15] Among patients suffering with chronic pain and receiving POMs, an estimated 21 to 29% misuse POMs.[16] A variety of patient-related and prescriber-related factors have been identified as risk factors for opioid-related complications. Co-morbid psychiatric illnesses are common among patients with OUD and chronic pain,[17,18] and are associated with persistent illicit opioid abuse among those receiving treatment for OUD.[19] Co-morbid substance use disorders are associated with increased risk for abusing POMs.[20] Ongoing cocaine use is associated with decreased retention in methadone maintenance treatment[21] while tobacco use has been associated with higher POM doses among patients with chronic pain,[22] as well as increased risk of death from POMs.[10] Treatment of pain with daily doses of 100 mg morphine equivalent (MME) or greater have been associated with increased risk of overdose death when compared to lower daily doses among patients with a variety of diagnoses, including acute pain, chronic pain, cancer-related pain and substance use disorders.[11] Daily opioid consumption of greater than 200 MME has been associated with a 3-fold increase in opioid-related mortality in patients with chronic nonmalignant pain.[12]

The results from this survey remind us that many of the patients prescribed POM at ED discharge go on to use them daily, as most of the ED patients surveyed here that had previously received POM from our institution reported daily use (56%). Furthermore, 24% reported high daily opioid consumption greater than 100 MME, suggesting increased risk for overdose death.

Of patients surveyed, 74% reported taking a POM prior to their arrival to the ED, which may have implications for risk of administered opioid medications in the ED. Prior treatment for substance use disorders, and ongoing substance use, particularly tobacco, were common in this sample and associated with higher daily self-reported MME, in line with previous research.[23] This research suggests that ED patients that have previously been prescribed POM may have a variety of markers to suggest they are high risk for adverse events associated with opioid use and may be an important target for harm-reduction measures. Future research centered on validation of the use of these risk factors to screen for opioid use prior to prescribing opioids from the ED may fill a critical gap in care as current ED based screening tools for OUD are limited in validity and reliability.[24]

4.2. Harm-reduction strategies

A variety of harm-reduction strategies have been proposed to respond to the opioid epidemic, including medications for opioid use disorder (MOUD) and take-home naloxone. MOUD is a harm-reduction strategy that decreases risk of death in patients with OUD.[25–28] The initiation of MOUD, specifically buprenorphine, in the ED has been described as a means to engage the ED population with OUD in long-term treatment.[29,30] However, the role of MOUD in patients with POM misuse and overdose is not clear, as it has been more often studied in individuals with heroin or other illicit opioid use. Additionally, a variety of barriers (financial, regulatory, geographic, attitudinal, logistic)[31] limit the capacity of the US healthcare system to offer MOUD services to meet the immense needs of the population. Thus, unfortunately many patients with OUD are unable to access MOUD services that could significantly reduce their risk of mortality.[32]

Naloxone has been embraced as an overdose prevention strategy; however, the focus has traditionally been on individuals with illicit opioid use, rather than patients that have been prescribed high doses of POMs. Although research suggests that the most at-risk opioid users would accept take-home naloxone from the ED,[33] the majority of EDs do not prescribe naloxone to patients with unsafe POM use, despite CDC guidelines in the United States recommending routine co-prescription of Naloxone to patients receiving greater than 50 MME per day.[34,35] Even among those that have received naloxone, most rarely or never carry it.[36] Analysis of opioid-related deaths suggests that although bystanders were present in 44% of cases, naloxone was administered in only 4% of illicit opioid deaths and 0.8% of POM deaths.[37]

Although the ED patients surveyed in this study had a variety of characteristics to suggest they could be at high risk for complication of POM use, engagement with harm reductions strategies was low. One patient reported current use of MOUD with methadone, none reported buprenorphine use, and the majority (66%) were not even aware of the existence of take-home naloxone to treat out-of-hospital overdoses.

4.3. Clinical implications and future directions

By describing patterns of POM use and suspected risk factors in patients that have overdosed on POM, this research lays the foundation for future research identifying and validating predictive factors for opioid overdose, which may ultimately be used to identify those that may benefit from intervention. Clinicians may consider alternative prescriptions or more proactive referral to harm-reduction services for patients with these identified POM risk factors. Further, these identified risk factors may lay the foundation for the design and application of screening tools to identify patients who are at risk for POM misuse and overdose. Future research may examine how well self-reported MME, as used in this study, correlates with other methods of describing MME, such as pharmacy data, and establish which is more accurate in predicting important outcomes such as overdose or mortality. Additionally, future research should examine the role of harm-reduction strategies in individuals with unsafe POM use. Future studies should also examine knowledge and use of other harm-reduction strategies beyond those examined in the present study, including diversion-resistant drug formulations and limitation of number of doses of POM that can be accessed by a patient at one time.

5. Limitations

There are several important limitations of this pilot study that require some consideration. The small sample size and single-site design may limit generalizability of study findings. We did not obtain data on patient ethnicity and due to the pilot nature of the study, we did not collect information on patients approached, screened and excluded. The daily average self-reported MME in our study population was very high which may be due to the patient population seen at the study hospital and may not be generalizable to all hospitals. This pilot proposed to survey individuals that have presented to the ED with prior opioid prescriptions in order to better understand this at-risk population. However, the context during which these surveys occurred (i.e., generally not during an emergency visit for opioid overdose) may have skewed the results towards more favorable patient attitudes, which may misrepresent the attitudes of opioid-related ED visits in general. Additionally, given that MME was estimated based on patient self-report, there is a potential that the reported data was inaccurate due to lower patient health literacy, stigma or other factors.

6. Conclusions

In this pilot survey of ED patients with a prior opioid prescription, many respondents reported risk factors for opioid misuse and overdose, and the majority of participants were unaware of the existence of important harm-reduction strategies, such as take-home naloxone programs, even among those with the highest daily POM use. This research further

characterizes a population of ED patients with prior opioid prescriptions in terms of expected risk factors, prevalence of various risk factors, and knowledge of harm-reduction strategies. This work will help to design future study of OUD screening tools to assess the risk of POM overdose and misuse.

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Presentations

Preliminary findings presented as a poster at the American College of Medical Toxicology Annual Scientific Meeting, in Clearwater Beach, FL, in March 2015, and at the North American Congress of Clinical Toxicology, in Boston, MA in September 2016.

Conflicts of Interest

The authors report no commercial conflicts of interest.

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Authors contributions

AM and LF obtained funding for the study, AM and LF designed the study, SS and LF drafted the manuscript, all authors edited the manuscript, LF and CR analyzed the data, AHB and AM oversaw data collection and AM takes overall responsibility for the paper. All authors approved the final version of the manuscript.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rcsop.2021.100062.

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