Clinical Neurology and Neuroscience
2025, Vol. 9, No. 1, pp. 13-19
https://doi.org/10.11648/j.cnn.20250901.12

Research Article

Clinical Factors Associated with Opioid Use in Abortive Headache Treatment Among Adolescents in the Emergency Department: Who Gets Them and Why

Rhea Zahir[1, *], Olivia Gould[2], David Kepplinger[3], Rhiya Dave[2], Tarannum Lateef[4]

[1]Undergraduate College of Arts and Sciences, University of Virginia, Charlottesville, The United States
[2]Inova L. J. Murphy Children's Hospital, Inova Medical Campus, Fairfax, The United States
[3]Department of Statistics, George Mason University, Fairfax, The United States
[4]Pediatric Specialists of Virginia and Children's National Health System, Washington DC, The United States

Abstract

Background: Routine use of opioids for headache can lead to worsening symptoms and may contribute to dependence. This study's main objective was to determine the prevalence and clinical factors associated with opioids used as abortive therapy, for adolescents presenting with headache, in a pediatric emergency room. Methods: We reviewed electronic medical records of youth aged 11 through 21 years presenting to a large suburban pediatric emergency department between January 2014 and December 2020, who were prescribed opioids for headache. Charts were analyzed for demographics, medications prescribed, clinical characteristics, and final diagnoses. Results: 204 youths were seen for headache and received an opioid abortive medication for it. Among those 70 received it for a procedure such as lumbar puncture. Of the remaining 134 patients – 126 received morphine, 28 – hydromorphone/hydrocodone, 26 – oxycodone, tramadol – 9, meperidine – 6, codeine/fiorcet/fentanyl – 8, and methadone – 1. Over half the patients (n=118, 58%) were female, 24% (n=49) had a prior headache history, 20% (n=41) seen a neurologist, and 30% (n=62) had a past psychiatric history. In terms of headache specific factors, only 15% (n=31) were on daily headache prophylaxis. Notably 46% (n=93) had a history of prior opioid use and only 9% (n=18) had used an ergot medication. Conclusion: Youth receiving opioids for headache treatment were more likely to be female, had significant mental health comorbidity, and without access to specialty neurology care. Our findings may help identify youth headache sufferers at risk for opioid use and highlight the need for early identification and referral to a neurologist.

Keywords

Migraine, Opioid Use, Emergency Encounters, Headache Status Migrainosus

[*]Corresponding author: kpt8nb@virginia.edu (Rhea Zahir)

Received: 6 May 2025; **Accepted:** 20 May 2025; **Published:** 19 June 2025

1. Introduction

Opioid use among children and adolescents is an emerging major concern, with limited characterization and understanding of specific patterns. Often, opioid use begins with the treatment of various pain syndromes in this vulnerable population [16].

Headache is the most common neurologic complaint in the pediatric population and a leading reason for visits to the emergency room [4, 5]. Most recent American Academy of Neurology guidelines for acute treatment of migraine in adolescents recommended that NSAIDs remain first line, followed by sumatriptan/naproxen orally disintegrating tablet (ODT), zolmitriptan nasal spray (NS), sumatriptan NS, rizatriptan ODT, or almotriptan ODT. Further stated again that there is no evidence to support the use of opioids in children with migraine [3]. Despite the availability of well-studied non-opioid treatments for headaches and growing awareness of the adverse effects of opioids, pediatric patients may still receive these medications for symptom relief. However, data on the prevalence of opioid prescriptions for pediatric headaches and the associated risk factors remain limited. The main objective of this study is to determine the prevalence and clinical factors associated with opioids used as abortive therapy, for adolescents presenting with headache, in a pediatric emergency room. Our secondary aim was to determine whether significant differences emerged between those patients discharged from the emergency department (ED) versus those admitted.

2. Materials and Methods

Study Design, Setting and Population

Using an observational retrospective chart analysis, we reviewed electronic medical records at Inova Fairfax Hospital for Children (IFHC) pediatric ED, a large suburban level 1 trauma center, for youth aged 11 through 21 years between January 2014 and December 2020 who presented with headaches. The search provided 204 unique patients who were prescribed opioids during their encounter, with 75 admitted to the hospital and 129 discharged. Each electronic medical record was de-identified and given a unique PIN that was securely stored within REDCap and accessible only to the research team. We received ethics approval from the Institutional Review Board and our protocol number is U20-07-4188.

2.1. Measures

We extracted the following sociodemographic data from each chart: patient age, legal sex, ethnic group, and insurance type. Clinical outcomes measured included number of lifetime ED visits, number of lifetime hospitalizations, age at diagnosis of headache disorder, headache characteristics, chronicity, comorbid physical and mental health conditions, pre-existing prescriptions for headache prophylaxis and/or rescue medications, and whether that had established outpatient neurologic care. Several outcome measures regarding opioid use prior to and during the encounter were evaluated, as well as other factors of the documented ED encounter including prescriptions administered during the visit, final diagnosis, disposition (admitted or discharged), and discharge prescriptions.

2.2. Data Analyses

This retrospective chart review used descriptive statistics to describe findings and also looked to identify potential differences in demographic and clinical characteristics between admitted and discharged patients. Differences were compared using Pearson's Chi-square test or Fisher's exact test (if less than 30 patients had that characteristic in either the admitted or discharged group) and deemed statistically significant if $P<0.05$.

3. Results

The study included 204 youth who were seen for headache and received an opioid abortive medication for it. Table 1 shows the sociodemographics of the study population with a female preponderance (n=119; 58%). Table 2 demonstrates the type of opioids received and procedures that these patients underwent during their ED evaluation. More than half the patients underwent head imaging and almost three fourths had laboratory studies done. Only 20% (n=41) had seen a neurologist for their headaches (Table 3).

Table 1. *Demographic Characteristics.*

		N (% of total)	% admitted	OR (95% CI)	p-value
Legal Sex	Female vs. Male	119 (58%)	33%	0.66 (0.36, 1.23)	0.19
Hispanic/Latino	Hispanic/Latino vs. Non Hispanic/Latino	73 (36%)	22%	0.37 (0.18, 0.74)	< 0.01
	Missing	11 (5%)	64%	3.20 (0.78, 15.43)	0.10
Insurance Type					0.13

		N (% of total)	% admitted	OR (95% CI)	p-value
	None	14 (7%)	21%	0.45 (0.08, 1.78)	0.26
	Private	103 (51%)	44%	1.83 (0.99, 3.42)	0.04
	Medicaid or charity	75 (37%)	35%	0.87 (0.46, 1.63)	0.65
	Covid19 hrsa	2 (1%)	0%	0.00 (0.00, 9.17)	0.53
	Tricare	3 (2%)	33%	0.86 (0.01, 16.76)	1.00
	Workers comp	6 (3%)	0%	0.00 (0.00, 1.44)	0.09
	Missing	1 (1%)	0%	0.00 (0.00, 67.01)	1.00

Table 2. *Opioid Prescription and Procedures During Encounter.*

		N (% of total)	% admitted	OR (95% CI)	p-value
Opioid					0.07
	Codeine/Fioricet /Fentanyl	8 (4%)	63%	2.98 (0.56, 19.78)	0.15
	Hydromorphone /Hydrocodone	28 (14%)	18%	0.33 (0.09, 0.95)	0.03
	Meperidine	6 (3%)	33%	0.86 (0.08, 6.15)	1.00
	Methadone	1 (1%)	0%	0.00 (0.00, 67.01)	1.00
	Morphine	126 (62%)	36%	0.89 (0.48, 1.67)	0.77
	Oxycodone	26 (13%)	50%	1.86 (0.75, 4.67)	0.19
	Tramadol	9 (4%)	56%	2.22 (0.46, 11.58)	0.29
Labs During Encounter	Yes vs. No	149 (73%)	44%	4.04 (1.79, 10.08)	< 0.01
Head Imaging During Encounter	Yes vs. No	111 (54%)	46%	2.43 (1.30, 4.66)	< 0.01
Opioids Given During Encounter For HA	Yes vs. No	134 (66%)	34%	0.74 (0.39, 1.40)	0.36
Has Seen A Neurologist	Yes vs. No	41 (20%)	42%	1.27 (0.59, 2.69)	0.59
	Missing	1 (1%)	0%	0.00 (0.00, 67.01)	1.00

Table 3 shows the clinical characteristics of the patients who received opioids: 24% (n=49) had a prior headache history and 30% (n=62) had a past psychiatric history or comorbid mental health disorder. In terms of headache specific factors, only 15% (n=31) were on daily headache prophylaxis (Table 1). Notably 46% (n=93) had a history of prior opioid use and 9% (n=18) had used an ergot medication in the past (Table 3).

Table 3. *Clinical Characteristics of Patients Receiving Prescription Opioids.*

		N (% of total)	% admitted	OR (95% CI)	p-value
# Of Lifetime Ed Visits Prior To This Visit					< 0.01
	None	30 (15%)	93%	37.15 (8.80, 333.88)	< 0.01
	Less than 3	87 (43%)	25%	0.41 (0.21, 0.78)	< 0.01

		N (% of total)	% admitted	OR (95% CI)	p-value
	3 to 10	48 (24%)	29%	0.64 (0.29, 1.35)	0.23
	More than 10	36 (18%)	28%	0.61 (0.25, 1.41)	0.26
	Missing	3 (2%)	33%	0.86 (0.01, 16.76)	1.00
Past Psych Hx	Yes vs. No	62 (30%)	36%	0.92 (0.47, 1.79)	0.88
Daily Preventative	Yes vs. No	31 (15%)	45%	1.51 (0.64, 3.51)	0.32
Prior Ergot Use	Yes vs. No	18 (9%)	44%	1.42 (0.46, 4.21)	0.61
Prior Opioid Use	Yes vs. No	93 (46%)	38%	1.07 (0.58, 1.97)	0.88
Hx Of Headaches	Yes vs. No	49 (24%)	33%	0.79 (0.37, 1.63)	0.61
On Daily HA Prophylaxis	Yes vs. No	31 (15%)	32%	0.79 (0.31, 1.89)	0.69
Months Since Diagnosis	Less than 6 vs. Greater than 12	2 (1%)	100%	0.00 (0.00, 4.37)	0.19
	Missing	191 (94%)	36%	0.66 (0.18, 2.48)	0.56
Frequency Of Headaches					0.46
	Less than or equal to once a month	6 (3%)	17%	0.34 (0.01, 3.09)	0.42
	More than once a month to less than twice a week	6 (3%)	50%	1.74 (0.23, 13.38)	0.67
	More than twice a week and less than 15 days a month	3 (2%)	0%	0.00 (0.00, 4.16)	0.30
	Greater than or equal to 15 days a month	9 (4%)	44%	1.39 (0.27, 6.71)	0.73
	Missing	180 (88%)	37%	1.18 (0.45, 3.38)	0.82

Among the 204 adolescents, 75 patients were admitted to the hospital and 129 were discharged. The only statistically significant difference between the patients who were admitted or discharged was mean age — 16.97 for the admitted group compared to 19.49 for discharged patients.

4. Discussion

This study provides a valuable glimpse into headache-related emergency department (ED) visits among youth aged 11–21 years at a large suburban level 1 trauma center, with a focus on demographic, clinical, and treatment characteristics, particularly opioid use. Among 204 patients reviewed, a female preponderance was observed (n=118; 58%), and a significant proportion had comorbid mental health conditions (n=62; 30%) or a history of prior opioid use (n=93; 46%) (Tables 1, 3). Despite the prevalence of chronic headache disorders, only 15% (n=31) of patients were on prophylactic treatment, one-fifth (n=41, 20%) had seen a neurologist (Tables 2, 3). Opioid use was notable, with morphine being the most frequently administered medication (Table 2).

Our findings on opioid use is consistent with a review of the Washington State Medicaid data set analyzed ambulatory and emergency department visits for children ages 7 – 17 years with the primary diagnosis of headache from 2012 - 2015 and found that patients were nearly four times as likely (4%) to walk away with an opioid prescription in the ED than if they were seen in the ambulatory care setting (1%) [2]. In the Washington State Medicaid retrospective study, non-pediatric providers were more likely to prescribe opioids, adolescents were more likely than children 12 or younger to be prescribed opioids, and certain ethnic minorities were less likely to be prescribed opioids. Notably, they have also found that adolescents receive opioids more frequently when they have a history of frequent ED visits or are not followed by neurology [1].

Past psychiatric history and mental health conditions, specifically depression, has been identified within the study as a correlation factor of migraine and opioid abuse disorder. The observed correlation between depression and both migraine and opioid use in this study aligns with existing literature documenting the comorbidity of migraine and mood disorders, including depression. Prior studies have consistently shown that individuals with migraines are more likely to have co-occurring psychiatric conditions, particularly depression, with prevalence rates ranging from 25% to 50%

in various populations [9, 10]. Furthermore, youth with mood disorders, including depression, are at an increased risk of substance use disorders, including opioid misuse, potentially due to shared neurobiological pathways involving dysregulation of pain and mood or as a maladaptive coping mechanism [11, 12]. Mental health conditions including anxiety disorders are observed with an increased prevalence in migraine patients. Obsessive compulsive disorder (OCD), panic disorder, and generalized anxiety disorder (GAD) are seen to correlate with patients with migraine in cross-sectional investigations [17]. Rates of abuse psychiatric disorders such as alcohol abuse disorder are also seen to be higher in migraineurs [17]. The presence of mental health conditions poses a risk factor for transformation of acute migrainosus into a chronic form [17]. In this study, 30% (n=62) of patients disclosed having a past psychiatric history which emphasizes the importance of addressing mental health comorbidities in pediatric headache management to mitigate risks of both chronic pain and substance use (Table 3).

Only one-fifth (20%) of the patients in this study had seen a neurologist which underscores a significant gap in access to specialty care, and may contribute to suboptimal headache management and increased reliance on emergency department (ED) services (Table 2). Timely access to neurologic care has been shown to play a critical role in accurately diagnosing and effectively managing headache disorders, reducing the frequency and severity of headaches, and preventing the chronification of pain [14]. Seeing a neurologist on a regular basis may reduce the need for pharmacologic treatments for migraine management as adherence to a treatment plan using non-pharmacologic treatments may also reduce migraine frequency [8]. Early intervention by specialists can facilitate tailored treatment plans, including preventive strategies, which are particularly important for reducing the need for acute care and mitigating the risk of opioid use [16]. However, this may be unfeasible due to economic concerns, health insurance barriers especially for those without insurance, lack of family support, and dependent on the number of neurologists available within the area. If individuals do not have access to a general practitioner, it may also be more difficult to obtain a referral to a neurologist as well.

Barriers to specialty care, such as limited availability of pediatric neurologists, socioeconomic disparities, and systemic issues within healthcare access, are well-documented and disproportionately affect underserved populations [15]. Poor access to specialized headache management can lead to delayed or incorrect diagnoses, inadequate treatment, and higher utilization of acute care settings like EDs. In contrast, comprehensive headache care has been associated with improved patient outcomes, fewer ED visits, and reduced healthcare costs over time [13].

Among patients with migraine in Sutter Health primary care, those who were seen in neurology were more likely to receive acute and preventive migraine medications than those who did not see a neurologist [8]. This study has several strengths. It addresses a gap in prior literature by focusing on pediatric migraine treatment, particularly in the emergency department setting. While most migraine-related ED research focuses on adult populations, this study contributes valuable data to the limited body of knowledge on pediatric migraine care and treatment. Additionally, it highlights important correlations between gender, mental health, and migraine comorbidities, supporting and expanding upon findings from the few existing studies on these associations in the pediatric age group.

However, we acknowledge the limitations of our study as well. Its retrospective design inherently restricts data analysis to the information available in electronic medical records, which may have gaps or inconsistencies in documenting relevant past medical history or findings. Specifically, we recognize that electronic medical records may not provide proper documentation for past psychiatric and mental health history as this category is often self-reported in an ED encounter. Furthermore, the study population was not randomized, as patients were selected based on their receipt of opioids during their ED encounter and a chief complaint of headache. These factors may introduce selection bias and limit the generalizability of the findings.

Despite great strides in addressing the opioid addiction and overdose epidemic, the U.S. continues to see significant rates of abuse [6] and there is limited research on this health crisis among the pediatric and adolescent populations. According to population-based findings, about 769,000 adolescents misused prescription opioids, 103,000 adolescents had an Opioid Use Disorder in the past year and approximately 1 million adolescents (or about 1 in 24) needed treatment for a substance use disorder [6]. Opioids successfully treat acute postsurgical and postprocedural pain, but they are not recommended as abortive treatments for common pediatric disorders like migraine. Yet according to the American Migraine Prevalence and Prevention (AMPP) study, about 30% of respondents reported opioid use for migraine at home and in the emergency department (ED), 59% of visits for migraine involved opioid administration or prescription [7].

Thus this study is both relevant and important. We have had study-supported guidelines for much safer and more effective headache treatment options for years that continue to be updated. If we can better understand the risk factors that drive opioid prescriptions in the emergency department, then we may be able to better prepare providers to recognize these pitfalls, accurately and effectively manage pain from headache, and ultimately reduce rates of addiction. If primary care physicians refer migraineurs to neurologists, appropriate abortive and prophylactic migraine medications can be prescribed. Primary care physicians should also ascertain potential mental health comorbidities, especially depression, and refer to psychology and/or psychiatry as needed.

5. Conclusion

Youth receiving opioids for headache treatment were predominantly female, frequently had significant mental health comorbidities, and often lacked access to neurologic specialty care. These findings underscore the importance of early identification of at-risk youth and improved access to specialized care, which could enhance headache management, address underlying comorbidities, and reduce reliance on emergency department visits for this population.

Abbreviations

NS	Nasal Spray
ODT	Orally Disintegrating Tablet
ED	Emergency Department
IFHC	Inova Fairfax Hospital for Children
AMPP	American Migraine Prevalence and Prevention

Author Contributions

Rhea Zahir: Conceptualization, Formal Analysis, Investigation, Methodology, Writing — original draft

Olivia Gould: Conceptualization, Resources, Methodology, Investigation

David Kepplinger: Data Curation, Visualization, Formal Analysis, Software

Rhiya Dave: Data curation

Tarannum Lateef: Conceptualization, Project administration, Resources, Supervision

Funding

No external funding was received.

Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] DeVries, A., Koch, T., Wall, E., Getchius, T., Chi, W., & Rosenberg, A. (2014). Opioid use among adolescent patients treated for headache. Journal of Adolescent Health, 55, 128.

[2] Meckler, G., Sheridan, D., Charlesworth, C., Lupulescu-Mann, N., Kim, H., & Sun, B. (2019). Opioid prescribing practices for pediatric headache. Journal of Pediatrics, 204.

[3] Oskoui, M., Pringsheim, T., Holler-Managan, Y., Potrebic, S., Billinghurst, L., David Gloss, D. et al. (2019). Practice guideline update: Acute treatment of migraine in children and adolescents. American Academy of Neurology.

[4] Raucci U, Della Vecchia N, Ossella C, Paolino MC, Villa MP, Reale A, Parisi P. Management of Childhood Headache in the Emergency Department. Review of the Literature. Front Neurol. 2019 Aug 23; 10: 886. https://doi.org/10.3389/fneur.2019.00886

[5] Prezioso G, Suppiej A, Alberghini V, Bergonzini P, Capra ME, Corsini I, De Fanti A, Fiumana E, Fornaro M, Marangio L, Ricciardelli P, Serra L, Cordelli DM, Esposito S, The Emilia-Romagna Headache Study Group. Pediatric Headache in Primary Care and Emergency Departments: Consensus with RAND/UCLA Method. Life (Basel). 2022 Jan 19; 12(2): 142. https://doi.org/10.3390/life12020142

[6] Substance Abuse and Mental Health Services Administration. (2018). Key substance use and mental health indicators in the United States: Results from the 2017 National Survey on Drug Use and Health (HHS Publication No. SMA 18-5068, NSDUH Series H-53).

[7] Lipton, R. B., Buse, D. C., Friedman, B. W., Feder, L., Adams, A. M., Fanning, K. M., Reed, M. L., & Schwedt, T. J. (2020, August 4). Characterizing opioid use in a US population with migraine: Results from the cameo study. Neurology. https://doi.org/10.1212/WNL.0000000000009324

[8] Pressman, A. R., Buse, D. C., Jacobson, A. S., Vaidya, S. J., Scott, A. B., Chia, V. M., Szekely, C. A., Stewart, W. F., & Lipton, R. B. (2021). The migraine signature study: Methods and baseline results. Headache, 61(3), 462–484. https://doi.org/10.1111/head.14033

[9] Breslau, N., Schultz, L. R., Stewart, W. F., Lipton, R. B., & Welch, K. M. A. (1994). Comorbidity of migraine and depression: Investigating potential etiologic relationships. Neurology, 44(10 Suppl 7), S 17–S 22.

[10] Lipton, R. B., Hamelsky, S. W., Kolodner, K. B., Steiner, T. J., Stewart, W. F. (2000). Migraine, quality of life, and depression: A population-based case-control study. Neurology, 55(5), 629–635.

[11] Goldstein, B. I., Bukstein, O. G., & Miklowitz, D. J. (2009). Comorbid substance abuse in bipolar disorder: Phenomenology and treatment considerations. Bipolar Disorders, 11(Suppl 3), 7–19.

[12] McDermott, B. M., & Goldstein, R. D. (2013). The long-term sequelae of adolescent depression: Substance abuse and suicidality. Journal of Clinical Psychology in Medical Settings, 20(3), 237–248.

[13] Friedman, B. W., Serrano, D., Reed, M., Diamond, M., & Lipton, R. B. (2009). Use of the emergency department for severe headache. A population-based study. Headache, 49(1), 21–30. https://doi.org/10.1111/j.1526-4610.2008.01282.x

[14] Bigal, M. E., & Lipton, R. B. (2009). Overuse of acute migraine medications and migraine chronification. Current pain and headache reports, 13(4), 301–307. https://doi.org/10.1007/s11916-009-0048-3

[15] Zuckerman, K. E., Perrin, J. M., Hobrecker, K., & Donelan, K. (2013). Barriers to specialty care and specialty referral completion in the community health center setting. The Journal of pediatrics, 162(2), 409–14.e1. https://doi.org/10.1016/j.jpeds.2012.07.022

[16] Dowell, D., Ragan, K. R., Jones, C. M., Baldwin, G. T., & Chou, R. (2022). CDC Clinical Practice Guideline for Prescribing Opioids for Pain - United States, 2022. MMWR. Recommendations and reports: Morbidity and mortality weekly report. Recommendations and reports, 71(3), 1–95. https://doi.org/10.15585/mmwr.rr7103a1

[17] Antonaci, F., Nappi, G., Galli, F., Manzoni, G. C., Calabresi, P., & Costa, A. (2011). Migraine and psychiatric comorbidity: a review of clinical findings. The journal of headache and pain, 12(2), 115–125. https://doi.org/10.1007/s10194-010-0282-4