Trends in Initiate Pediatric Opioid Prescriptions in Rhode Island: 2017–2021

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ABSTRACT

OBJECTIVE: To analyze recent trends in initiate pediatric opioid prescriptions dispensed in Rhode Island.

METHODS: All Rhode Island residents aged 0–17 years with an initiate opioid prescription dispensed between January 1, 2017 and December 31, 2021 were obtained from the Rhode Island Prescription Drug Monitoring Program. Analyses were conducted to investigate trends related to patient demographics, prescription characteristics, diagnosis codes, and prescriber type.

RESULTS: From 2017–2021, there was a decrease in the number of unique pediatric patients dispensed an initiate prescription, the number of initiate pediatric opioid prescriptions, and the initiate prescription dosage. Initiate opioid prescriptions were primarily related to dental-related diagnoses, and dentists and oral and maxillofacial (OMF) surgeons comprised the largest category of prescriber type.

CONCLUSION: Initiate pediatric opioid prescriptions have decreased in Rhode Island in recent years. However, there remain opportunities to educate prescribers on reducing opioid exposure to vulnerable populations, including the use of alternate analgesics.

KEYWORDS: opioids, prescription drugs, pediatrics, Rhode Island

INTRODUCTION

A significant portion of the research and outreach programs addressing opioid misuse and overdose in the US primarily focus on adult populations; however, the deleterious impact of this epidemic on children and adolescents merits additional consideration. A study of national mortality data from the CDC for ages 0–19 reported approximately 9,000 pediatric opioid poisoning deaths between 1999 and 2016, representing a 286% mortality rate increase during that time.[1] The vast majority of these deaths were unintentional, and most involved prescription opioids. While mortality rates decreased in the following years, prescription opioids remained the top substances implicated in pediatric drug overdose deaths.[2]

Previous studies of pediatric opioid prescriptions have identified potential risk factors and patterns for this population. A study of children and young adults in the US in 2019 found that approximately 80% of opioid prescriptions were for opioid-naïve patients.[3] Nearly half of these prescriptions were considered "high-risk", based on metrics including days-supply, drug type, morphine milligram equivalents (MMEs), and the presence of benzodiazepine prescriptions. This research group also found that increased daily dosage, co-prescriptions with benzodiazepines, and use of extended-release/long-acting drugs were associated with higher risk of subsequent opioid overdose.[4] Risks presented by opioid prescriptions have also been identified in individual state analyses; 2016–2018 data from North Carolina Medicaid showed that nearly half of opioid-related adverse events in children were precipitated by a filled opioid prescription within the previous six months, often only days prior to the incident, and 1999–2014 data from Tennessee revealed that nearly 90% of reported opioid-related adverse events in children were related to their own prescription, and that approximately 70% of those events occurred when the patient was using the prescription properly.[5-6]

The source and purpose of opioid prescription is also an important point of consideration for pediatric populations. Some of the aforementioned studies reported that the highest percentage of pediatric opioid prescriptions analyzed were from dentists and surgeons, and furthermore that a small subset of providers were responsible for a significant volume of prescriptions, including those considered "high-risk" prescriptions.[4,6] Another study of pediatric dental patients found that those who filled an opioid prescription had higher rates of subsequent opioid prescriptions as well as future events of opioid misuse.[7] Use of opioids among family members may also be a risk factor for this group; a study of approximately 350,000 adolescents who were prescribed opioids found a higher rate of subsequent persistent use in patients who had a family member exhibiting long-term opioid use.[8]

Data from the Rhode Island Prescription Drug Monitoring Program (PDMP) have shown decreases in number of total opioid prescriptions, high-dose opioid prescriptions, and new opioid prescriptions across all age groups in recent years.[9] The purpose of this study was to conduct a more detailed analysis of initiate pediatric opioid prescription data

to investigate trends in patient demographics, prescription characteristics, diagnosis codes, and prescriber types. This could additionally help highlight any unique risks regarding opioid prescribing in pediatric patients compared to the general population, as well as identify potential patterns of overprescribing for particular diagnoses or within certain prescriber types.

METHODS

Study Design and Population

For this analysis, we utilized data from the RI PDMP from April 1, 2016 to December 31, 2021. Our study population included all RI residents that were dispensed their first opioid prescription by a retail pharmacy with a controlled substance registration, when they were a minor (aged 0–17 years) during the analysis period. Individuals were excluded from the analysis if they received an opioid prescription greater than 30 days prior to January 1st, 2017. Buprenorphine prescriptions prescribed for opioid use disorder treatment were excluded from this analysis.

An initial opioid prescription is defined in RI as either (1) the patient's first and only opioid prescription or (2) subsequent opioid prescriptions that started at least 30 days after the patient's previous opioid prescriptions. This was determined by using the prescription fill date and the days' supply of medication dispensed. A patient's first exposure to opioid prescriptions was flagged and for patients with more than one initial opioid prescription during the analysis period, one prescription per year was randomly selected for inclusion in the analysis of patient demographics to maintain independence of observations.

Data Analysis

Patient demographic variables, including age and sex, were reported as recorded in the PDMP for all initiate pediatric opioid prescriptions, as well as characteristics of each initiate opioid prescription such as: opioid type and prescriber type. Prescriber type was also analyzed temporally across the 5-year time frame. Mean MME and days' supply were calculated, as well as their respective interquartile ranges, for all initiate pediatric opioid prescriptions. International Classification of Diseases-10 (ICD-10) codes were matched to their corresponding diagnoses. Prior to 2018, providers in RI were not required to indicate a diagnosis code on a patient's opioid prescription.[9] This analysis is restricted to ICD-10 codes from 2020-2021, as years prior to this have counts of missing data. In addition to this, initial opioid prescriptions filled by pharmacies for which ICD-10 codes were missing for more than 80% of their dispensed opioid prescriptions were excluded from the analysis, as to avoid biased diagnostic entries. For brevity, only the top five diagnoses out of 102 were included in this analysis.

To determine if first exposure pediatric opioid prescriptions differ from overall initiate pediatric opioid prescriptions, we conducted a sensitivity analysis analyzing the above metrics on first exposure pediatric initiate prescriptions. Patient demographics, prescription characteristics and diagnostic codes were compared between first exposure initiate prescriptions and non-first exposure initiate prescriptions using Chi-Square test of association. In addition, differences in mean MME and days' supply across years within first exposure initiate prescriptions were compared. Based on the homogeneity of the samples, if samples were found to have unequal variances, then we performed a Welch's test. Otherwise, an Analysis of Variance (ANOVA) test was performed. If applicable, a Tukey-Kramer test was performed to assess differences between samples. For all tests, p-values less than .05 were statistically significant.

RESULTS

The number of unique pediatric initiate users dropped from 3,368 in 2017 to 2,231 in 2021 (33.8%; **Figure 1**). When compared to RI pediatric population, the percent of minors being dispensed an initiate opioid prescription has dropped 40.5% between 2017 and 2021 (**Table 1**). Of these users, the distribution of binary sex remained equal, and 79.3% of users were between the ages of 12 and 17 years. All age categories have a downward trend from 2017 to 2020; however, ages 0-5 and 12-17 are showing increasing trends from 2020 to 2021 (**Table 1**). When comparing first exposure users and non-first exposure users, the relationship between binary sex and user type was significant, $\chi 2$ (1, N=12,808) = 25.2, p <.0001). First exposure users were more likely to be male and non-first exposure users were more likely to be female. There was also a significant relationship between age category and user type, $\chi 2$ (2, N=12,808) = 73.4, p <.0001). First exposure users were more likely to be between the ages of zero and 11-years-old when compared to non-first exposure users (**Table 2**).

Figure 1. Number of Initiate Pediatric Opioid Prescription Users in RI, by Quarter, 2017–2021.

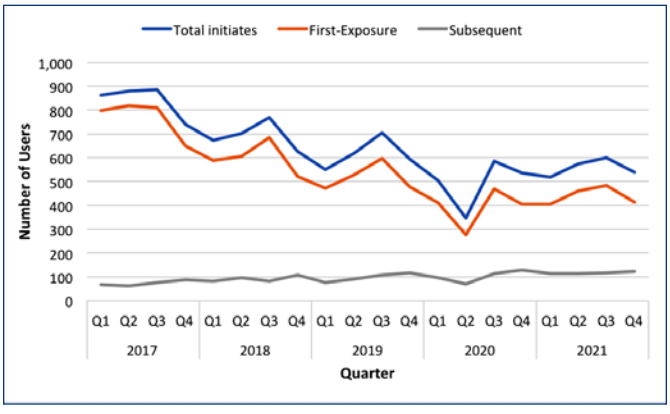


Table 1. Demographics of initiate opioid prescription users aged 0–17 years, 2017–2021.

	2017 N (%)	2018 N (%)	2019 N (%)	2020 N (%)	2021 N (%)	Total
Sex						
Female	1,621 (48.1)	1,351 (48.8)	1,241 (50.3)	1,023 (51.9)	1,082 (48.5)	6,316 (49.3)
Male	1,747 (51.9)	1,418 (51.2)	1,226 (49.7)	949 (48.1)	1,149 (51.5)	6,489 (50.7)
Age						
0–5	241 (7.2)	187 (6.8)	138 (5.6)	87 (4.4)	127 (5.7)	780 (6.1)
6–11	610 (18.1)	486 (17.6)	325 (13.2)	247 (12.6)	198 (8.8)	1,866 (14.6)
12–17	2,517 (74.7)	2,096 (75.7)	2,005 (81.2)	1,638 (83.1)	1,906 (85.4)	10,162 (79.3)
Proportion of RI minors dispensed an initiate opioid prescription (%)						
	1.3	1.0	0.9	0.7	0.8	—

Table 2. Demographics of initiate opioid prescription users aged 0–17 years during their initial opioid prescription in RI, 2017–2021.

	First Exposure	Subsequent	Chi-sq		
			df	Value	p
Total	10,880	1,928			
Sex			1	25.2	<.0001*
Female	5,265 (48.4)	1,051 (54.6)			
Male	5,615 (51.6)	874 (45.4)			
Age Category			2	73.4	<.0001*
0–5	718 (6.6)	62 (3.2)			
6–11	1,667 (15.3)	199 (10.3)			
12–17	8,495 (78.1)	1,667 (86.5)			

*Indicates a p-value that is statistically significant ($\alpha = 0.05$).

Table 3. Characteristics of pediatric initiate opioid prescriptions, 2017–2021.

	First Exposure Rx	Subsequent Rx	Total	Chi-sq		
				df	Value	p
Total	10,880	2,226	13,106			
Opioid Prescribed				9	1,051.9	<.0001*
Hydrocodone	4,928 (45.3)	561 (25.2)	5,489 (41.9)			
Oxycodone	4,063 (37.3)	1,072 (48.2)	5,135 (39.2)			
Codeine	1,569 (14.4)	246 (11.1)	1,815 (13.9)			
Tramadol	218 (2.0)	98 (4.4)	316 (2.4)			
Morphine	60 (0.6)	172 (7.7)	232 (1.8)			
Hydromorphone	23 (0.2)	56 (2.5)	79 (0.6)			
Buprenorphine†	10 (0.1)	14 (0.6)	24 (0.2)			
Methadone	<5	6 (0.3)	<5			
Fentanyl	8 (0.1)	0	8 (0.1)			
Prescriber Type				4	540.2	<.0001*
Dentist/OMF Surgeon	4,489 (41.3)	474 (21.3)	4,963 (37.9)			
Physician	1,853 (17.0)	746 (33.5)	2,599 (19.8)			
Adv Nurse	887 (8.2)	222 (10.0)	1,109 (8.5)			
PA	321 (3.0)	155 (7.0)	476 (3.6)			
Missing	3,330 (30.6)	269 (28.3)	3,959 (30.2)			
Diagnosis a, b, †, c				8	167.8	<.0001
Diseases of oral cavity and salivary glands	512 (18.4)	69 (8.4)	581 (16.1)			
Injuries to the knee and lower leg	142 (5.1)	65 (7.9)	20 (5.7)			
"Other" acute post-procedural pain	160 (5.8)	37 (4.5)	197 (5.5)			
Joint disorders (including dentofacial anomalies and disorders of the jaw)	78 (3.8)	69 (8.4)	147 (4.1)			
Injuries to shoulder and upper arm	93 (3.3)	30 (3.6)	123 (3.4)			

Note: Initiate prescriptions are defined as either the patient's first opioid prescription or an opioid prescription that started ≥30 days after the patient's previous opioid prescription ended.

*Indicates a p-value that is statistically significant ($\alpha = 0.05$).

† Excludes buprenorphine products that are only FDA-approved for medication-assisted treatment of opioid use disorder

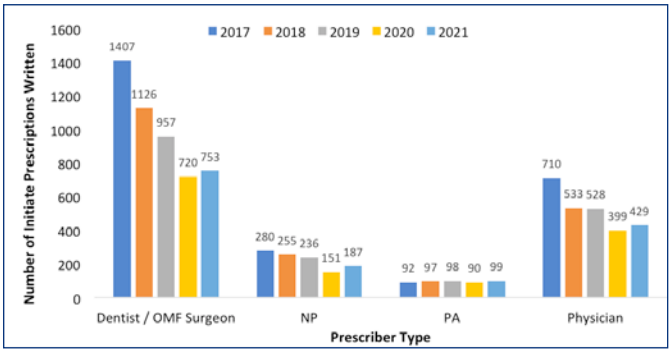
a Excludes n=1,193 prescriptions (33.1%) missing a diagnosis code.

b Mandatory ICD-10 reporting by prescribers to pharmacies on opioid prescriptions was introduced in July 2018. The Prescription Drug Monitoring Program began collecting ICD-10 codes in April 2019; pharmacies are not required to report the ICD-10 codes.

c Data from 2020-2021, and pharmacies with >80% of ICD-10 codes missing were excluded from analysis.

Overall, the number of initiate pediatric opioid prescriptions dispensed dropped from 3,431 in 2017 to 2,300 in 2021 (33.0%). Within this, the number of first exposure initiate pediatric opioid prescriptions dropped from 3,076 in 2017 to 1,763 in 2021 (42.7%). The two most common initiate opioid prescriptions dispensed to minors were hydrocodone and oxycodone, making up 81.1% of all prescriptions. In addition, dentists and oral and maxillofacial (OMF) surgeons prescribed 37.9% of all pediatric initiate opioid prescriptions dispensed between 2017 and 2021 (**Table 3**). Pediatric initiate opioid prescriptions prescribe by dentists, OMF surgeons and physicians have decreased over the last 5 years, while prescriptions written by nurse practitioners (NPs) and physicians assistants have fluctuated (**Figure 2**). When comparing first exposure pediatric initiate opioid prescriptions and non-first exposure initiate opioid prescriptions, there was a significant relationship between opioid type and user type, $\chi 2$ (9, N=13,106) = 1,051.9, p <.0001. First exposure prescriptions were more likely to include hydrocodone, codeine, and fentanyl. The relationship between prescriber type and user type was also significant, $\chi 2$ **(4, N=**13,106) = 540.2, p <.0001. First exposure prescriptions were more likely to be prescribed by a dentist, or OMF surgeon when compared to non-first exposure prescriptions (**Table 3**).

Figure 2. Number of Initiate Opioid Prescriptions Dispensed by Prescriber Type, 2017–2021 [a]



a Excludes n=3,959 prescriptions (30.2%) missing prescriber type.

Table 4. ANOVA Comparing Mean MME and Days' Supply of First-Exposure Initiate Pediatric Opioid Prescriptions by year, 2017–2021.

	Days' supply	MME
Mean		
2017	4.1	26.0
2018	3.9	22.5
2019	3.4	22.5
2020	3.3	22.4
2021	3.2	23.5
F statistic	4.2	2.03
p-value	.0018	<.0001

Pediatric initiate opioid prescriptions dispensed between 2017 and 2021 had a mean days' supply of 3.6 days. When comparing mean days' supply of first exposure pediatric initiate opioid prescriptions across all 5 years, the variance across the samples was equal and so, a one-way ANOVA was used. We rejected the null hypothesis that days' supply was the same across all years (F=4.2, p=.0018, **Table 4**).

Pediatric initiate opioid prescriptions dispensed between 2017 and 2021 had a mean MME of 23.8 When comparing mean MME of first exposure pediatric initiate opioid prescriptions across all 5 years, the variance across the samples was unequal (p=.089). We rejected the null hypothesis that stated that mean MME was the same across all years (F=2.03, p<.0001, **Table 4**).

The most common diagnosis for a pediatric initiate opioid prescription was for "diseases of oral cavity and salivary glands", which accounted for 16.1% of prescriptions (**Table 3**). Diagnoses for oral cavity and salivary gland disease increased from 247 to 334 (35.4%) from 2020 to 2021. First exposure pediatric initiate opioid prescriptions are more likely to be prescribed with diagnosis codes for "diseases of oral cavity and salivary glands", "Other acute post-procedural pain", and "joint disorders (including dentofacial anomalies and disorders of the jaw)", $\chi 2$ **(8, N=**3,606) = 167.8, p <.0001 (**Table 3**). About 209 patients under the age of 12 years old were dispensed either Codeine or Tramadol as a first-exposure initial prescription and 196 (93.8%) of these patients were first-exposure users. Roughly 45.7% of these prescriptions were prescribed by physicians, and 39.1% by dentists or OMF surgeons.

DISCUSSION

This analysis found an overall decline in initiate pediatric opioid prescribing patterns in Rhode Island between 2017 and 2021. Specifically, reductions were observed in number of unique pediatric initiate users, number of initiate pediatric opioid prescriptions, mean days' supply, and mean MMEs. These trends generally match those seen across all age groups within the state.[10]

First exposure users were more likely to be male and between the ages of 0–11 compared to non-first exposure users. Dentists and OMF surgeons comprised the leading group of initiate pediatric opioid prescriptions, followed by physicians, and first-exposure prescriptions were more likely to be prescribed by these practices compared to other prescriber types. Likewise, "diseases of oral cavity and salivary glands" was the most common diagnosis type for initiate prescriptions. Prescribing patterns for these groups followed the overall trend, with reductions in initiate prescriptions over the study period, whereas prescribing trends among NPs and physicians' assistants demonstrated more fluctuation.

When analyzing drug type, hydrocodone and oxycodone comprised the majority of dispensed initiate prescriptions. These were followed by codeine and tramadol. Of important note, approximately 200 patients under the years of 12 were dispensed codeine or tramadol, despite these drugs being contraindicated for this age group by the FDA.[11]

These findings generally complement pediatric opioid prescribing patterns observed in similar state and nationwide studies. A recent analysis of dispensing in South Carolina found a significant decline in opioid prescribing rates amongst children, although an observed reduction in MMEs was limited to ages 0–9.[12] Another study of an all-payer opioid prescription database noted a decrease in opioid prescription rates for ages 25 and younger between 2006–2018.[13] Higher rates of decline were seen in more recent years, which may be reflective of the rise of national initiatives designed to curb the opioid overdose epidemic.

When considering dental-related prescriptions specifically, an investigation using Medicaid claims database data for 2012-2019 reported an overall reduction in dental-related pediatric opioid prescriptions, although also noted that dental professions made up an increasingly higher percentage of pediatric opioid prescribers.[14] The findings from the current analysis also compliment recent all-ages data from Rhode Island, which showed substantial decreases in dental-related opioid prescriptions as well as number of dental providers actively prescribing opioids.[15] However, the US continues to be a significant dispenser of opioids for dental-related procedures; for example, a study of prescriptions by dentists in 2016 found that the proportion of those that were for opioids was 37 times greater among US dentists compared to their English counterparts.[16]

Although this analysis, along with similar studies, suggests an encouraging trend of reductions in pediatric opioid prescriptions, other investigations highlight lingering potential issues. One of the aforementioned studies of pediatric opioid prescribing in the US found that approximately 42% of prescriptions for opioid-naïve children exceeded a 3-day supply, and, similar to our findings, children were still being prescribed codeine and tramadol despite federal guidelines.[3] Many states have implemented cap-laws that place limits on dose and/or duration of opioid prescriptions, however a recent study found no association between implementation of these laws and changes in opioid dispensation patterns in children and adolescents, suggesting the need for additional measures.[17] The consistent and proper use of Prescription Drug Monitoring Programs, as well as patient education on the risks of opioids, may also encourage safer prescribing patterns. One survey of dentists found that inconsistent PDMP implementation and lack of patient education was associated with higher rates of opioid prescribing, and another reported that, despite the comparable efficiency of non-opioid analgesics, many patients perceived opioids to be preferable for pain management.[18-19] In both studies, only approximately half of respondents reported consistent use of their state's PDMP.

In November 2022, the Centers for Disease Control and Prevention (CDC) published updated guidelines for prescribing opioid for pain management. These guidelines highlight that acute pain can often be managed with the use of non-opioid medications, and that prescribers should maximize the utility of these non-opioid pharmacologic treatments, including NSAIDs and acetaminophen when appropriate.[20] Although the intended target for the guidelines is adult patients, the authors recommend that treatment for minors also aligns with the guidelines to ensure safe and effective pain management.

In 2019, the Rhode Island Department of Health developed the PharmD academic detailing program to deliver educational sessions to Rhode Island prescribers about acute pain management best practices. RIDOH's trained pharmacist encourages prescribers to utilize non-opioid treatment options first. Additionally, prescribers are provided with guidance on prescribing opioids appropriately and safely for eligible patients where the benefits outweigh the risks. Regarding subsequent exposures, RIDOH has provided advice including the re-evaluation of patients after completion of a post-operation opioid prescription, as well as safely titrating patients off opioids. Guidance related to contraindicated substances for minors such as tramadol and codeine follow FDA and CDC recommendations.

The primary strength of this analysis is the robustness of the dataset. The RI PDMP functions as a centralized system for collecting data on all controlled substances dispensed by retail pharmacies with a Controlled Substance Regulation (CSR) within the state. Furthermore, in July 2016, all dispensers were automatically registered within the PDMP. Additionally, Schedule V substances and opioid agonists were added to reporting requirements, and reporting timeline was reduced to one business day.[9] Therefore, the vast majority of the data in this investigation fell within these regulations, contributing to completeness of the dataset.

One limitation of this study is that the RI PDMP only carries data on dispensed substances, and therefore does not capture prescriptions that are prescribed but not dispensed to the patient. Additionally, mandatory ICD-10 reporting by prescribers to pharmacies on opioid prescriptions was introduced in July 2018, and the PDMP did not begin collecting ICD-10 codes until April 2019, which limited the scope of the diagnostic analyses conducted.

Overall, there has a been a decline in initiate pediatric opioid prescribing in Rhode Island, including amongst "high-prescriber" professions. Despite this positive trend, there remain potential avenues for future reduction in pediatric opioid use. Additional consideration should be given to first-exposure patients, as these tend to be younger than opioid-exposed individuals. Prescribers should aim to avoid prescribing contraindicated opioid drugs in children, and further

consideration should be given to non-opioid analgesics including non-steroidal anti-inflammatory drugs (NSAIDs), as per CDC recommendations.[20] The Rhode Island PDMP continues to serve as a helpful tool to promote individual patient safety, as well as provides insight into prescribing patterns and behaviors that can help inform best practices.

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Ethics Statement

This study was part of RIDOH's response to the opioid overdose epidemic in Rhode Island and did not require institutional review board approval. This analysis is limited to prescriptions dispensed vs. prescribed, and overlap was assumed based on the dispensed date and day supply, which may inaccurately represent prescribing practices. All authors approve this work, and we have no conflicts of interest to disclose.

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Disclaimer

The views expressed herein are those of the authors and do not necessarily reflect the views of the Bureau of Justice Assistance.

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