


# Home opioid use following cesarean delivery: How many opioid tablets should obstetricians prescribe?

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## Abstract

**Aim:** To quantify home opioid use after cesarean delivery and identify factors associated with increased opioid use.

**Methods:** A convenience sample of women discharged by postoperative day 2 following a term cesarean delivery of a singleton fetus from May 2015 to May 2016 were contacted 2 weeks post-partum and questioned regarding opioid use, pain control and pain expectations.

**Results:** Among 141 women included in the analysis, the median number of opioid tablets used was 36 (interquartile range 16–45) and the median number prescribed was 60 (interquartile range 42–65). Logistic regression identified operative time  $\geq 59.5$  min and number of opioid tablets prescribed as two factors independently associated with opioid use in the top quartile.

**Conclusion:** In the first 2 weeks post-partum, 75% of women used 45 or fewer opioid tablets. Operative time over 1 h and increased number of opioid tablets prescribed are factors associated with higher post-partum opioid use.

**Key words:** analgesics, opioid, cesarean section, drug prescriptions, postnatal care, practice patterns, physicians'.

## Introduction

According to the Centers for Disease Control (CDC), prescription opioid overdose death rates have more than tripled from 1999 to 2008 (1.4 vs 4.8 persons per 100 000, respectively, and 0.9 vs 3.7 female persons per 100 000, respectively).<sup>1</sup> To address the rising concern regarding the opioid abuse 'epidemic', the CDC released an issue brief recommending that health care providers follow evidence-based guidelines for prescribing opioids.<sup>2</sup>

The most common indication for a patient's initial opioid prescription is surgery.<sup>3</sup> This is likely related to the fact that opioid-based therapy regimens are the most commonly used treatment for postoperative pain. With cesarean deliveries (CD) being the most commonly performed surgery in the United States,<sup>4</sup> it

is important that obstetric providers prescribe opioids in a safe and effective way. However, as there is currently limited data<sup>5</sup> quantifying home opioid needs following CD, we have limited evidence on which to base our opioid prescribing practices—much less to establish evidence-based guidelines.

A lack of guidelines regarding the average number of opioid tablets that patients require following specific procedures or surgeries, forces physicians to rely on their 'best guess'. This subjective approach has led to overprescribing in many surgical specialties, as detailed in dermatologic,<sup>6</sup> orthopedic,<sup>6</sup> urologic,<sup>7</sup> obstetric<sup>5,8</sup> and gynecologic literature.<sup>9</sup>

Therefore, the primary aim of our study was to quantify the number of opioid tablets used by patients in the first 2 weeks following CD. A secondary aim was to identify factors available at the time of

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patient discharge that are independently associated with increased opioid use.

## Methods

We conducted a retrospective study using a convenience sample of women undergoing a CD at the University of Michigan Health System between May 2015 and May 2016. The study does not violate the policies and/or procedures established by the journal and received exempt status from the University of Michigan Institutional Review Board (HUM00098254). A list of patients who met study criteria were obtained from our departmental database every 2 weeks during the study period. Women were included if they were 18 years old or older and *status post* CD for a term, singleton gestation. Our aim was to survey a low-risk population of post-partum women. Exclusion criteria included less than 37 weeks gestational age at delivery, multifetal gestation, intrauterine fetal death/still birth or any other complications requiring the infant and/or patient to still be hospitalized at 2 weeks post-partum. Women were also excluded if they were discharged after postoperative day 2, which is customarily the day of discharge following an uncomplicated CD at our institution.

An attempt was made to contact women by phone on postoperative day 14, and if unsuccessful, three total attempts were made through postoperative day 16. Women were excluded if they were unable to be contacted after three attempts. A research assistant conducted the interviews using a script. Interview questions used the term 'narcotic' rather than 'opioid', as narcotics is deemed the term patients use and understand the most.<sup>11</sup> Consent was implied when women verbally agreed to participate. Women were given a verbal version of the Surgical Pain Scale, which assesses average pain on a scale of 0–10 within the previous 24 h during various levels of activity.<sup>10</sup> Women were asked to specify the types of pain medications they were using and then count the number of narcotic tablets remaining from their original (or refilled) prescription. Women rated their overall pain control as poor, adequate or good. They were also asked to rate their postoperative pain relative to what they expected their pain to be (much better than expected, better, about the same, worse or much worse). Finally, they were asked about breastfeeding status. Chart review was then performed to obtain basic demographic, clinical and peripartum data (including tobacco use,

anteartum opioid use and chronic pain—defined as a prepregnancy diagnosis of chronic pain, chronic back pain, migraines or chronic headaches, fibromyalgia or temporomandibular joint pain). Data regarding the number of discharge opioids prescribed, as well as any opioid refills, were also obtained.

Our study group ultimately included women from two time periods over the course of the study: May through July 2015 and February through May 2016. The reason for these two 'cohorts' was that while analyzing data from the initial groups, the average number of opioid tablets being prescribed at discharge had notably decreased. Therefore, we decided to collect data on a second group of women in 2016 to assess whether opioid prescribing practices had actually changed by virtue of our conducting the study.

Continuous data were tested for normality using histograms, as well as the Kolmogorov–Smirnov and Shapiro–Wilk tests. Bivariate analyses compared women whose opioid use was determined to be in the top quartile versus those in the bottom 75% in order to identify variables associated with increased opioid use. A similar comparison was done for women from the 2015 versus 2016 cohorts. Normally distributed data were analyzed using Student's *t*-test and non-parametric data were analyzed using Mann–Whitney *U* test. Categorical variables were analyzed using chi-square or Fisher's exact tests where appropriate. Given the trend toward significance with infant weight, and our hypothesis that a higher infant weight may be a marker for pre-CD labor, require larger incisions and/or have a more traumatic delivery, a receiver operator characteristic (ROC) curve was generated and the maximal Youden's index determined. The same was done for operative time. The optimal cut-off value for each was determined using Youden's index.<sup>12</sup> The area under the receiver operator characteristic curve (AUC) was calculated for infant weight and operative time as well and was used as an index of diagnostic accuracy. Variables significant in bivariate analyses were used in a logistic regression model to identify factors independently associated with women in the top quartile for opioid usage. Analyses were performed using IBM SPSS Statistics for Windows (version 21.0; IBM Corp.).

## Results

A total of 141 women met inclusion and exclusion criteria, of which 99 were contacted between May and

July 2015 and 42 were contacted between February and May 2016.

Overall, subjects were  $32.0 \pm 4.9$  years old (mean  $\pm$  standard deviation) and had a body mass index of  $29.0 \pm 6.3$  kg/m<sup>2</sup>. A total of 114 women were Caucasian (80.9%), 12 were African American (8.5%), nine were Asian (6.4%) and six were of another race (4.2%). All of the study participants had low transverse incisions of both skin and uterus. Three women were discharged home on post-partum day 1 (two from the 2015 cohort and one from the 2016 cohort) and the remaining 97.9% (138/141) were discharged home on post-partum day 2. Sixteen subjects had postoperative complications: nine had wound infection/dehiscence (56.3%), three had pre-eclampsia (18.8%), two had endometritis (12.5%), one had mastitis (6.3%) and one had pyelonephritis (6.3%).

The median number of opioid tablets used in the first 2 weeks post-CD was 36 (interquartile range [IQR] 16–45) and the median number prescribed was 60 (IQR 42–65). The distribution of opioid-containing analgesic medications prescribed was as follows: 84.4% (119/141) oxycodone 5 mg/acetaminophen 325 mg; 6.4% (9/141) oxycodone 5 mg; and 1.4% (2/141) hydrocodone 5 mg/acetaminophen 325 mg. Overall, 94.3% (133/141) of women reported using ibuprofen. While 54.6% (77/141) of women reported receiving 'enough' opioid tablets at the time of discharge, 31.9% (45/141) thought they were prescribed 'too much' and 12.8% (18/141) stated their prescription was 'not enough'. Seven percent (10/141) of women received an opioid refill. Nineteen percent (27/141) were still using opioids and 63.8% (90/138) were still using ibuprofen at 2 weeks post-partum.

Women who used more than 45 opioid tablets were determined to be in the top quartile and, with the exception of parity, had similar demographic characteristics as those who used less than or equal to 45 tablets (Table 1). There were otherwise no statistically significant differences between the opioid use groups across demographic, peripartum and postoperative variables. Ninety-eight percent of CD involved residents and the level of residents did not differ significantly between groups.

Women in the top quartile used more than double the number of opioids compared to women in the bottom 75% (60 vs 25 tablets;  $P < 0.001$ ). Table 1 shows a comparison of these two groups. Significant findings from this comparison showed that top quartile users were prescribed significantly more opioid tablets at discharge, were provided more opioid

prescription refills and reported continued use of opioid medications at 2 weeks post-partum, which was over three times the rate seen in women in the bottom 75%.

Overall, 97% of women reported pain control as good or adequate in both groups. Women in the top quartile reported higher pain scores at rest, during normal activities and during the worst pain experienced on the day of the phone interview, as well as more frequently reporting their pain as 'worse than expected'. Table 2 shows a comparison of pain scores and pain expectations between women in the top quartile and those in the bottom 75% for opioid use.

The AUC for infant weight was 0.646 and the maximal Youden's index was 0.272, corresponding to an optimal cut-off for infant weight of  $\geq 3560$  g. For operative time, the AUC was 0.607 and the maximal Youden's index was 0.35, corresponding to an optimal cut-off of  $\geq 59.5$  min. Using the cut-off values of infant weight of  $\geq 3560$  g and operative time  $\geq 59.5$  min in bivariate analyses (see Methods section for AUC and Youden's index calculations), women in the top quartile had a higher prevalence of infants weighing  $\geq 3560$  g (57.1% [20/35] vs 34.9% [37/106],  $P = 0.03$ ) and operative time  $\geq 59.5$  min (57.1% [20/35] vs 31.1% [33/106],  $P = 0.01$ ). Table 3 shows the multivariable logistic regression performed using dichotomized infant weight and operative time, as well as variables significantly different from Table 1. Operative time  $\geq 59.5$  min and number of opioid tablets prescribed at discharge remained independently associated with opioid use in the top quartile. Pearson's correlation between number of discharge opioids prescribed and number of opioids used was 0.45 ( $P < 0.001$ ).

Data from the 99 women from 2015 and the 42 women from 2016 were then compared. Groups were similar for all demographic and perioperative variables except for parity (median [IQR] 1 [1–2] vs 1 [0–1], respectively,  $P = 0.003$ ) and indication for CD (more women in 2016 underwent a scheduled CD [73.8% (31/42) vs 53.5% (53/99),  $P = 0.03$ ]). Figure 1 shows the comparison of number of opioids prescribed and patient opioid use between the 2015 and 2016 cohorts. Women who underwent CD in 2016 received significantly fewer opioids at discharge and also used fewer opioids in the first two post-partum weeks. A smaller proportion of women from 2016 received an opioid prescription refill compared to those in 2015; however, this finding was not statistically significant (2.4% [1/42] vs 9.1% [9/99],  $P = 0.16$ ). Additionally, pain scores and satisfaction

**Table 1** Demographics, perioperative variables and 2-week postoperative opioid use for women who underwent cesarean delivery

Demographics and perioperative variables	Number of opioid tablets used <sup>†</sup> ( <i>n</i> = 141)		
	≤45 ( <i>n</i> = 106)	>45 ( <i>n</i> = 35)	<i>P</i> value
Age (years), mean ± SD	31.9 ± 4.7	32.2 ± 5.6	0.70
Parity, median (IQR)	1 (0–2)	1 (0–1)	0.04
BMI (kg/m <sup>2</sup> ), mean ± SD	28.8 ± 6.5	29.7 ± 5.3	0.48
Race/Ethnicity, <i>n</i> (%)			0.73
Caucasian	83 (78.3)	31 (88.6)	—
Asian	8 (7.5)	1 (2.9)	—
African American	9.4 (10)	5.7 (2)	—
Hispanic	2 (1.9)	0 (0)	—
Other/Unknown	3 (2.8)	1 (2.9)	—
Tobacco user, <i>n</i> (%)	9 (8.5)	5.7 (2)	0.60
Cesarean delivery, <i>n</i> (%) <sup>‡</sup>			0.59
Primary	45 (42.5)	19 (54.3)	—
Repeat	61 (57.5)	16 (45.7)	—
Chronic pain diagnosis, <i>n</i> (%) <sup>§</sup>	7 (6.6)	3 (8.6)	0.71
Antepartum opioid use, <i>n</i> (%)	2 (1.9)	0 (0.0)	>0.99
Gestational age, weeks, median (IQR)	39.3 (39.0–39.9)	39.1 (38.6–40.3)	0.63
Infant weight (g), mean ± SD	3495.70 ± 487.5	3683.4 ± 538.6	0.06
Indication for cesarean delivery, <i>n</i> (%)			0.11
Scheduled/Planned	67 (63.2)	17 (48.6)	—
Arrest of descent	18 (17.0)	5 (14.3)	—
Arrest of dilation	5 (4.7)	7 (20.0)	—
Fetal indication	16 (15.1)	6 (17.1)	—
Labeled prior to cesarean delivery, <i>n</i> (%)	25 (23.9)	11 (31.4)	0.36
Length of active second stage (min), mean ± SD	602.6 ± 337.0	681.8 ± 339.7	0.64
Operative time (min), mean ± SD	56.1 ± 17.9	60.7 ± 20.0	0.20
Skin closure, <i>n</i> (%)			0.41
Staples	11 (10.4)	2 (5.7)	—
Suture	95 (89.6)	33 (94.3)	—
Estimated blood loss, mL, median (IQR)	800 (800–1000)	850 (800–1000)	0.15
Opioids tablets prescribed at discharge, median (IQR)	50 (40–60)	60 (60–70)	<0.001
At 2 weeks post-partum			
Opioids tablets used, median (IQR)	25 (12–39)	60 (54–66)	<0.001
Received a opioid refill, <i>n</i> (%)	3 (2.8)	7 (20.0)	0.001
Still using opioids, <i>n</i> (%)	13 (12.3)	14 (40.0)	<0.001
Still using ibuprofen, <i>n</i> (%)	60 (56.6)	30 (85.7)	0.003
Breastfeeding, <i>n</i> (%)	88 (83.0)	29 (82.9)	0.98
Postoperative complication, <i>n</i> (%)	13 (12.3)	3 (8.6)	0.76

<sup>†</sup>*P* values calculated using chi-square, Fisher's exact test, Student's *t*-test or Mann-Whitney *U* test. If data are normally distributed, they are reported using mean ± SD. <sup>‡</sup>Two cesarean deliveries were performed, with two attendings and one with an attending and a fellow. <sup>§</sup>Defined as pre-pregnancy diagnosis of chronic pain, chronic back pain, migraines or chronic headaches, fibromyalgia or temporomandibular joint pain.

with pain control were similar between the groups (data not shown).

## Discussion

In this study of women 2 weeks following a term CD and discharged home by post-partum day 2, 75% used 45 or fewer opioid tablets. On average, patients

were prescribed 40% more opioids than they used. Factors independently associated with being in the top quartile for opioid use included operative time ≥59.5 min and increased number of discharge opioids prescribed. Over the course of the study, physicians decreased the number of discharge opioids prescribed and patients also used fewer. Variability in opioid prescribing practices and differences in consumption following CD highlights the need to better understand

**Table 2** Pain scores and expectations for women who underwent a cesarean delivery

Pain scores and expectations	Number of opioid tablets used <sup>†</sup>		
	≤45 ( <i>n</i> = 106)	>45 ( <i>n</i> = 35)	<i>P</i> value
Surgical pain scale scores 2 weeks postoperatively (0, no pain, 10, worst pain imaginable), median (IQR)			
What was the average amount of pain you had when you were at rest?	0 (0–2.0)	1.5 (1–3)	0.018
How much pain did you have during your normal activities (for example walking, climbing stairs, driving a car, getting up from a chair)?	1 (1–3)	3 (1–5)	0.002
How much pain did you have when you were exercising, doing strenuous work or lifting objects you used to be able to lift comfortably?	2 (1–3) ( <i>n</i> = 59)	2 (2–4.5) ( <i>n</i> = 14)	0.395
How unpleasant or disturbing was the worst pain that you had today?	1 (0–3)	3.5 (1–5.25)	0.002
Overall rating of post-partum pain control 2 weeks postoperatively, <i>n</i> (%)			
Poor	3 (2.8)	1 (2.9)	0.11
Adequate	24 (22.6)	13 (37.1)	
Good	79 (74.5)	21 (60.0)	
Post-partum pain versus expectation 2 weeks postoperatively, <i>n</i> (%)			
Much worse than expected	3 (2.8)	0 (0.0)	0.02
Worse than expected	13 (12.3)	10 (28.6)	
About what expected	41 (38.7)	13 (37.1)	
Better than expected	23 (21.7)	12 (34.3)	
Much better than expected	26 (24.5)	0 (0.0)	

<sup>†</sup>*P* values calculated using chi-square, Fisher's exact test or Mann–Whitney *U* test.

prescription patterns, utilization by patients and the potential impact of these practices. Identifying risk factors for increased post-partum opioid requirements may help physicians prescribe opioids more accurately and therefore reduce surplus. The two factors we identified to be independently associated with post-partum opioid use in the top quartile were operative time ≥59.5 min and number of opioids prescribed at discharge. We hypothesize that an increased operative time may be a marker of surgical difficulty or a result of additional planned or unplanned procedures. Surgical technique may also impact operative time as well, with shorter times

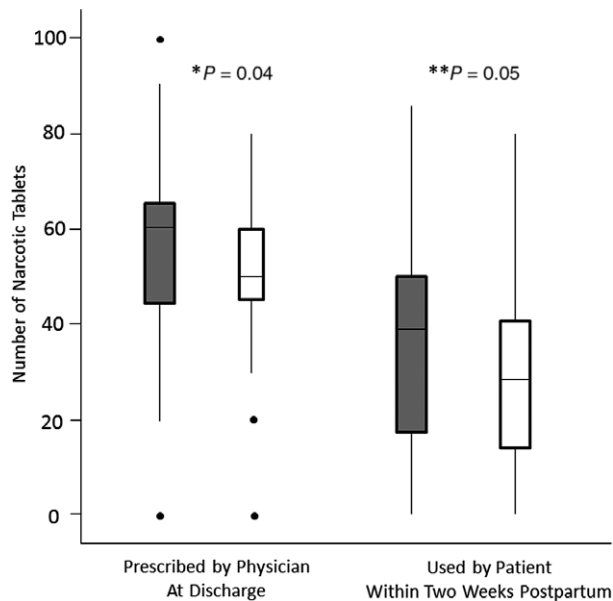
associated with choosing not to close the peritoneum,<sup>13</sup> blunt versus sharp abdominal entry,<sup>14</sup> single versus double layer uterine closure<sup>14</sup> and no creation of a bladder flap.<sup>15</sup> At our institution, surgical techniques used during CD vary based on surgeon discretion and certain details may not be specified in the operative reports. Therefore, we were unable to determine the impact of variations in surgical technique on operative time in the current study.

Number of discharge opioid tablets prescribed was the other factor predictive of women in the top quartile for opioid use. This is concordant with the findings by Bateman *et al.*, who showed that prescribing

**Table 3** Factors available at discharge and associated with women in the top quartile for opioid use during the first 2 weeks following cesarean delivery<sup>†</sup>

Variable	Crude odds ratio	Adjusted odds ratio	95% confidence interval	Regression coefficient	Standard error	<i>P</i> value
Constant	—	0.01	—	−4.96	1.13	<0.001
Parity	0.58	0.63	0.37–1.08	−0.46	0.27	0.09
Infant weight ≥ 3560 g	2.49	2.27	0.95–5.43	0.82	0.44	0.06
Operative time ≥59.5 min	2.95	2.70	1.12–6.53	0.99	0.45	0.03
Number of opioid tablets prescribed at discharge	1.07	1.06	1.03–1.10	0.06	0.02	<0.001

<sup>†</sup>Logistic regression performed including variables significant in bivariate analyses for women in the top quartile of post-partum opioid use.



**Figure 1** Changes in number of discharge opioid tablets prescribed following cesarean delivery and patient opioid use over the study period. \*Comparison of number of opioid tablets prescribed between 2015 and 2016. \*\*Comparison of number of opioid tablets used by patients between 2015 and 2016. (■) 2015 and (□) 2016.

more opioids at discharge was associated with consuming more opioids, independent of pain severity at discharge or other patient characteristics.<sup>5</sup> Because our study design precludes our ability to assess causality, we are unable to state with certainty why women who were prescribed more opioids used more—was it because more were available to use or because they were having more pain? Our finding, that women who underwent surgery in 2016 versus 2015 were prescribed significantly fewer discharge opioids and also used significantly fewer tablets, in conjunction with Bateman *et al.*'s findings, supports the first hypothesis.

These groups were otherwise similar in terms of demographics, perioperative variables and patient-reported pain measures. Therefore, our results suggest that physician-prescribing patterns may influence utilization of opioid pain medications by patients. Although chronic pain diagnoses and preoperative opioid use have been shown in prior studies to increase postoperative pain medication requirements,<sup>5,16,17</sup> the absolute numbers of women with these characteristics in our study were low; consequently, we were likely underpowered to detect these differences.

Limitations of our study include the use of a relatively homogenous population collected via convenience sampling, which can be prone to selection bias and sampling errors. In an effort to minimize bias, we used a system-generated list of women who met our study criteria and attempted to call all women on the list. We limited our study to a relatively low-risk population discharged by postoperative day 2, so our results may not be generalizable to high-risk pregnancies or patients discharged on postoperative day 3 or more. We also do not know how many opioid pills patients used following the first two post-partum weeks. Finally, our study was subject to 'observed bias', as physicians began prescribing fewer discharge opioids after data on the initial 2015 cohort were collected. However, we feel that our study was actually strengthened by the incorporation of data on the second cohort of women in 2016, as it reflects actual clinical practice.

This study also has several strengths. First, we present a simple yet effective method for quantifying home opioid use following surgery, and recall bias was limited because the phone interview was within 2 weeks of surgery. Second, we assessed patient pain using the Surgical Pain Scale, which in written form is a validated measurement tool. Third, to our knowledge this is the first study quantifying opioid use after hospital discharge following CD.

In summary, our findings suggest that a discharge prescription of 45 opioid tablets following a term CD for patients discharged on postoperative day 1 or 2 is acceptable for the majority of women. Operative time exceeding 1 h is a risk factor for using a greater number of opioid tablets. Larger studies will be necessary to identify other patient-level modifiers that may impact postoperative opioid utilization. Ultimately, these data could serve as a reference for developing evidence-based guidelines for opioid prescribing following CD.

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## Disclosure

None declared.

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