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BRIEF REPORT

Opioid use patterns and risk characteristics among injured patients

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ABSTRACT

Background: Injured patients are at risk for prolonged opioid use after discharge from care. Limited evidence exists regarding how continued opioid use may be related to opioid medication misuse and opioid use disorder (OUD) following injury. This pilot study characterized opioid consumption patterns, health characteristics, and substance use among patients with active prescriptions for opioid medications following injury care. *Methods:* This study was a cross-sectional screening survey combined with medical record review from February 2017 to March 2018 conducted among outpatient trauma and orthopedic surgery clinic patients. Eligible patients were 18–64 years of age, admitted/discharged for an injury or trauma-related orthopedic surgery, returning for clinic follow-up ≤6 months post hospital discharge after the index injury, prescribed opioid pain medication at discharge, and currently taking an opioid medication (from discharge or a separate prescription post discharge). Data collected included demographic, substance use, mental health, and physical health information. Descriptive and univariate statistics were calculated to characterize the population and opioid-related risks. *Results:* Seventy-one participants completed the survey (92% response). Most individuals (≥75%) who screened positive for misuse or OUD reported no nonmedical/illicit opioid use in the year before the index injury. A positive depression screen was associated with a 3.88 times increased likelihood for misuse or OUD (95% confidence interval [CI] = 1.1–13.5). Nonopioid illicit drug use (odds ratio [OR] = 1.89, 95% CI = 1.1–3.4) and opioid craving (OR = 1.29, 95% CI = 1.1–1.5) were also associated with increased likelihood for misuse or OUD. Number of emergency department visits in the 3 years previous to the index injury was associated with a 22% likelihood of being misuse or OUD positive (95% CI = 1.0–1.5). *Conclusions:* Patients with behavioral health concerns and greater emergency department utilization may have heightened risk for experiencing adverse opioid-related outcomes. Future research must further establish these findings and possibly develop protocols to identify patients at risk prior to pain management planning.

KEYWORDS
Injury; opioid misuse; opioid use disorder; pain management

Introduction

Increases in opioid-related adverse events in the United States over the past 15 years, including overdose,[1] highlight the difficult balance between the provision of adequate pain management and the mitigation of opioid-related risks.[2] Pain management is particularly salient for injury survivors. In the United States, traumatic injury is the leading cause of morbidity and mortality for people under 47 years old.[3] Patients with severe injuries, acute pain conditions,[4,5] preinjury opioid use,[6,7] and preinjury illicit drug use[4] have demonstrated prolonged opioid use after discharge. Although a growing literature suggests a link between injury and continued opioid consumption,[4–6] there is limited evidence regarding how this link may be related to opioid medication misuse and opioid use disorder (OUD) following injury. In the context of the opioid epidemic, it is critical to extend the current knowledge base regarding opioid-related risks among patients following injury care to appropriately prevent future adverse opioid-related events, including addiction and overdose.

The purpose of this pilot clinical research study was to characterize opioid consumption patterns, mental and physical health, health services utilization, and substance use characteristics that increase risk for opioid medication misuse or having OUD among patients following injury-related care. Results of this study have important implications for

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integrated behavioral health services and prevention among patients seeking postinjury care.

Methods

Study design

This study was a cross-sectional screening survey combined with medical record review from February 2017 to March 2018. This study was conducted in 2 outpatient trauma clinics and 2 outpatient orthopedic clinics affiliated with a large academic medical system in the northeastern United States. Patients were provided study information by clinic staff or research assistants during regularly scheduled appointments. Potentially eligible patients were screened by research staff for inclusion.

Inclusion/exclusion

Patients were eligible for study inclusion if they were (1) aged 18–64, (2) admitted/discharged for an injury or for trauma-related orthopedic surgery and were returning for clinic follow-up $\leq$6 months after the index injury discharge, (3) prescribed opioid pain medication at discharge, and (4) currently taking an opioid medication (from discharge or a separate prescription post discharge). Patients were excluded if they were receiving treatment for a cancer diagnosis, were pregnant, did not speak English as a primary language, or were under criminal justice supervision, or if the mechanism of injury was a standing fall (those >65 years were not included to limit the number of standing-fall injury patients screened). Interested and eligible patients were required to provide written informed consent. Participants who completed the survey received $20 compensation.

Data source and measures

The screening survey was self-administered via iPad tablet and took approximately 30 minutes to complete. Research assistants were available if participants needed assistance. Demographic questions asked about sex, age, and race. Opioid medication use, substance use, and mental/physical health were assessed with a series of brief validated self-reported instruments. The consent procedure also authorized research assistants to review and extract physical and behavioral health history from patient medical records.

Opioid and substance use

The DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*) Checklist was used to assess presence of opioid use disorder.[8] The Prescription Opioid Misuse Index was used to capture opioid medication misuse status.[9] The Opioid Craving Scale was employed to assess current level of opioid craving.[10] A modified Drug Abuse Screening Test-10[11] was used to measure nonmedical/illicit opioid use severity in the year prior to the index injury, and an unmodified Drug Abuse Screening Test-10 was used to determine nonopioid substance use severity in the year preceding the completion of the survey. The Alcohol Use Disorders Identification Test-C was used to assess presence of unhealthy drinking (e.g., frequency, amount, and binge drinking).[12,13] Illicit drug toxicology taken at index injury hospital admission was obtained from medical records.

Mental health

The Primary Care Post-Traumatic Stress Disorder (PTSD) screen was used to assess presence of probable PTSD related to the index injury.[14] The Hospital Anxiety and Depression Scale was used to screen for anxiety and depression status.[15]

Physical health/health services use

The Brief Pain Inventory (BPI) was used to assess current level of injury-related pain severity.[16] Mechanism of injury and discharge opioid medication daily morphine equivalent were obtained from the medical record.

Analyses

Descriptive statistics were initially employed to examine frequencies, percentages, and measures of central tendency for demographics and mental health, substance use, physical health, and health service use indicators for the total population. These factors were also grouped by positive screening results for opioid medication misuse or OUD status to examine descriptive differences. Next, we combined positive screens for misuse or OUD status in a single variable to examine univariate relationships between those who reported these behaviors and demographics, mental health, substance use, physical health, and health service use. To examine these associations, we conducted binary logistic regression analyses, with odds ratios reported. Analyses were performed in Stata version 14.2.[17]

Results

Descriptive characteristics

A total of 77 patients met inclusion criteria (Appendix 1). Six patients who completed the screening and were assessed as eligible were excluded. Two of these patients voluntarily withdrew, 1 patient was already enrolled in the study, 2 patients were later found to be ineligible, and 1 declined after consent. Therefore, a total of 71 patients were included in the final analysis (92% response), and they completed the study survey an average of 40.5 (standard deviation [SD] = 39.4) days post injury. Table 1 displays participant demographics, health status, and service utilization for the total sample and by opioid misuse and OUD status. For mental health and substance use, just over half of participants screened positive for depression (50.7%), with 80% positive for misuse and 62.5% positive for OUD also being positive for depression. Further, although just over one third of participants screened positive for anxiety (36.6%), half of those positive for misuse or OUD also screened positive for

Table 1. Demographics, health status, and service utilization by opioid misuse and opioid use disorder (OUD).

			Misuse ($n = 10$)				OUD ($n = 8$)			
	Total ($N = 71$)		Positive		Negative		Positive		Negative	
Characteristic	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Demographics										
Male	56.3	(40)	70.0	(7)	54.1	(33)	75.0	(6)	54.0	(34)
Female	43.1	(31)	30.0	(3)	45.9	(28)	25.0	(2)	46.0	(29)
Age[a]	41.1	(12.3)	38.3	(9.7)	41.5	(12.7)	40.3	(11.4)	41.2	(12.5)
White race	67.6	(48)	60.0	(6)	68.9	(42)	75.0	(6)	67.7	(42)
Days from injury to study recruitment[a]	40.5	(39.4)	47.9	(52.4)	39.3	(37.3)	40.1	(32.7)	40.5	(40.3)
Mental health										
Depression	50.7	(36)	80.0	(8)	45.9	(28)	62.5	(5)	49.2	(31)
Anxiety	36.6	(26)	50.0	(5)	34.4	(21)	50.0	(4)	34.9	(22)
Posttraumatic stress disorder	22.5	(16)	20.0	(2)	23.0	(14)	12.5	(1)	23.8	(15)
Behavioral health										
Unhealthy alcohol use	29.6	(21)	40.0	(4)	27.9	(17)	50.0	(4)	27.0	(17)
Nonopioid drug use risk severity										
Low	69.0	(49)	60.0	(6)	70.5	(43)	62.5	(5)	69.8	(44)
Moderate	16.9	(12)	10.0	(1)	18.0	(11)	0.0	(0)	19.1	(12)
High	8.5	(6)	30.0	(3)	4.9	(3)	12.5	(1)	7.9	(5)
Severe	5.6	(4)	0.0	(0)	6.6	(4)	25.0	(2)	3.7	(2)
Current opioid craving[a]	3.9	(4.8)	6.8	(5.8)	3.4	(4.5)	12.3	(5.5)	2.9	(3.6)
Physical health										
Mechanism of injury										
Assault	19.7	(14)	20.0	(2)	19.7	(12)	50.0	(4)	15.9	(10)
Nonassault	80.3	(57)	80.0	(8)	80.3	(49)	50.0	(4)	84.1	(54)
Discharge daily morphine equivalent[a]	63.5	(33.4)	58.1	(34.2)	64.3	(33.5)	65.1	(28.0)	63.2	(34.2)
Level of pain at recruitment visit[a]	5.3	(2.2)	4.7	(2.3)	5.4	(2.2)	6.0	(2.1)	5.2	(2.2)
ED[b] visits last 3 years[a]	2.0	(3.1)	3.1	(3.0)	1.9	(3.1)	5.3	(5.2)	1.6	(2.6)

[a]Mean (standard deviation).
[b]Emergency department.

anxiety. Approximately 30% of all participants reported unhealthy alcohol use, and 40% of those who were positive for misuse and 50% positive for OUD were engaged in unhealthy alcohol use. In the year before completing the assessment, high and severe nonopioid illicit drug use were prominent among those with OUD compared with those without OUD (high: positive OUD = 12.5% vs. negative OUD = 7.9%; severe: positive OUD = 25% vs. negative OUD = 3.7%). Further, a larger portion of those positive for misuse had high drug use severity (30%) compared with those without misuse (4.9%).

Transition to misuse or OUD

We also cross-tabulated the percentages of participants who screened positive for misuse or OUD by those with no nonmedical/illicit opioid use in the year prior to their injury (results not shown). Each of the 10 individuals with a positive opioid medication misuse screen reported no nonmedical/illicit opioid use in the year before the index injury. For the 8 individuals with OUD, 75% reported no nonmedical use/illicit opioid use in the year before their index injury. All participants with misuse or OUD ($n = 2$) who had positive opioid toxicology reports upon admission reported no nonmedical/illicit opioid use in the year before their injury; both of whom were administered opioids during prehospital transport.

Misuse and OUD and participant characteristics

Lastly, we examined the univariate relationships between combined misuse or OUD status and participant demographic and health characteristics (Table 2). Those with a positive screen for depression at recruitment had the highest odds for reporting misuse or OUD (odds ratio [OR] = 3.88, 95% confidence interval [CI] = 1.1–13.5), followed by those with nonopioid illicit drug use in the year preceding study recruitment (OR = 1.89, 95% CI = 1.1–3.4). In addition, participants with higher levels of reported opioid craving also had increased odds for misuse or OUD (OR = 1.29, 95% CI = 1.1–1.5). Finally, higher numbers of emergency department visits in the previous 3 years was associated with a 22% likelihood of being misuse or OUD positive (95% CI = 1.0–1.5).

Table 2. Univariate associations for misuse/opioid use disorder with demographics, health status, and service utilization.

Characteristic	OR	SE	P	95% CI
Demographics				
Male	2.89	1.8	0.10	(0.8–10.1)
Age	0.98	0.2	0.31	(0.9–1.0)
White	0.75	0.4	0.62	(0.2–2.4)
Days injury to study recruitment	1.00	0.0	0.75	(0.9–1.0)
Mental health				
Depression	3.88	2.5	0.03	(1.1–13.5)
Anxiety	2.06	1.2	0.21	(0.7–6.4)
Posttraumatic stress disorder	0.42	0.3	0.29	(0.1–2.1)
Behavioral health				
Risk alcohol use	1.60	1.0	0.43	(0.5–5.2)
Nonopioid drug use risk severity	1.89	0.6	0.03	(1.1–3.4)
Current opioid craving	1.29	0.1	0.00	(1.1–1.5)
Physical health				
Nonassault injury	0.43	0.2	0.20	(0.1–1.5)
Discharge daily morphine equivalent	1.00	0.0	0.82	(1.0–1.0)
Level of pain at recruitment visit	0.96	0.1	0.77	(0.7–1.2)
ED[a] visits last 3 years	1.22	0.1	0.03	(1.0–1.5)

[a]Emergency department.

Discussion

This paper reports the results of a patient screening survey and medical record review to assess opioid use risk among those seeking follow-up care subsequent to injury care or orthopedic surgery. Results suggest tentative findings in 2 important areas: opioid-related risks and transitions to misuse or OUD.

With respect to opioid-related risks among the study population, large proportions of patients screened positive for depression, anxiety, and PTSD, which have been linked with increased risk for opioid medication misuse or OUD.[18,19] Physical injury may activate or worsen the presence of these mental health conditions. Further, individuals with depression were overrepresented among those with misuse or OUD, and depression specifically appears to be associated with increased likelihood for patients being positive for these conditions.

Consistent with prior research,[4,18–20] nonopioid drug use also appears to be associated with patients screening positive for misuse or OUD. Further, current craving for opioids also was associated with positive misuse or OUD status. Although future research should seek to substantiate these relationships in a larger, prospective study, this evidence suggests that it may be beneficial for care teams to screen for history of and monitor behavioral health among injured patients. Such efforts could be completed using brief measures of behavioral health characteristics, such as those applied within this project, and subsequently charted/reviewed prior to development of pain management strategies. Relatedly, emergency department utilization in the 3 years previous to the index injury emerged as another valuable indicator of increased risk; this factor is accessible from patients' charts and may be used to inform the development of pain management plans preceding discharge.

Patients' transitions to opioid misuse or OUD were also an important finding from this project. Specifically, a nontrivial portion (≥75%) of patients who reported no nonmedical/illicit opioid use in the year previous to the index injury appears to have initiated misuse or developed OUD following discharge. Although it is possible that patients with misuse or OUD may recover without intervention, the absence of a specific protocol or adequate support for opioid-naïve patients who require treatment beyond the duration of injury-related care is an important gap to fill. It must be noted that we did not assess whether the newly developed misuse or OUD cases were direct results of the opioid exposure related to the index injury, and future research should seek to understand whether a causal connection exists. Irrespective of the origin of the misuse or OUD, however, close opioid monitoring is likely advisable during post-injury care.

Although the strengths of this project include robust clinical data collection and enrollment at a time proximal to the injury (average = 35.4 days), study findings should be interpreted while considering the limitations. This study was conducted within trauma and orthopedic clinics associated with a large urban academic medical center in the northeastern United States among a limited number of participants. Further establishing these findings at additional injury care clinics with a larger sample may enhance external validity. Likewise, we acknowledge the urgency of disseminating the results of this project as foundational data; however, we recognize that only summary and univariate analyses were employed herein to describe patient risk. Future studies seeking to test hypotheses and understand inferential relationships must seek to build powered multivariable models that may better capture relationships between misuse or OUD and participant characteristics and health care utilization patterns.

Conclusion

This pilot study provides necessary provisional data describing patient-level risks for opioid medication misuse or OUD among those returning for follow-up care subsequent to injury. Assessing patients at this critical time period after injury allows for identification of those at risk for opioid-related outcomes, for preventive intervention, and/or for a change in care plan. Future research must continue to establish these findings and possibly develop protocols to better monitor and protect patient health.

Author contributions

Dr. Cochran designed the study, trained research staff, analyzed data, and wrote/revised the manuscript. Dr. Pacella assisted in designing the study, training research staff, and writing/revising the manuscript. Whitney Ringwald assisted in data collection and writing/revising the manuscript. Melissa Repine, Valerie Hruschak, and Corinne Beaugard assisted in data collection/management and manuscript revision. Craig Sewall assisted in data analysis, developed the participant flow chart, and assisted in manuscript revision. Drs. Rosen, Alarcon, Tarkin, Moloney, and Corcos assisted in study design and manuscript revision.

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