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## Opioid Prescriptive Practices in Adolescents

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### Keywords

opioid epidemic, narcotics, adolescent addiction, non-prescription opioid abuse, opioid prescribing pattern

### Disciplines

Nursing

### Comments

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## Opioid Prescriptive Practices in Adolescents

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## **Abstract**

### *Objective*

Assess changes in prescribing practices in the adolescent population after common knee surgeries in light of the enactment of Pennsylvania Opioid Prescribing Law Act 125.

### *Methods*

An analysis of postoperative opioid morphine milligram equivalents (MMEs), number of opioid pills, and total milligram dosages of nonsteroidal anti-inflammatory drugs (NSAIDs) prescribed to adolescents after common knee surgeries was performed. An analysis comparing MMEs to the number of opioid pills prescribed to patients specifically undergoing anterior cruciate ligament (ACL) surgery was also conducted.

### *Results*

There was a statistically significant decrease in the number of opioid pills and MMEs prescribed postoperatively in 2017 compared to 2014. There was a statistically significant increase in the number of opioid pills prescribed and MMEs postoperatively for those who received a femoral nerve catheter compared to those who did not receive a femoral nerve catheter in 2017.

### *Conclusion*

While there is a general trend that fewer opioid pills and more NSAIDs are being prescribed postoperatively, lowering MMEs, when comparing data from 2014 to 2017, doctors prescribed more postoperative opioid pills for patients who received femoral peripheral nerve catheters, than those who did not receive femoral peripheral nerve catheters.

**Key Words:** Opioid epidemic, narcotics, adolescent addiction, non-prescription opioid abuse, opioid prescribing pattern.

## **Introduction**

The Centers for Disease Control and Prevention (CDC) declared an opioid epidemic in the United States in 2011, one that affects Americans of all races, ethnicities, and socioeconomic statuses.<sup>1</sup> Rudd et al reported that from 2000-2014 more than 500,000 people in the United States died due to overdosing and that 61% (305,000) of these overdoses were due to opioid drugs alone.<sup>2</sup> Oxycodone and hydrocodone were the most common drugs related to these overdoses and are also the most common drugs prescribed for postoperative pain. Rudd et al also reported that the number of prescriptions for opioid medications have quadrupled since 1999.<sup>2</sup>

Additionally, the economic burden of this epidemic is growing, costing the United States more than \$78.5 billion dollars annually, and public sources pay for nearly 25% of it.<sup>3</sup> According to Taylor et al., the opioid crisis is largely due to a long history of poorly managed prescription practices in healthcare.<sup>4</sup>

But opioid abuse is not the only consequence of liberal opioid prescription practices: there has also been a similar increase in heroin abuse. Compton et al estimated that while only 4% of those who misuse prescription opioids move on to heroin use, 70% of those who use heroin started off misusing prescription opioids.<sup>5</sup> They also reported that heroin use since 2007 has increased by over 145% and that deaths from heroin overdose have more than quintupled.<sup>5</sup> Thus, the abuse of both heroin and prescription opioids have grown in parallel and at an alarming rate in the past decade, with the increase in the former largely due to heroin being a more potent, less expensive, and more easily acquired opioid compared to other drugs within the same class.<sup>5</sup> And while heroin is an opioid with unique chemical components, it affects the brain receptors the same way as prescription opioids; this leads a

certain percentage of the population, then, to switch from one source of opioid to another. The similar way in which heroin affects the brain, in conjunction with its low price, therefore makes prescription opioids a driving factor for heroin abuse.<sup>5</sup>

The pediatric population, specifically young teens from the ages of 13 through 17, also suffer with opioid abuse, yet the medical literature does not report on this epidemic as robustly as it does for adults. Allen et al<sup>6</sup> examined data from poison control centers in the United States and found that adolescents had the second highest rate of opioid exposures and the greatest number of intentional opioid exposures. Furthermore, Allen et al's work supports previous research which found that the adolescent population was the only age group in which intentional exposures were more common than unintentional exposures. This, then, emphasizes the importance of studying this vulnerable population.<sup>6</sup>

While the National Survey on Drug Use and Health<sup>7</sup> reported that 53% of adolescents who misused prescription opioids purchased or stole them from a friend or relative, another 35.4% misused their own valid prescriptions. Operative procedures often involve a significant amount of postoperative pain, which can lead to physicians over-prescribing opioids and, consequently, to the misuse of opioid medications. Common knee surgery and anterior cruciate ligament (ACL) repair, which are some of the most frequently needed surgeries in the adolescent population, both require considerable pain control with recovery and therefore provide a distinct time in which adolescents can become addicted to opioid medications.<sup>4</sup> Taylor et al<sup>4</sup> found that of 100 adolescents who underwent ACL reconstruction performed by six sports medicine surgeons, the surgeons prescribed, on average, 60 oxycodone (5 mg) tablets per patient. These patients used only 36% of the pills prescribed and so 64% of excess pills remain unused in the patients' homes.<sup>4</sup> Of concern is the fact that

sixty-four percent of patients and families did not know how to dispose of the extra opioids properly, meaning that a significant number of these pills remain accessible and available for non-prescribed use.<sup>4</sup> This data underlines the great opportunity to decrease the number of opioids available for non-prescription by limiting the number of opioids prescribed after surgeries.

Both Sheridan et al and Gaither et al examined the number of prescriptions written for opioid medications in relation to, calls and visits to poison control centers, attempted suicides, and further illicit drug use within the adolescent community across the United States and both found a direct relationship.<sup>8,9</sup> From 1997 to 2012 there has been 140% increase in suicide or self-inflicted injury, a 176% increase in hospitalizations for opioid poisonings per 100,000 adolescents, and a 161% increase in poisonings from heroin.<sup>9</sup> These findings highlight the depth of the opioid epidemic in the adolescent community.

The state of Pennsylvania (PA) attempted to mitigate this epidemic by limiting opioid prescriptions for minors in 2016. Specifically, it enacted PA senate bill 1367 act 125, which restricts practitioners from prescribing minors more than a seven-day supply of opioids unless there is a documented medical opinion regarding why the patient needs more. Prior to this law there was no limit on the number of pills that could be prescribed to minors postoperatively. Few studies, though, have been done looking at changes in actual provider practice following enactment of the bill.

The primary aim of this study was to assess changes in prescribing practices for adolescents that underwent various arthroscopic knee surgeries after the enactment of Pennsylvania Opioid Prescribing Law Act 125. The average MMEs of opioid prescriptions

and the total number of opioid pills and NSAID milligram dosages prescribed in 2014 vs 2017 were analyzed.

Changes in provider practices for the years 2014 and 2017 with regard to the use of regional anesthesia in postoperative arthroscopic knee surgery patients was also evaluated. More specifically, comparing MMEs of postoperative opioid prescriptions for adolescents that underwent arthroscopic ACL surgery and received a femoral nerve catheter for postoperative pain control to those who did not receive a femoral nerve catheter in 2014 vs 2017.

## **Methods**

A retrospective cohort study was conducted of patients aged 13 to 17 who underwent common arthroscopic knee surgeries from February through September 2014 and from February through September 2017 at a large Pennsylvania pediatric hospital and its corresponding satellite sites. Data received was de-identified data from the institution's data warehouse, which included type of surgery, date of surgery, all post-operative prescriptions for the specific patient, and the type of peripheral nerve catheter utilized (if applicable). Inclusion criteria for this study was as follows: (1) Adolescents between 13 and 17 years of age and (2) patients undergoing common knee surgeries. Exclusion criteria for this study was as follows: (1) patients who underwent surgery more than once in the same year and/or appeared in both 2014 and 2017 data sets, and (2) as well as patients who received postoperative prescriptions with liquid medications. A total of 267 cases were identified with 155 of them involving the anterior cruciate ligament. In addition, a total of 107 cases involving ACL surgery utilized femoral nerve catheters.

Postoperative prescription opioids were standardized to MMEs. NSAIDs were summed to total milligram dosages. Examples of opioids include (but are not limited to) Vicodin®, OxyContin®, Percocet®, Demerol®, Dilaudid®, morphine, opium, and codeine. Prescribed MMEs were determined and analyzed for the included patients for the 2014 and 2017 sample groups. In addition, prescribed MMEs for individuals that underwent any knee surgery with anterior cruciate ligament (ACL) involvement with or without receiving a femoral peripheral nerve catheter were investigated.

## **Results**

A post hoc power analysis proved our study was able to achieve an 80.00% power to reject the null hypothesis of zero effect size when the population effect size is 0.46 and the significance level (alpha) is 0.050 using a two-sided two-sample method.

The non-parametric Mann-Whitney test was used to compare the total number of opioid pills prescribed postoperatively, opioid dosage prescribed postoperatively expressed in MMEs, and total NSAID dosage expressed in milligrams after all common surgical procedures in the data set. Comparing interquartile ranges (IQR) outlined the statistically significant decrease in number of opioid pills prescribed postoperatively and MMEs in 2017 ( $U=11042$ ,  $p=0.0003$ ) compared to 2014 ( $U=10991$ ,  $p=0.0003$ ). The median number of post-operative pills and MMEs prescribed in 2014 was 20 and 225 respectively (IQR: 28-50; IQR: 210-375) compared to 2017 with the same medians of 20 and 225 respectively (IQR: 20-40; IQR: 150-300) (Table 1). There was a statistically significant increase in NSAID total dosage in 2017 compared to 2014 ( $U=5430$ ,  $p<0.0001$ ). The median dosage of NSAIDs in 2014 was 1200 (IQR: 0-48000) compared to the 2017 median dosage of 48000 (IQR: 24000-72000) (Table 1).

When comparing opioid prescribing habits in relation to femoral peripheral nerve catheters, only surgeries involving the ACL were included in the Mann-Whitney test to standardize predicted postoperative pain. Results included no statistically significant difference in the number of opioid pills or mean MMEs prescribed postoperatively between those who did receive a femoral nerve catheter and those who did not receive a femoral nerve catheter in 2014. However, there was a statistically significant increase in the number of opioid pills and MMEs prescribed postoperatively for those who received a femoral nerve catheter compared to those who did not receive a femoral nerve catheter in 2017. (U=261.5,  $p<0.0001$ ; U=261.5,  $p<0.0001$ ). The median number of opioid pills and MMEs prescribed for patients who received a femoral nerve catheter in 2017 was 40 and 300 respectively (IQR: 30-40; IQR 225-300) compared to patients without femoral nerve catheters in 2017 with a median number opioid and MMEs of 27 and 203 respectively (IQR: 20-30; IQR 150-225) (Table 2). In addition, there was no significant difference in the number of opioid pills or MMEs in 2017 when compared to 2014 among patients who received nerve catheters. There was a significant decrease in number of opioid pills and MMEs prescribed postoperatively in 2017 compared to 2014 among patients who did NOT receive a nerve catheter (U=345.5,  $p=0.0018$ ; U=345.5,  $p<0.0002$ ). The median number of opioid pills and MMEs prescribed in 2017 was 27 and 203 respectively (IQR: 20-30; IQR 150-225) compared to 2014 in which the median number of opioid pills and MMEs prescribed was 33 and 243 respectively (IQR: 28-41 IQR: 210-303) (Table 3).

### **Limitations**

Limitations to this study include only collecting data from a single facility, thereby making results not generalizable to all facilities, weak support for causality, and lack of

knowledge of possible confounding institutional factors. In addition, there was a small sample size for 2014 and 2017 ACL surgeries without the use of peripheral nerve catheters (n=12 & n=36, respectively). Finally, it is difficult to standardized expected pain postoperatively due to the subjective manner of pain perception. While it was attempted to standardized pain expectation by choosing the same surgery, pain perception is still highly individualized.

## **Discussion**

The results of the analysis show that after common knee surgeries, there is a general trend that physicians are prescribing fewer postoperative opioid pills, lower MMEs, and more NSAIDs postoperatively in the population of interest when comparing data from 2014 to 2017. This is a promising finding and certainly what would be expected to see following the enactment of Pennsylvania Opioid Prescribing Law Act 125. However, when looking at how prescribing habits have changed when initiating multimodal pain control methods such as peripheral nerve catheters, our results highlight key issues.

The general trends when comparing this surgical population do not hold true. In fact, in 2017, patients who received femoral peripheral nerve catheters, a procedure done to decrease postoperative pain, received more postoperative opioid pills and higher average MMEs than those who did not receive femoral peripheral nerve catheters. Femoral nerve catheters carry the risk of infection, bleeding, migration of the catheter, and nerve damage. These risks are very low and there is a consensus that the benefit of superior pain control outweighs these very rare risks. In fact, Jeng et al<sup>10</sup> argued that retrospective studies showed that the incidence of nerve damage from peripheral nerve blocks were approximately 0.5%-1% and the incidence of hematoma formation was 5.7%-6.6% for femoral nerve catheters.

Infection rates from the same study show that local infection from peripheral nerve catheters occurred at a rate of 0-3.2%. Bacterial colonization of peripheral nerve catheters, however, can range from 7.5% to 57% depending on the location of the catheter.<sup>10</sup> When utilizing femoral nerve catheters, patients are typically sent home with the catheter to aid with pain control for the next 24-72 hours. When using this superior method of pain control, fewer postoperative opioids and lower average MMEs should be prescribed to decrease opportunity for excess opioids to enter the community. This is a relatively large oversight and needs to be addressed.

## **Conclusions**

New multimodal approaches to pain management have the potential to decrease greatly the number of excess opioids health care providers inadvertently distribute to the community. This study shows that while utilizing these new approaches, prescribing practices are not adapting quickly and physicians are prescribing the same number of opioids postoperatively. Patients are receiving the benefit of superior pain control, but the number of opioids in the community available for diversion continues to increase. Future research needs to address driving factors behind this prescribing discrepancy and possible solutions to fix this problem.

## **Implications**

Future research needs to help determine how prescribers are deciding to change prescriptive practices after femoral nerve catheters are administered and the appropriate postoperative dosing adjustments after initiation femoral nerve catheters, as well as how best to address the attitude prescribers have towards femoral nerve catheters and to educate them about their benefits. With new and evolving methods of pain control, using multimodal

approaches to decrease the necessity of opioid usage, providers must make sure postoperative prescribing practices evolve at the same time.

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**Table 1.** Prescriptions After All Common Knee Surgeries 2014 Vs. 2017

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	2014 (n=120)			2017 (n=147)			U Statistic	<i>P</i>
	Median	IQR		Median	IQR			
<hr/> <b>All Common Knee Surgeries</b>								
MME	225	210	375	225	150	300	10991	0.0003
Number of Opioid Pills	30	28	50	30	20	40	11042	0.0003
NSAIDS	12000	0	48000	48000	24000	72000	5430	<0.0001

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Abbreviations: IQR, interquartile ranking; MME, morphine milliequivalent; NSAIDS, nonsteroidal antiinflammatory drugs.

**Table 2.** Postoperative Prescriptions ACL Surgeries With Vs. Without Femoral Peripheral Nerve Catheters 2014 and 2017

	2014 (n=72)						U Statistic	P
	No Block (n=12)			Block (n=60)				
	Median	IQR		Median	IQR			
<b>ACL</b>								
MME	243	210	303	300	210	450	310	0.4409
Number of Opioid Pills	33	28	41	35	28	60	320	0.5336
NSAIDS	0	0	2400	19000	0	48000	293	0.2944
<hr/>								
	2017 (n=83)						U Statistic	P
	No Block (n=36)			Block (n=47)				
	Median	IQR		Median	IQR			
<b>ACL</b>								
MME	203	150	225	300	225	300	261.5	<0.0001
Number of Opioid Pills	27	20	30	40	30	40	261.5	<0.0001
NSAIDS	7200	66000	72000	36000	24000	62000	1256	0.0001

Abbreviations: ACL, anterior cruciate ligament; IQR, interquartile ranking; MME, morphine milliequivalent; NSAIDS, nonsteroidal antiinflammatory drugs.

**Table 3. Postoperative prescriptions ACL surgery With Vs. Without Femoral Peripheral Nerve Catheters 2014 Compared to 2017**

	2014		2017		U Statistic	P		
	Median	IQR	Median	IQR				
<b>No Block (n=48)</b>								
MME	243	210 303	203	150 225	345.5	0.0002		
Number of Opioid Pills	33	28 41	27	20 30	345.5	0.0018		
NSAIDS	0	0 2400	7200	66000 72000	65.5	0.0001		
<b>Block (n=107)</b>								
MME	300	210 450	300	225 300	1426.5	0.9190		
Number of Opioid Pills	35	28 60	40	30 40	1388.5	0.8913		
NSAIDS	19000	0 48000	36000	24000 62000	930.5	0.0023		

Abbreviations: ACL, anterior cruciate ligament; IQR, interquartile ranking; MME, morphine milliequivalent; NSAIDS, nonsteroidal anti-inflammatory drugs.