


# Opioid prescribing practices in trauma patients at discharge

## An exploratory retrospective chart analysis

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### Abstract

This study examined the opioid prescribing patterns at discharge in the trauma center of a major Canadian hospital and compared them to the guidelines provided by the Illinois surgical quality improvement collaborative (ISQIC), a framework that has been recognized as being associated with reduced risk.

This was a retrospective chart review of patient data from the trauma registry between January 1, 2018, and October 31, 2019. A total of 268 discharge charts of naïve opioid patients were included in the analysis. A Morphine Milligram Equivalents per day (MME/day) was computed for each patient who was prescribed opioids and compared with standard practice guidelines.

About 75% of patients were prescribed opioids. More males (75%) than females (25%) were prescribed opioids to patients below 65 years old (91%). Best practice guidelines were followed in most cases. Only 16.6% of patients were prescribed over 50 mg MME/day, the majority (80.9%) were prescribed opioids for  $\leq 3$  days and only 1% for  $> 7$  days. Only 7.5% were prescribed extended-release opioids and none were strong like fentanyl. Patients received a multimodal approach with alternatives to opioids in 88.9% of cases and 82.9% had a plan for opioid discontinuation. However, only 23.6% received an acute pain service referral.

The majority of the prescriptions provided adhered to the best practice guidelines outlined by the ISQIC framework. These results are encouraging with respect to the feasibility of implementing opioid prescription guidelines effectively. However, routine monitoring is necessary to ensure that adherence is maintained.

**Abbreviations:** APS = acute pain services, ISS = injury severity score, MME/day = Morphine Milligram Equivalents per day, SD = standard deviation.

**Keywords:** hydromorphone, injury severity score, Morphine Milligram Equivalents per day MME/day, opioid prescription, trauma care

### 1. Introduction

Canada, similar to the United States, is facing an opioid crisis that requires an immediate address.<sup>[1]</sup> In 2019, there were 4514 hospitalizations and 3831 deaths due to apparent opioid-related poisonings per 100,000 people, a sharp increase from 3784 and 2825, respectively, in 2021.<sup>[2]</sup> Within Canada, prescriptions opioids are being increasingly used to manage chronic and acute pain and contribute to 50% of opioid-related deaths in Ontario.<sup>[3,4]</sup> This is particularly evident for patients in hospital trauma centers where they may experience their first introduction to narcotics, particularly long-acting opioids, both of which contribute to an increased risk of opioid misuse.<sup>[5]</sup> One study denoted this risk to represent about 5% of opioid-naïve patients, who became long-term users after being prescribed opioids for the first time.<sup>[6]</sup> The anticipated impact of

the COVID-19 pandemic is starting to be realized, with some studies reporting North American impacts linked to steep rises in opioid overdoses.<sup>[7,8]</sup>

Researchers continue to identify these high-risk patient characteristics and how they are linked to prescribing practices, which together can create patient vulnerabilities, to support efforts aimed at prevention.<sup>[6]</sup> Simultaneously, health care professionals are becoming increasingly aware of the patient risks linked to their opioid prescribing practices and in response, are adopting appropriate opioid prescription practices to minimize them. A few of the key high-risk characteristics linked to the greatest probability of continued opioid use include prescribing very potent opioids to naïve patients<sup>[5]</sup> and high doses of opioids in a first opioid prescription for opioid-naïve patients, which together are correlated with a larger risk of long-term opioid use.<sup>[6]</sup> With this recognized

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The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

This study received Research Ethics Board (REB) approval from both the host institution and the university (approval reference number: 2020-052). All patients' personally identifiable information was removed.

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focus, many healthcare organizations have outlined preventative practice guidelines to support better opioid prescription practices.<sup>[9]</sup> The Center for Disease Control in the USA, Health Quality Ontario in Canada, and the Illinois Surgical Quality Improvement Collaborative, have outlined standard practices for a variety of settings and circumstances which when applied have been shown to reduce risk.<sup>[10–13]</sup> However, several organizations continue to lack best practice guidelines to inform prescribing practices.<sup>[14–16]</sup> These guidelines emphasize the following: prescribing the least potent immediate-release opioid drug, in the lowest effective dose, and for a limited duration, as opioid prescriptions are very rarely indicated for acute pain lasting longer than seven days. Table 1 summarizes the guidelines of Health Quality Ontario.<sup>[12]</sup>

While best practice prescribing guidelines exist, few studies have examined how well healthcare organizations adhere to them,<sup>[12]</sup> particularly within high-risk situations. Measuring adherence is a far more sensitive indicator of the impact of these guidelines. As a first step, hospitals and other healthcare organizations need to examine whether practice guidelines are implemented accurately and completely. With that intention, the general objective of this study was to evaluate the extent to which the opioid prescription guidelines were being followed in a large urban Level 1 trauma center hospital in Canada. More specifically, the goals were to: determine the frequency, nature, and quantity of opioid drugs that were being prescribed to trauma patients at discharge by age, gender, and injury severity score, and assess whether these prescriptions aligned with the opioid best practice prescribing guidelines.

## 2. Methods

### 2.1. Data collection

A retrospective chart review was performed on the prescribing practices of opioids and other painkillers to patients discharged at a trauma center in Ontario, Canada. Patient records were extracted from the trauma registry. The trauma registry holds comprehensive patient information of each admitted trauma patient, including their injury, clinical course, and final outcome at discharge, along with age, gender, the injury severity score (ISS), date, cause of injury, length of stay, alive status, the number of surgeries, documented opioid use disorder, and discharge summary prescription. Detailed prescription information, comments, and information related to referrals were acquired from 2 other systems. The discharge charts were used to provide the discharge prescription information including the name and dosage of the medication prescribed, prescriber instructions, documentation of opioid discontinuation and multimodal therapy, whether the patient was seen by the acute pain services (APS)

**Table 1**  
Health Quality Ontario's quality standards: opioid prescribing for acute pain.<sup>[12]</sup>

- a. Percentage of sample population starting an opioid therapy for the first time.
- b. Patients prescribed an opioid drug with an initial dose greater than 50 mg morphine equivalent per day.
- c. Patients that are prescribed an opioid for 3 days or less.
- d. Patients that are prescribed an opioid for more than 7 days.
- e. Patients that are prescribed an extended-release opioid.
- f. Patients whose pain was managed without the use of opioids at discharge.
- g. Patients whose pain was managed using a multimodal approach at discharge.
- h. People that are prescribed an opioid with documentation of a plan for discontinuing the opioid.
- i. Referral to acute pain service during hospitalization.

aData adapted from Health Quality Ontario (HQO).<sup>[12]</sup>

team, and also to make sure that the patients did not have a past history or diagnosis of opioid use disorder.

### 2.2. Participants

Patients included in this study were aged 18 years and older, with all types of injuries (except head injuries, penetrating injuries, injuries of violent nature such as gun violence/bullets/pellets, stab injuries, etc), under two weeks' length of stay (LOS), no more than one surgery, alive, and registered in the trauma registry between January 1, 2018, and October 31, 2019.

Only opioid "naïve" patients were included and all patients with a significant past or present history of prescription and non-prescription opioid intake, current or past opioid use disorder, and withdrawal rehabilitation were excluded. However, patients whose pain had been managed using opioid analgesics during their course of stay at the trauma center right after the injury were included. Patient notes were read to exclude records that were not accurately coded for opioid use disorder, either because they had an opioid use disorder diagnosis, or there was not enough discharge information available. Patient information was de-identified. This study was approved by Research Ethics Board (REB) from both the host institution and the university (approval reference number: 2020-052). All patients' personally identifiable information was removed.

### 2.3. Statistical analysis

Whether patients were prescribed opioids or not and what opioid was prescribed by age and gender, drug-related variables, and hospital information were counted. Continuous variables such as age, length of hospital stays, MME per day, and the number of day of supplies for each prescription was computed as means and standard deviations (SD), and the mean differences by independent sample test and an ANOVA based on the number of categories, was performed. Data analysis was carried out using SPSS v27 (SPSS Inc, Chicago). For a comparison between groups of categorical data, the Fisher exact test was used for expected frequencies of <5, otherwise, the Chi-squared test was used. The Morphine Milligram Equivalents (MME) were calculated following the instructions provided by the Centre for Disease Control and Prevention (CDC), using the name, dosage, and frequency of the opioid drug intake provided on the prescription to arrive at the total daily dosage.<sup>[17]</sup> The MME was calculated using the formula, drug dosage × total number of pills × conversion factor. As the total number of pills was used to determine the MME, MME per day was determined by dividing this number by the number of daily supplies. Patients were categorized by ISS (out of 75) as mild (<9), moderate (9–15), and severe (over 16). The ISS provides a combined score that incorporates the effects of multiple injuries and the Abbreviated Injury Scale.<sup>[18]</sup>

Finally, these practices were compared against Health Quality Ontario's opioid prescription guidelines<sup>[12]</sup> described in Table 1. A multimodal approach was defined for this evaluation as providing more than one kind of pain medication to treat the pain and operationalized as a prescription that contained a combination of opioid and non-opioid drugs. Most discharge summaries included follow-up instructions to several outpatient clinics, such as the trauma clinic, fracture clinic, addiction clinic, etc. These were not included as a multimodal approach as they are all part of a given package of follow-up appointments provided at the hospital.

## 3. Results

### 3.1. Study participants

A total of 2603 patient discharge charts were reviewed and 282 patients met the inclusion criteria. Out of the 282

patients, 14 were excluded after data collection, as the patients were previously diagnosed with opioid use disorder or there was a lack of adequate discharge information. The 268 remaining patients were included for data analysis. The patient demographics showed the mean age was 43.3 (17.1) years old and the average length of hospital stay varied between 1 and 14 days with a mean stay of 4.3 (3.1) days. The majority were males (74.9%) between 18 and 64 years (91.0%) old. Only 9.0% were 65 or older. There were no statistically significant gender differences in age or hospital length of stay.

### 3.2. Types of opioids prescribed

Various opioids were prescribed including hydromorphone, and hydromorphone controlled release (CR) capsules (Table 2). Overall, 74.3% of the sample were prescribed an opioid. The 25.7% of the patients who were not prescribed opioids were mostly prescribed and/or advised to take over-the-counter non-opioid pain medications, such as ibuprofen or acetaminophen. Hydromorphone was the most commonly prescribed opioid (61.6% of the sample), followed by hydromorphone CR capsules (5.6%) (Table 2). The most common instructions provided by the prescribers were to take it orally every four hours on an average as needed.

The average number (SD) of opioid pills prescribed to the population was 13.5 (9.1), females 13.3 (9.2), males 14 (9.0) with a range of 4 to 60, and 10 pills were the most frequently prescribed amount. Table 3 shows the prescription of opioids at discharge by age and gender. Men (74.9%) were more frequently prescribed opioids than women (25.1%) and patients between the ages 18 to 64 years were much more frequently prescribed opioids (91.0%) than patients 65 and older (9.0%). These percentages were similar among elderly male and female patients. The relationship between the prescription of opioids at discharge by age and gender was statistically significant ( $P = .02$ ).

**Table 2**  
Number and percentage of prescriptions based on opioid names.

Opioid drug prescribed	Patients n = 268 (%)
Hydromorphone	165 (61.6)
Hydromorphone controlled release	15 (5.6)
Morphine	5 (1.9)
Oxycodone	4 (1.5)
Oxycodone IR	3 (1.1)
Percocet	3 (1.1)
Codeine Elixir	2 (0.7)
Tylenol #2	1 (0.4)
Tylenol #3	1 (0.4)
All opioids	199 (74.3)
Non-opioid pain medications	69 (25.7)

**Table 3**  
Proportion of patients that received opioids at discharge by gender and age.

	18–64 yrs n = 181	Over 65 yrs n = 18	All age n = 199
Female (n = 50)	20.6%	4.5%	25.1%
Male (n = 149)	70.4%	4.5%	74.9%
All gender (n = 199)	91.0%	9.0%	100%

\* $P$  value = .02

### 3.3. ISS and average Morphine Milligram Equivalents per day (MME/day)

The ISS stratification in comparison to the number of opioids prescribed showed that in all levels, most of the patients (67.5%) received at least one opioid drug, while 25.7% received none (Table 4). It was also found that mild (score 1–8) and moderate (score 9–15) categories had one prescription each of 3 opioid drugs. Opioid dosages increased as the ISS category increased and there was a statistically significant difference between the number of opioid drugs per prescription and ISS categories ( $P < .001$ ). Patients within the mild, moderate, and severe trauma categories received an average of 26.72 mg MME/day (SD 31.4), 34.88 mg MME/day (SD 27.3), and 35.80 mg MME/day (SD 21.7) respectively. The average MME/Day among these three ISS groups varied significantly ( $P = .04$ ). As well, the average MME/Day among males (33.58) was higher than females (25.50) and this difference was statistically significant ( $P = .04$ ). Fewer females ( $n = 72$ ) than males ( $n = 196$ ) received opioids. With mild injuries, females ( $n = 37$ ) were not only much less likely to receive opioids than men ( $n = 88$ ) with similar injuries, but their dosage was also almost half on average (17.48 mg vs 30.60 mg). This difference was also statistically significant ( $P = .03$ ). However, the differences in the average MME/Day among moderate and severe ISS groups for male and female doses were statistically insignificant.

### 3.4. Respect/follow the opioid prescription guidelines

Opioid prescriptions were compared to Health Quality Ontario's guidelines<sup>[12]</sup> described in Table 1. The extent to which these guidelines were followed is demonstrated in Table 5.

Prescriptions with opioid doses over 50 mgMME/day: Among 199 who received opioids, the prescriptions ranged from 5.88 mg MME/day to 169.09 mg MME/day, and the most common dose prescribed was 23.53 mg MME/day (63 prescriptions, 23.5%). The 2 most popular dosage ranges were between 23 and 25 mg MME/day (roughly half the recommended maximum) and between 47.1 and 50 mg MME/day (roughly the recommended maximum), which together accounted for 70% of opioid prescriptions. Prescriptions above the recommended maximum of 50 mg MME/day made up 16.6% of prescriptions (33 prescriptions), with a cluster of them at or right below 100 mg MME/day, twice the recommended maximum dosage.

Prescription duration: Most (80.9%) opioid prescriptions were prescribed for the recommended duration of less than 3 days, while only two opioid prescriptions (1%) instructed use for beyond 7 days. Variations by age and gender were small and not statistically significant.

Extended-release prescription: Only 7.5% of opioid prescriptions contained extended-release prescriptions (mostly Hydromorphone Controlled Release, as indicated above). No patients were prescribed extremely strong extended-release opioid drugs such as Fentanyl.

Multimodal care: Almost 88.9% of prescriptions were part of a multimodal care plan, with men (90.6%) slightly more likely to have one compared to women (84.0%). The most common non-opioid pain relievers prescribed or advised were acetaminophen and ibuprofen, and less commonly gabapentin, a drug that relieves nerve pain.

Documented plan for opioid discontinuation: The majority of opioid prescriptions (82.9%) contained a discontinuation plan, such as providing zero refills.

Acute Pain Service: Less than a quarter (23.6%) of patients with an opioid prescription were documented as being referred to an APS with a much lower rate for the elderly population (11.1%). There were no statistically significant gender or age differences with respect to referrals.

**Table 4**  
**Injury severity score in relation to number of opioids per prescription and average Morphine Milligram Equivalents/day.**

ISS stratification	# of opioid drugs per prescription (n = 268)				Avg mg MME/day (SD)			
	0 Opioids/Rx n (%)	1 Opioids/Rx n (%)	2 Opioids/Rx n (%)	3 Opioids/Rx n (%)	By ISS categories		By gender (n = 268)	
							Female n = 72	Male n = 196
Mild (1–8) n = 125	47 (17.5)	73 (27.2)	4 (1.5)	1 (0.4)	26.72 (31.3)	17.48	30.60*	
Moderate (9–15) n = 98	19 (7.1)	71 (26.5)	7 (2.6)	1 (0.4)	34.88 (27.3)	35.14	34.80	
Severe (≥16) n = 45	3 (1.1)	37 (13.8)	5 (1.9)	0 (0)	35.80 (21.7)	31.07	38.52	
Total n = 268	69 (25.7)	181 (67.5)	16 (6.0)	2 (0.8)	31.4 (28.7)	25.50 (24.7)	33.58** (27.7)	

ISS = injury severity score, MME/day = Morphine Milligram Equivalents per day, SD = standard deviation.

\*P = .03.

\*\*P = .04.

**Table 5**  
**Proportion of respect/follow the opioid prescription guidelines by age and gender.**

	Age		Gender		Total
	18–64 yrs (n = 181) (%)	Over 65 yrs (n = 18) (%)	Male (n = 149) (%)	Female (n = 50) (%)	Patients (n = 199) (%)
a. Percentage of sample population starting an opioid therapy for the first time.	NC	NC	NC	NC	
b. Prescriptions with opioids dose over 50 mg MME/day	32 (16.0)	1 (5.6)	26 (10.1)	7 (8.0)	33 (16.6)
c. Prescriptions provided for <3 days	145 (80.1)	16 (88.9)	124 (83.2)	37 (74.0)	161 (80.9)
d. Prescriptions provided for over 7 days	2 (1.1)	0 (0.0)	1 (0.7%)	1 (2.0)	2 (1.0)
e. Prescriptions with extended-release opioids	14 (7.7)	1 (5.6)	12 (8.1%)	3 (6.0)	15 (7.5)
g. Prescriptions showing multimodal care	161 (89.0)	16 (88.9)	135 (90.6%)	42 (84.0)	177 (88.9)
h. Prescriptions with documented plan for opioid discontinuation	149 (82.3)	16 (88.9)	127 (85.2%)	38 (76.0)	165 (82.9)
i. Patients with documented APS (acute pain services) referral	45 (24.9)	2 (11.1)	34 (22.8%)	13 (26.0)	47 (23.6)

MME/day = Morphine Milligram Equivalents per day, NC = not calculated.

## 4. Discussion

### 4.1. Dosages of opioid prescriptions

Within this trauma hospital center, 74% of the study sample had received a prescription containing one or more opioid drugs with no reported history of former opioid use. Hydromorphone (61.6%) dominated the discharge prescriptions. The analysis also primarily showed an increasing trend in the MME dose and the frequency of opioid prescriptions as the severity of the ISS score increased. Overall, prescriptions mostly adhered to the best practice guidelines recommended by Health Quality Ontario. Daoust et al<sup>[19]</sup> reported similar findings in older trauma patients in Quebec, Canada.

The guidelines advise against the use of opioid doses >50 mg MME/day and focus on the use of the lowest effective dose.<sup>[12]</sup> A little more than half (52%) of opioid prescriptions were 25 mg MME/day or below that, 28% were 50 mg MME/day or close below, and 7% were 100 mg MME/day or close below. This suggests that the 50 mg MME/day maximum is a reference for prescribing opioids, even when prescribing more than the recommended amount.<sup>[20]</sup> Wei et al<sup>[21]</sup> reported similar findings.

West et al<sup>[22]</sup> showed that older adults experienced an increased prevalence of chronic pain and were prescribed opioids more frequently compared to the young. As a result, increases in prescription opioid use, misuse, and overdose have been reported in older adults over the past decade in both the US and Canada.<sup>[22,23]</sup> Whereas, in this study, older adults were prescribed less opioids relative to their younger counterparts. 7.5% of older patients received long-acting or extended-release opioids through controlled-release capsules, and no potent forms of opioids like fentanyl were prescribed. Most patients received a multimodal treatment approach. Using a multimodal therapy to treat pain has been supported by healthcare practitioners and addiction experts for several years.<sup>[24]</sup> A meta-analysis of

trauma case studies showed that non-opioid pain medications and opioid-sharing multimodal pain medications are safer and easier for pain related to injury, particularly when there are contraindications, such as age, to be considered.<sup>[25]</sup> The majority of prescriptions had documented instructions to discontinue the prescriptions. Providing zero refills was the most commonly used approach.

The only guideline that was not widely followed in the current study was linked to pain management referrals with less than a quarter of the patients being documented with a referral to Acute Pain Services. Further investigation is needed to determine if this is an effect specific to the site or setting investigated or a wider problem. This could provide an area for improvement with significant impact based on the research<sup>[26]</sup> and represent an opportunity for further examination of the key factors limiting referrals.

These results suggest that guidelines can make a significant difference in opioid prescribing practices. Future research needs to establish further details of any justifiable or relevant issues that may result in reduced adherence to the guidelines. Further investigation is needed to identify the key prescribing practices within hospitals that contribute to increased risk of addiction.

### 4.2. Variations of opioid prescriptions by age and gender

The opioid prescriptions varied by gender. Women (69%) were less likely to be prescribed opioid prescriptions than men (76%). This is particularly striking for mild injuries, where 48% of women were prescribed opioids versus 68% of men, and women received on average about half the dosage of men (17.48 mg vs 30.60 mg). These findings contradict previous studies that suggest women are more likely to be users of prescription opioids than men.<sup>[26]</sup> Men represented 73% of the sample and had on average more severe injuries, which could

also explain the sex-based prescription differences. Another influencing factor may be providers' perception of women's need for pain medication in trauma care. It remains concerning that physicians continue to be more willing to prescribe opioids to men, even though they account for 75% of opioid-related causes of deaths. In contrast, Serdarevic et al<sup>[27]</sup> women were more likely to use prescription opioids compared to men when they are prescribed. Overall, there is limited information on the role that sex plays in opioid prescribing practices in a hospital setting and the associated risks, and this study highlights that there is a necessity for more research in this area.<sup>[27]</sup>

There were also major differences by age in opioid prescriptions. The older patients, particularly men, were less likely to receive an opioid prescription and none of them were prescribed dosages over 50 mg MME/day, and never received a prescription for more than 7 days. These findings are promising given that studies have shown that the majority of deaths from drug use disorders in older adults (age  $\geq$  65, approximately 75%) were linked to the use of opioids.<sup>[28,29]</sup> Another study reported that about 55% of 33762 patients with a traumatic injury received an opioid prescription at discharge, and in risk-adjusted models, older age (45–64 vs 18–24 years: odds ratio [OR], 1.28, 95% CI: 1.13–1.44) was associated with a higher possibility of opioid prescription at discharge.<sup>[30]</sup> Together, older age and higher injury severity were both significantly associated with a higher likelihood of receiving an opioid prescription.<sup>[2]</sup> Similar to the current findings, the researchers also found patients were more likely to have shorter (under 3 days) prescriptions and to receive multimodal care, but they were also less likely to be referred to APS. This prominent age-specific disparity in prescription practices suggests physicians were more cautious in prescribing opioids to the elderly. These findings are positive given that research findings indicate that the risks of adverse drug effects or comorbidities remain higher in the elderly population.<sup>[31]</sup>

#### 4.3. Limitations

Data quality was limited by some incomplete patient records. Systematically coding opioid prescription practices would make it easier to keep track of opioid prescribing practices and routine evaluations with a larger sample would strengthen the current findings. The cost and human resources needed for further research would also be drastically reduced if all patient variables were coded at the patient discharge stage. Real-time reporting of data would allow prescribers to be aware of their prescribing patterns and trends.

Beyond these guidelines, the assessment and management of pain remain a subjective issue and it cannot be treated using a standardized approach. Two patients with similar history and injury could be provided two different opioid prescriptions based on the many influencing factors identified in the current study.

#### 5. Conclusions

The majority of the prescriptions provided in this large urban acute Level 1 trauma center adhered to best practice guidelines, thereby reducing the risk of opioid misuse. They adhered to using short-acting opioids like hydromorphone for short duration continuous use for 3 days or less and they avoided the use of strong extended-release opioids, both of which are associated with a higher risk of addiction. Lower daily dosages were prescribed, which rarely went beyond 50 mg MME/day, and in most cases, a multimodal approach was followed by discharge and a discontinuation plan, but rarely contained a referral to acute pain services. Greater caution was taken with pain management treatment of older individuals, which aligns with best practice guidelines. These results show encouraging adherence

to the designated opioid prescription guidelines, while also highlighting the need for post-implementation continuous monitoring of guideline adherence.

#### Author contributions

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