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Characterizing opioid prescribing to adolescents at time of discharge from a pediatric hospital over a five-year period

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ABSTRACT

Purpose: To characterize opioid prescribing over a 5-year period to adolescents upon discharge from one urban pediatric medical center.

Design and methods: A retrospective cross-sectional analysis of 4354 adolescents discharged with a pain medication after an admission of ≤5 days between January 2015 and December 2019 was performed. Two outcome groups, based on the analgesics prescribed at discharge, were compared: those discharged with a prescription for a non-opioid only and those discharged with an opioid prescription. The association between year of discharge and receipt of opioid, while adjusting for relevant demographic and clinical characteristics, was also explored.

Results: Approximately 64% of the sample was discharged with an opioid prescription. Of those, the median daily dosage was 45.0 morphine milligram equivalents (MME) [IQR: 32.4, 45.0]. Year of discharge was associated with decreased odds of receiving an opioid when adjusting for age, race, sex, insurance, pain scores, opioid exposure during hospitalization, length of stay, and undergoing surgery. The odds of being discharged with an opioid decreased each year by 29% (Adjusted Odds Ratio [AOR] = 0.71, CI:0.68–0.73). Concurrently, the proportion of patients discharged with nonopioid pain medication increased from 25% of adolescent patients in 2015 to 50% in 2019.

Conclusions: Overall, opioid prescribing to adolescents at time of discharge decreased over time in our sample.

Practice implications: While prescribing has decreased opioid analgesics are dispensed to young patients. Risk of opioid use disorder and overdose is rare in this population, but adolescence is good opportunity for nursing to promote safe prescribing and analgesic use.

Introduction

Concerns about the nation's opioid use continues to be a topic of attention, albeit that prescription opioids remain valuable analgesics for many populations. Prescribing practices have varied widely over the past two decades, including by specialty, patient population, geography, and time (Barnett et al., 2017; Centers for Disease Control and Prevention, 2018a; Fortuna et al., 2010; Guy et al., 2017; Hill et al., 2017; Levy et al., 2015; Volkow et al., 2011). In the adult patient population, rates of opioid prescribing peaked around 2010, and have generally declined since 2012 (Guy et al., 2017; Levy et al., 2015). Opioid prescribing to younger populations is less-well characterized but historically appears to be more stable over time than prescribing to adults, with a similar decline in recent years (Gagne et al., 2019; Groenewald et al., 2016; McCabe et al., 2017).

There remains a need to characterize opioid prescribing to adolescents. Adolescence is an important period of maturation, between childhood and adulthood, with lasting health implications across the lifespan. Characterized by both physiological and social transitions, definitions of adolescence vary, mostly between the ages of 10 and 24. The

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World Health Organization (WHO) defines this phase as ages 10 to 19 (Sawyer et al., 2018; WHO, n.d). Although the relationship has not been extensively explored, some research suggests a possible association between exposure to opioids during adolescence and future non-medical use (McCabe et al., 2017; Miech et al., 2015). Even though consequences related to prescription opioids have been replaced by those related to illicit opioids, guidelines continue to be developed to inform clinical practice and mitigate risks, largely in the adult patient population. The Centers for Disease Control and Prevention's (CDC) Guideline for Prescribing Opioids for Chronic Pain released in 2016, is perhaps the most notable example of how prescribing guidelines can be implemented, resulting in a systemic and untargeted decline in opioid prescribing. (Bohnert et al., 2018; Dowell et al., 2016). However, few guidelines address the adolescent population. The National Academies of Science, Engineering, and Medicine have outlined a need for researchers to monitor the uptake and impact of clinical practice guidelines for patients in acute pain, including adolescents (National Academies of Sciences, Engineering, and Medicine, 2020). Key to shaping adolescent care is understanding current practices. By understanding the current context, researchers and clinicians can look towards developing interventions to define best prescribing practices and target education efforts promoting safe prescribing and prescription use in adolescent patients. The purpose of this analysis was to characterize changes over time in analgesic prescribing to adolescents upon discharge at one large pediatric health system.

Design and methods

Design

To examine changes in opioid prescribing to adolescents over a five-year period, a cross-sectional design was utilized to determine factors associated with adolescent patients discharged with an opioid prescription from a large acute care setting. Employing secondary data analysis with electronic health record data, patient and clinical covariates likely to affect receipt of an opioid prescription (age, sex, race, length of stay, insurance, surgical status, unit of discharge, administration of opioids during inpatient stay, date of discharge, and pain scores) over time were examined in the analyses (Fortuna et al., 2010; Groenewald et al., 2016; Guy et al., 2017).

Data acquisition and sample

Using a simple random sampling approach, we obtained a sample of 10,000 patients between the ages of 10 and 19 seen between January 2015 and December 2019 at a single academic pediatric hospital. Internationally recognized, the hospital has nearly 600 beds and is located in a large urban area. From the random sample, the electronic health record (EHR) of adolescents admitted for 5 days or less and discharged with an analgesic medication were eligible for inclusion in the analytical sample. These parameters were chosen to mitigate sampling patients admitted for chronic conditions requiring prolonged lengths of stay as well as to reflect median and interquartile ranges for length of stays commonly seen in pediatric and adolescent patient populations needing acute care. (Markham et al., 2018). Each visit corresponded to a unique patient and readmissions were not included. If a patient had multiple visits during the study period, only the index visit was included. Complete data were available for each patient. The final analytical sample comprised 4354 adolescents. The Institutional Review Board at the University of Pennsylvania approved this study. This study follows established guidelines for reporting observational studies (Von Elm et al., 2007).

Measures

The final sample was dichotomized into two groups based on the analgesic medications prescribed at discharge (discharge medication groups): 1) those discharged with an opioid prescription (including prescriptions for opioids compounded with a non-opioid) and 2) those discharged with a non-opioid pain prescription only. Adolescents who received a prescription for both opioids and non-opioids were categorized as being discharged with an opioid prescription. Discharge medication group was the dependent variable as the primary aim was to characterize prescribing over the five-year period while accounting for the relationship between patient and clinical factors known to contribute to a patient being discharged from an inpatient unit with an opioid prescription. Additionally, we conducted a subanalysis to examine dosage prescribed among those discharged with an opioid prescription. The daily dose of opioid prescribed at discharge was converted to morphine milligram equivalents (MME/day) using the CDC's guidelines for computing equianalgesic dosage. This conversion accounted for adolescents prescribed multiple medications and allowed for the comparison of dosages across different prescription opioids (Centers for Disease Control and Prevention, 2018b).

Patient and clinical characteristics known to affect opioid provision were obtained from the EHR (Fortuna et al., 2010; Groenewald et al., 2016; Guy et al., 2017). Age, race, sex, pain scores, insurance, whether a surgical procedure was performed, and opioid receipt during inpatient hospitalization were extracted. Pain was assessed using the numeric rating scale (NRS) which ranges from 0 (no pain) to 10 (worst pain). Average pain during hospitalization was measured by taking the mean of all the pain scores recorded during the admission. While a number of pain scales are validated for this patient population, only pain scores using the NRS were included in this analysis. Age, length of stay (LOS), date of discharge, and pain scores were treated as continuous variables. Race was categorized as white, Black, and other or unknown. Insurance was dichotomized as Medicaid/self-pay and private insurance. A dichotomous variable (yes/no) was created to indicate whether a surgical procedure was performed during the admission. Similarly, a dichotomous variable was created to indicate whether a patient received opioids as an inpatient.

Statistical analysis

Descriptive and comparative statistics (e.g. chi-square, Mann-Whitney *U* test) were computed to evaluate sample characteristics and group differences between those who did and did not receive an opioid prescription at discharge. To identify changes in the odds of being discharged with an opioid over time, a multivariable mixed effects logistic regression model was constructed to account for potential clustering and collinearity at the inpatient unit level and among prescribers. Due to the deidentified nature of the data and the lack of clinician specific data per patient, inpatient units served as a proxy for prescribing patterns by clinicians rounding on the units. The inclusion of patient- and clinical-factors in the regression modeling made it possible to control the variance thus allowing associations between temporal factors (year) and discharge medication outcomes to be ascertained. Model fit was assessed using AIC values and Hosmer-Lemeshow goodness of fit. Due to the skewed nature of the dosage data, a Kruskal-Wallis test was used to compare annual median MME prescribed to patients at discharge. Significance was set at $p < .01$ and all analyses were conducted in R version 3.5.1 (R Foundation, Vienna).

Results

Of the final sample of 4354 adolescents (Table 1), approximately 64% were discharged from the hospital with an opioid prescription. Of those discharged with an opioid prescription ($N = 1567$), 12% left with only an opioid prescription, while 88% left with prescriptions for both an opioid and a non-opioid pain medication. The proportion of patients discharged with an opioid declined year to year with 75.3% of patients seen in 2015 discharged with an opioid compared to 50.3% in 2019 (Fig. 1). Of those discharged with an opioid prescription, the median

Table 1
Characteristics of the sample by medication outcome group.

	Total Sample	Discharged Without Opioid	Discharged with Opioids	P
	4354	1567	2787	
Age, years, median [IQR]	14.67 [12.70, 16.56]	14.63 [12.43, 16.53]	14.72 [12.84, 16.58]	0.031
Race, n (%)				0.094
Black	2588 (59.4)	396 (25.3)	692 (24.8)	
Other/Unknown	1088 (25.0)	267 (17.0)	411 (14.7)	
White	678 (15.6)	904 (57.7)	1684 (60.4)	
Sex, n (%)				<0.001
Female	2194 (50.4)	852 (54.4)	1342 (48.2)	
Male	2160 (49.6)	715 (45.6)	1445 (51.8)	
Insurance, n (%)				<0.001
Medicaid/Self Pay	1469 (33.7)	586 (37.4)	883 (31.7)	
Private	2885 (66.3)	981 (62.6)	1904 (68.3)	
Length of Stay, days, median [IQR]	2.54 [1.79, 3.44]	2.66 [1.81, 3.56]	2.50 [1.76, 3.41]	0.269
Surgery, n (%)				<0.001
No	1394 (32.0)	1016 (64.8)	378 (13.6)	
Yes	2960 (68.0)	551 (35.2)	2409 (86.4)	
Received opioids while inpatient, n (%)				<0.001
No	1055 (24.2)	959 (61.2)	96 (3.4)	
Yes	3299 (75.8)	608 (38.8)	2691 (96.6)	
Discharged with non-opioid, n (%)				<0.001
No	322 (7.4)	0 (0.0)	322 (11.6)	
Yes	4032 (92.6)	1567 (100.0)	2465 (88.4)	
Dosage, MME, median [IQR]	45.00 [32.40, 45.00]	NA [NA, NA]	45.00 [32.40, 45.00]	
Year Discharged, n (%)				<0.001
2015	1066 (24.5)	263 (16.8)	803 (28.8)	
2016	968 (22.2)	256 (16.3)	712 (25.5)	
2017	821 (18.9)	335 (21.4)	486 (17.4)	
2018	721 (16.6)	327 (20.9)	394 (14.1)	
2019	778 (17.9)	386 (24.6)	392 (14.1)	
Average Pain Score, median [IQR]	3.33 [2.00, 4.81]	2.79 [1.28, 4.53]	3.57 [2.35, 4.92]	<0.001

SD = Standard deviation; IQR = Interquartile range, ICU = Intensive care unit.
Test of differences across medication groups evaluated using Chi-square, and Mann-Whitney.

daily dosage was 45.0 MME [IQR: 32.4, 45.0]. There was no statistically significant difference in median length of stay between those who did and did not receive a discharge opioid, with the overall sample's median length of stay being 2.5 days. The majority of the sample was white (54%), 25% of the sample was Black, and 21% of the sample was either another race or unknown. Nearly 66% of patients were covered by private insurance.

Differences in prescribing were observed between medication groups based on patient and clinical factors. A slightly larger proportion of females (54.4%) compared to males (45.6%) did not receive an opioid at time of discharge ($p < .001$). A larger proportion of patients covered by private insurance received an opioid prescription (68.3%) compared to patients covered by Medicaid or self-paying for care (31.7%) ($p < .001$). No statistically significant differences in medication received at discharge were noted by race. A substantially larger proportion of patients who received an opioid prescription had undergone a surgical procedure (86.4%) compared to those who were discharged with only non-opioid medication (35.2%) ($p < .001$). Further, nearly all patients discharged with an opioid prescription received an opioid while hospitalized (96.6%) compared to only 38.8% of those discharged with only non-opioid medication ($p < .001$). In addition, patients discharged with an opioid had a higher median pain score throughout hospitalization, 3.57 [IQR: 2.35, 4.92] than patients discharged without an opioid 2.79 [IQR: 1.28, 4.53] ($p < .001$).

There were temporal changes in the proportion of adolescent patients discharged across medication groups year to year. Chi-square tests indicated significant differences in the proportion of patients in each medication group over time ($p < .001$). For example, in 2015, 28% of all patients were discharged with an opioid whereas by 2019 only 14% of patients were discharged with an opioid. A Kruskal Wallis test determined significant differences in the distribution of MME/day prescribed across years ($p = .003$). Specifically, post hoc pairwise Dunn's tests indicated that MME in each year differed significantly after 2015. While the median dosage prescribed was the same for each observed year (45 MME/day), the distribution, as captured by the interquartile range (IQR), widened. For example, the IQR in 2015 was 41.4 MME/day to 45 MME/day. However, the IQR in 2019 was 30 MME/day to 45/MME day.

When controlling for relevant covariates, year of discharge was found to be associated with decreased odds of receiving an opioid prescription. In the final multivariable model (Table 2), each year was associated with a 29% decrease in the adjusted odds ratio (AOR) of being discharged with an opioid compared to being discharged with a non-opioid only (AOR = 0.71, CI: 0.68–0.73). Increased age was associated with increased odds of receiving an opioid at discharge (AOR = 1.04, CI: 1.01–1.08). Compared to patients who identified as white, Black adolescents were found to have higher odds of being discharged with an opioid (AOR = 1.52, CI: 1.18–1.94). Patients covered by private insurance had 27% greater odds of receiving an opioid at time of discharge compared to those covered by Medicaid or self-paying (95% CI: 1.03–1.56). As expected, surgery was significantly associated with increased odds of being discharged with an opioid (AOR = 5.66, CI: 4.42–7.24), as was receiving an opioid during the inpatient stay (AOR = 16.58, CI: 12.71–21.64). Each 1-point increase in average pain score throughout hospitalization was associated with a 14% increase in the odds of receiving an opioid at discharge (AOR = 1.14 CI: 1.08–1.20). Conversely, each additional day of hospitalization was associated with lower odds of receiving an opioid at discharge (AOR = 0.83, CI: 0.76–0.90).

Given the significant association between race and receipt of an opioid prescription at discharge in the adjusted model a sensitivity analysis was conducted to examine potential confounding. A *t*-test indicated that significant differences in average pain scores, scored from 0 to 10, were noted between Black and white patients, with Black patients reporting on average, half a point higher pain scores than white patients (CI: 0.40–0.71, $p < .001$). As such, a two-way interaction term between race and average pain score was included in the modeling to estimate the AOR of receiving an opioid at time of discharge. The inclusion of

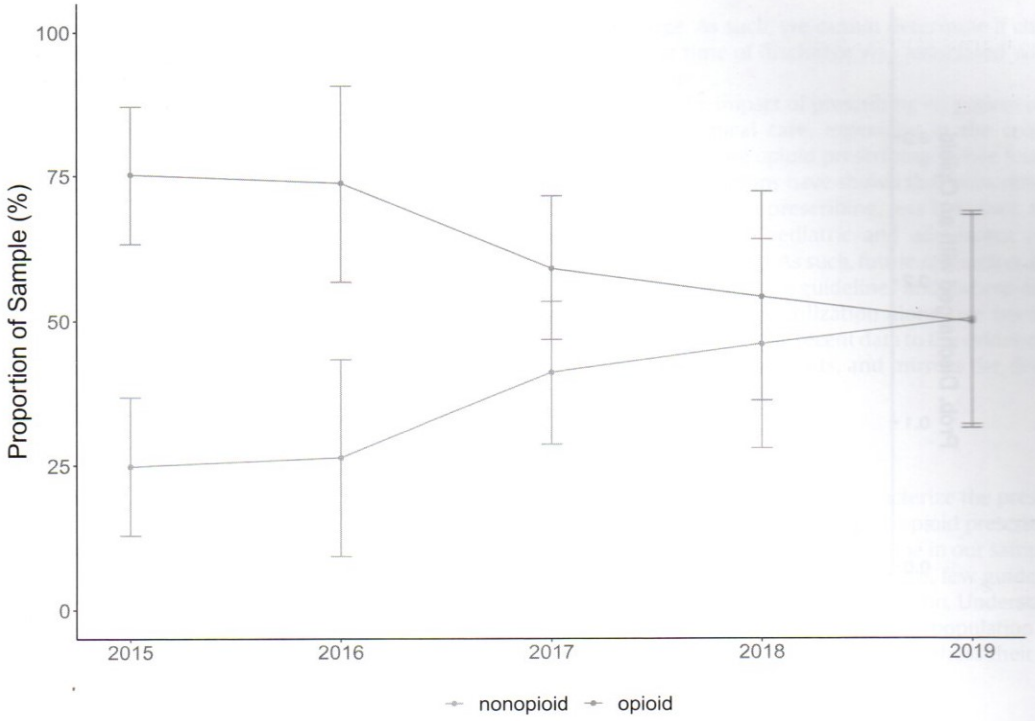

Fig. 1. Average Proportion of Patients Discharged to Medication Group, By Year.

this interaction term resulted in race no longer being statistically significantly associated with receiving an opioid at discharge. Rather, differences were observed between patients of different races as average pain scores increased (Fig. 2), such that the AOR of receiving an opioid remained relatively stable over time for patients who identified as white or of other or unknown races as pain scores increased, while for Black patients, the AOR of receiving an opioid increased as pain scores increased (AOR = 1.20, CI: 1.08–1.34). Year remained significant (AOR = 0.71, CI: 0.69–0.72, $p < .001$).

Table 2
Multivariable logistic regression estimating odds of being discharged with an opioid medication.

Variable	Adjusted Odds Ratio	Lower 95% Confidence Interval	Upper 95% Confidence Interval	P
Admission Year	0.71	0.68	0.73	<0.001
Age	1.04	1.01	1.08	0.033
Race				
White (Ref)				
Other/Unknown	0.96	0.74	1.24	0.743
Black	1.52	1.18	1.94	<0.001
Sex				
Female (Ref)				
Male	1.11	0.92	1.33	0.284
Insurance, n (%)				
Medicaid/Self Pay				
Private	1.27	1.03	1.56	0.025
Average Pain Score	1.14	1.08	1.20	<0.001
Received opioids while inpatient	16.58	12.71	21.64	<0.001
Surgery	5.66	4.42	7.24	<0.001
Length of Stay, days	0.83	0.76	0.90	<0.001

Note: Reference medication group = discharged with a non-opioid; CI = Confidence interval; AOR = Adjusted Odds Ratio.

Discussion

This study characterized opioid prescribing to adolescents upon discharge from a pediatric hospital over a five-year period, while adjusting for patient and clinical characteristics. This study identified a decline in opioid prescribing and an increase in prescribing of non-opioid pain medication between the years 2015 and 2019 at this single urban pediatric medical center. These effects were observed while adjusting for patient (age, sex, race, insurance) and clinical (surgical intervention, length of stay, administration of opioids during inpatient stay) factors.

These findings reflect national trends; according to the CDC, opioid prescribing in the US has decreased since 2010 by a number of indicators including dosage, duration, rates, and co-prescribing with other medications like benzodiazepines. While opioid prescribing to younger populations has been less-well characterized, existing research suggests a similar trend. A study using data from the Medical Expenditure Panel Surveys (MEPS) found the overall trend in opioid prescriptions to children and adolescents ages 0–17 years old remained stable between 1996 and 2012 (Groenewald et al., 2016). However, opioid prescribing to younger patients has been in decline in more recent years. McCabe and colleague's analysis of data from Monitoring the Future found a decline in medical use of prescription opioids from 2013 to 2015 (McCabe et al., 2017). Further, Gagne and colleagues analyzed data from sample of commercially insured patients 18 years old or younger between January 2014 to March 2017 and found prescription opioids dispensed to this patient population have been steadily declining since 2012 (Gagne et al., 2019).

Our analysis similarly revealed a decline in opioid prescriptions over time, but uniquely focused on an adolescent population discharged from the inpatient setting. Nearly 29% of the sample discharged in 2015 was prescribed an opioid at discharge while the rate declined by more than half in 2019. Each year was associated with a 29% decrease in the odds of receiving a prescription opioid. While median dosage did not differ, the increasingly variability over time observed in the

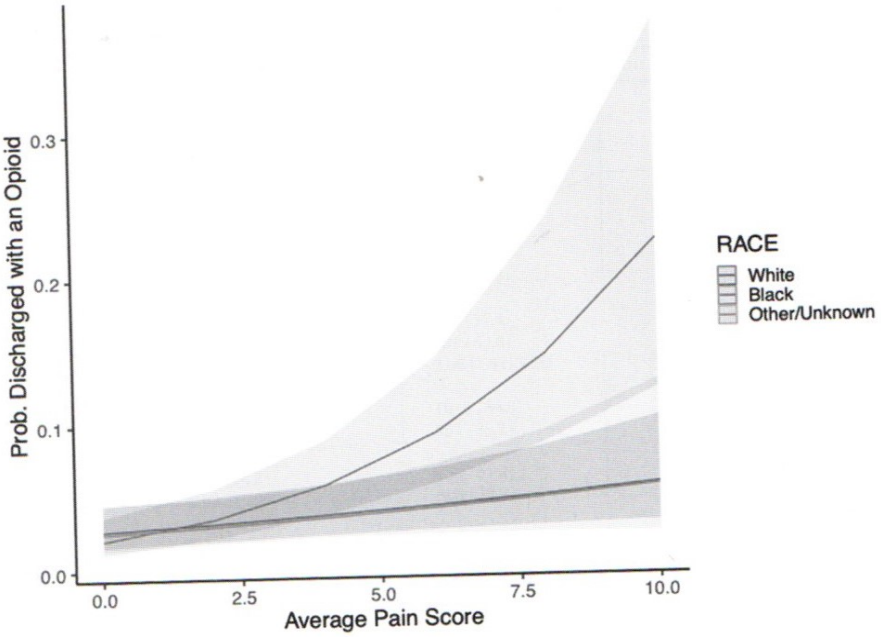

Fig. 2. Interaction of Race and Average Pain.

range of MME prescribed highlights the need for future research to examine these trends, specifically as the lower end of the range decreased over time in this sample. As expected, the proportion of adolescents discharged with a non-opioid also changed significantly during the study period.

Further, we found several notable associations between clinical and patient factors and being discharged with an opioid prescription. Unsurprisingly, higher pain scores, receipt of opioids during the hospital stay, and undergoing a surgical procedure during hospitalization were associated with increased odds of being discharged with an opioid prescription. We found each one-point increase in average pain score was associated with a 14% increase in the odds of leaving with an opioid prescription. The association between opioid prescription and surgical procedures is well-documented. Indeed, surgical care is one of the most common medical encounters resulting in an opioid prescription (Clarke et al., 2014; Harbaugh et al., 2018). However, it is important to note that while differences by surgical procedure were not explored in this analysis, variation has been well-documented in both adult and pediatric populations (Harbaugh et al., 2018; Hill et al., 2017; Voepel-Lewis et al., 2015; Waljee et al., 2016; Wunsch et al., 2016).

Similar to other investigators' findings, as length of stay increased, the odds of receiving an opioid prescription upon discharge decreased (Monitto et al., 2017). Each additional day as an inpatient was associated with a 27% decrease in the odds of receiving an opioid prescription. While the length of hospitalization was censored in this study in order to sample patients with acute hospitalizations as opposed to emergency room visits/observations or chronic conditions with prolonged stays, the longer a patient remained inpatient, the less likely they were to receive an opioid prescription upon discharge. This may be indicative of pain management over time during hospitalization or as other researchers have found, that average perceived pain intensity plateaus during hospitalization, at least among adult surgical patient populations (Kannampallil et al., 2016). Pain scores are most variable in the immediate days after admission, especially following surgery, which may explain why those with shorter lengths of stay had higher odds of being discharged with an opioid than those with longer lengths of stay (Vasilopoulos et al., 2021). Finally, adolescents who received an opioid during hospitalization were significantly more likely to leave to with an opioid prescription compared to adolescents who did not receive and opioid during hospitalization. Hill and colleagues similarly found an association between inpatient and outpatient use of opioids (Hill et al., 2017). However, their analysis focused on an adult population and prescription pills taken the day before discharge and used at home.

We did not find significant associations between receiving an opioid prescription and the patient-specific factors of age or sex. Other studies have found differences in prescribing across age groups, such that children between the ages of 1 and 9 years old had increased odds of receiving opioid medication compared to those over 14 (DePhillips et al., 2019). In the literature, findings related to sex and opioid prescriptions are variable, though our finding is supported by previous studies (Groenewald et al., 2016; McCabe et al., 2013; McCabe et al., 2017). In our sample, Black adolescents were more likely to be discharged with an opioid prescription compared to white adolescents. This is contrary to previous disparity research finding Black patients are less like to receive opioids, compared to white patients (Groenewald et al., 2018; Guy et al., 2017; Joynt et al., 2013). However, once pain scores were controlled for, there was no significant association between race and being discharged with an opioid prescription. This warrants further investigation, but our findings suggest that the odds of a white adolescent being discharged with a prescription opioid were relatively stable in this sample while the odds of leaving with an opioid prescription increased with higher pain scores in Black adolescents. Future research should examine temporal changes in pain scores, pain assessment frequency, and medication prescribing upon discharge across adolescent patient populations from diverse racial and ethnic backgrounds.

Comparing adolescents on Medicaid or self-paying, adolescents with private insurance were 27% more likely to be discharged with an opioid prescription. In a study of uncomplicated laparoscopic appendectomies in patients aged 7–20 years, Freedman-Weiss and colleagues found that Medicaid coverage was associated with decreased post-operative opioid prescriptions (Freedman-Weiss et al., 2019). Tomaszewski and colleagues similarly found pediatric patients with Medicaid coverage were less likely to be prescribed an opioid analgesic (Tomaszewski et al., 2018). This association has been found in adult patient populations and national trends (Guy et al., 2017; Lee et al., 2016). However, Wang and colleagues did not find an association in their analysis of

patients aged 22 years or younger discharged from a tertiary care children's hospital urgent care and emergency department (Wang et al., 2019). These disparate findings may be related to the differences between patients seeking more urgent or acute care compared to those admitted for longer planned admissions. These findings may also be related to differences in facility utilization. However, future research is needed to examine these possibilities.

Practice implications

It is important to note that while prescribing has decreased, prescription opioid analgesics remain readily dispensed in young populations (Renny et al., 2021). Even though risk of opioid use disorder and overdose is rare in this population after an initial exposure, adolescence remains a critical time in human development and a good opportunity to promote safe prescribing and analgesic use (Hadland et al., 2021). In order to promote patient safety and best clinical practices, nurses should understand emerging trends in opioid prescribing and use in adolescents. Nurses are often the last clinician patients and their families encounter upon discharge. Therefore, even if they are not the prescriber, they must possess the knowledge and skills to effectively assess and contribute to the management of their patient's pain while considering risk mitigation (Compton & Blacher, 2020). Further, all nurses have an important role in patient education. Improving patient education in acute care settings may help lessen some of the factors contributing to poor health outcomes among individuals discharged with opioid prescriptions. Nurses are well positioned to continue research in this context to better address the information needs of patients and families. The wide scope of practice of nursing creates many future research opportunities related to this work. Incorporating additional patient-reported pain outcomes, multi-modal and non-medical pain management techniques, and addressing non-physical symptoms are among the needed and potentially nurse-led paths to better address adolescent health needs.

Limitations

The observational nature and design of this study have inherent limitations. First, it was conducted at a single institution, thus limiting its applicability to other settings and populations. This analysis consisted of all discharges from inpatient units of ≤5 days. While this allowed for a broad sample to be analyzed, the heterogeneity introduced with this sampling approach limits our ability to examine procedure and diagnosis specific variation. For example, while we accounted for surgical status, we did not account for types of procedures or primary conditions leading to hospital admission. Doing so might provide more information for specific patient populations. Additionally, patient race in these analyses was based on the EHR and therefore may not capture differences as accurately as using patient-reported race and ethnicity.

While we were able to calculate MME/day dosage, we did not have access to more detailed prescribing information such as days supplied. As such, we could not distinguish those who left with enough medication for one day from those who had multiple days of medication. Similarly, we derived MME/day according to prescription instructions, which does not account for if the prescriptions were actually filled and how the medications were used by the patient. Both duration of prescriptions and actual use are important considerations for future work on safe prescribing. We also recognize some non-opioid medications prescribed, such as acetaminophen, have indications other than pain. It is also possible that some patients were instructed to purchase an over-the-counter pain medication instead of receiving a prescription. Prescriber license and specialty were not available and thus no conclusions can be made by these important characteristics. However, our analyses adjusted for correlation among patients discharged from the same unit in the absence of individual prescriber data. Finally, this study was not able to account for pain experienced by adolescents after discharge. As such, we cannot determine if changes in analgesic prescribing at time of discharge was associated with any changes in pain outcomes.

Evaluating the impact of prescribing on patient outcomes is critical for informing clinical care, especially in the context of emerging guidelines addressing opioid prescribing. While research studies with adult patient populations have shown that prescribing guidelines have impacted acute opioid prescribing, less is known on how guidelines have impacted acute pediatric and adolescent opioid prescribing (Sutherland et al., 2021). As such, future research examining the association between prescribing guidelines and patient-reported outcomes, rather than medication utilization alone, are needed. Despite these limitations, this study adds recent data to the evidence of decreased opioid prescribing in adolescents, and mirrors the declines observed in adult populations.

Conclusion

This work adds to efforts to characterize the prescription of opioids in the adolescent population. Overall, opioid prescribing to adolescents at time of discharge decreased over time in our sample. Despite the developmental importance of adolescence, few guidelines address prescription opioids in this patient population. Understanding the current use of opioid analgesics in the adolescent population is necessary to develop best practices that appropriately address their clinical needs.

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CRediT authorship contribution statement

Sydney A. Axson: Conceptualization, Methodology, Investigation, Project administration, Funding acquisition, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Resources. **Nicholas A. Giordano:** Conceptualization, Methodology, Investigation, Project administration, Funding acquisition, Data curation, Formal analysis, Visualization, Writing – original draft, Writing – review & editing. **Peggy Compton:** Conceptualization, Methodology, Investigation, Supervision, Resources, Writing – original draft, Writing – review & editing. **Catherine C. McDonald:** Conceptualization, Methodology, Investigation, Supervision, Funding acquisition, Resources, Writing – review & editing. **Jennifer A. Pinto-Martin:** Conceptualization, Methodology, Investigation, Supervision, Funding acquisition, Resources, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

None.

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