

Research and Analysis

# Early Indicators of High-Risk Opioid Use and Potential Alternative Treatments



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## Executive Summary

Since 2012, the use of opioids has significantly and continuously declined in the California workers' compensation system. The share of claims with at least one opioid prescription 12 months after the injury decreased from 42% of all claims that had any drug prescription in the same time frame in 2013 to 20% in 2017. In 2017, the average cost of opioid prescriptions per 100 claims was down by almost 80% from 2013. The precipitous reduction in opioid prescriptions has contributed to a lower level of overall pharmaceutical use in the workers' compensation system.

The downward trend of opioid prescriptions may be leading to a shift in the patterns of medical treatments for California's injured workers. This potential shift could also result in more utilization of alternative measures in place of high levels of opioid use. Therefore, early identification of injured workers who may be using high doses of opioids and thus experiencing more adverse effects of opioids could facilitate early provision of alternative treatments and also help identify key system cost drivers.

However, there is limited information available on early indicators that may help identify claims involving high-risk opioid use in workers' compensation ("high-risk opioid use," using 50 Morphine Milligram Equivalents [MME] or more for at least 30 consecutive days) or on alternatives that have been used in place of high levels of opioid prescriptions. This study compares the characteristics and treatment patterns on claims involving high-risk opioid use to otherwise similar claims involving lower doses of opioids to identify early indicators of and potential alternatives to high-risk opioid use. This study also compares the potential alternatives for older claims, which had a heavier reliance on opioids, to newer claims to assess changing treatment patterns.

### Principal Findings:

- About 2.5% (1,725 claims) of all Accident Year 2013 (AY2013) claims with any opioid prescription involved high-risk opioid use within 12 months of the date of the injury, compared with 1.4% (531 claims) of Accident Year 2016 (AY2016) claims.
- High-risk opioid use claims incurred significantly higher medical and indemnity costs than lower-dose use claims of similar age and injury type, and they tended to remain open longer. For example, by the fourth year after the injury, high-risk use claims had almost three times higher indemnity costs than those of otherwise similar lower-dose claims, and they were almost twice more likely to be open than lower-dose claims.
- High-risk opioid use claims were more likely to involve permanent disability benefits than otherwise similar lower-dose claims. Four years after the date of injury, about three-quarters of high-risk opioid use claims involved permanent disability benefits, compared with about one-half of lower-dose claims.
- During the first six months of treatment after the date of the injury, the number of opioid prescriptions per AY2013 claim was 50% lower on lower-dose use claims compared to the high-risk use claims of similar age and injury mix, contributing to 50% lower total drug payments per claim. The cost savings from a lower level of drug use were also significant on AY2016 claims.

- Early indicators of high-risk opioid use found by comparing high-risk to lower-dose opioid use claims with similar distributions of age, pain type and type of major surgery include:
  - **Obtaining similar opioids from multiple dispensers (both pharmacies and non-pharmacy dispensers):** Both AY2013 and AY2016 high-risk opioid use claims were twice more likely to get similar opioids from two pharmacies than lower-dose use claims and almost four times more likely to involve three or more pharmacies. Similar patterns were found for non-pharmacy dispensers.
  - **Overlapping opioid prescriptions:** Claims involving high-risk opioid use were about four times more likely to have multiple similar opioids prescribed concurrently, and they were six times more likely to concurrently use three or more different opioids.
  - **Using extended-release/long-acting (ER/LA) opioids:** For AY2013 claims, high-risk opioid use claims were three times more likely to involve ER/LA opioids than lower-dose use claims (23% vs. 7%). For AY2016 claims, the differential use of ER/LA opioids was even more pronounced (26% vs. 5%).
  - **Concurrently using opioids and benzodiazepines:** Among AY2013 claims, high-risk opioid use claims were almost five times more likely to take opioids and benzodiazepines concurrently. The differences in the use of these two drugs between the high-risk and lower-dose opioid use claims are more stark (about seven times) on AY2016 claims.
- **Physical therapy, acupuncture and chiropractic services** were utilized consistently and significantly more on lower-dose use claims than on high-risk use claims, suggesting these alternative treatments could have been used in place of high levels of opioid prescriptions.
  - The consistently higher utilization of physical therapy on the lower-dose use claims was primarily driven by the use of therapeutic exercise, manual therapy techniques and kinetic activities.
  - Electroacupuncture was the primary acupuncture treatment used significantly more on lower-dose use claims than high-risk use claims.
  - Chiropractic manipulative treatment on one to two spinal regions was the main procedure used significantly more on lower-dose use claims.
- **Nonsteroidal anti-inflammatory drugs (NSAIDs) and non-narcotics** were used significantly more on lower-dose opioid use claims than on high-risk use claims. In fact, NSAIDs were the leading drug group used on AY2016 lower-dose use claims.
- The level of physical therapy utilization remained essentially unchanged over time. However, newer claims were less likely to use electrical stimulation and more likely to utilize therapeutic exercise, kinetic activities and neuromuscular re-education. In addition, newer claims started to use more acupuncture.
- Utilization of pharmaceuticals declined sharply over time on both lower-dose and high-risk opioid use claims. Among lower-dose use claims, AY2016 claims involved significantly less pharmaceuticals than AY2013 claims, except for NSAIDs and non-narcotic drugs, as the use of these drugs experienced only a modest decline, by 2% and 5%, respectively.



## Background

Since 2012, the use of opioids has significantly and continuously declined in the California workers' compensation system. The share of claims with at least one opioid prescription 12 months after the injury decreased from 42% of all claims that had any drug prescription in the same time frame in 2013 to 20% in 2017.<sup>1</sup> In addition, the cost of opioid prescriptions per 100 claims dropped by almost 80% from 2013 to 2017.<sup>2</sup> This precipitous drop in opioid prescriptions has also contributed to a lower level of pharmaceutical use in the system, reducing the share of the total medical payments to pharmaceuticals to 5% in the first half of 2018. Similarly, lower levels of opioid use contributed to a continued reduction (76%) in the pharmaceutical cost per claim between 2012 and 2018.<sup>3</sup>

A host of factors – including the implementation of independent medical review to resolve medical treatment disputes pursuant to Senate Bill No. 863, the use of the Controlled Substance Utilization Review and Evaluation System (CURES) database, as well as the national reaction to the opioid epidemic – has been instrumental in driving the decline in opioid use in the California workers' compensation system. In addition, the new drug formulary adopted pursuant to Assembly Bill No. 1124 in January 2018 encourages non-opioid treatment of pain by exempting most non-narcotic analgesics and NSAIDs from prospective utilization review (UR).

The downward trend of opioid prescriptions, together with the new drug formulary's impact on the prospective UR requirements for the non-opioid drugs, may lead to a shift in the patterns of medical treatments for injured workers in the California workers' compensation system. This potential shift could also result in more utilization of alternative measures to high levels of opioid use. Therefore, early identification of injured workers who may be using high doses of opioids and thus experiencing more adverse effects of opioids could facilitate early provision of alternative treatments for injured workers and help identify key system cost drivers. The WCIRB's 2018 study on chronic opioid use and weaning showed that claims involving chronic opioid use in the California workers' compensation system tend to incur more than nine times the physician services costs of a claim not involving chronic opioid use.<sup>4</sup>

There is limited information available on early indicators of high-risk opioid use that may increase the adverse effects of opioids ("high-risk opioid use," defined as using 50 MME or more for at least 30 consecutive days) in workers' compensation or on alternatives that have been used in place of high levels of opioid prescriptions. This study compares the characteristics and treatment patterns on claims involving high-risk opioid use to those involving lower doses of opioids to identify indicators that may help identify high-risk use claims early and some potential alternatives that may have substituted for high levels of opioid use. This study also compares the potential alternatives for older claims (claims that had accident dates in 2013), which had a heavier reliance on opioids, to newer claims (those that had accident dates in 2016) to assess changing treatment patterns over time.

## Research Questions

This study addresses the following questions:

- What are the characteristics of claims involving high-risk opioid use?
- What are the early indicators of high-risk opioid use?
- What are the differences in the utilization patterns of alternative medical treatments, including both non-opioid drugs and physician services, between claims involving lower doses of opioids and those involving high-risk opioid use?
- Did the patterns of alternative treatments change over time?

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<sup>1</sup> WCIRB Medical Transaction Data

<sup>2</sup> WCIRB (2018). State of the System

<sup>3</sup> See Item AC16-06-05 of the December 5, 2018 WCIRB Actuarial Committee Agenda and Minutes.

<sup>4</sup> Basuino, Tim, and Julia Zhang, PhD. *Study of Chronic Opioid Use and Weaning*. WCIRB California, 2018.

## Research Methods

The medical transactions<sup>5</sup> occurring through 12 months of treatment on the California workers' compensation claims that had accidents in 2013 (AY2013 claims) and 2016 (AY2016 claims)<sup>6</sup> were analyzed to understand the impact of high-risk opioid use as well as potential alternative measures for pain control that may have been taken in place of opioids on claims involving lower-dose opioid use. The WCIRB Unit Statistical Report (USR)<sup>7</sup> data through the fourth report level (54 months from policy inception) was also linked to the medical transactions to analyze the long-term impacts of high-risk opioid use on medical and indemnity costs.

High-risk opioid use is defined for the purpose of this study as using 50 MME or more per day<sup>8</sup> for at least 30 consecutive days. Lower-dose use claims are defined as those with at least one opioid prescription involving use of 50 MME or less per day or use of higher doses of opioids for less than 30 consecutive days. Total MME per claim was calculated by summing the MME of each opioid used by the injured worker, based on the MME information for different types of opioids in the conversion table published by the Centers for Diseases Control and Prevention (CDC).<sup>9</sup> Days of opioid supply was calculated based on the assumptions that (1) each opioid prescription lasts the entire duration until the next prescription, and (2) if there is only one prescription during a 30-day period, the prescription would last for 30 days. Daily MME per claim was calculated by dividing the total MME per claim by the days of opioid supply.

To compare opioid use and medical treatments on the high-risk opioid use claims to otherwise similar claims that involve lower doses of opioids, this study matched these two groups on the injured worker's age at the time of the injury, type of the first major surgery<sup>10</sup> and type of pain (acute, chronic or both) before or at the time of the first opioid prescription. Type of surgery was based on a grouping of surgery procedure codes<sup>11</sup> (Table A1), and type of pain was identified using the International Classification of Diseases codes representing chronic and/or acute pain.<sup>12</sup> Each high-risk opioid use claim was matched to two lower-dose use claims.<sup>13</sup> The analysis of early indicators and alternative treatments was conducted on the matched claims for both accident years 2013 and 2016 to ensure that differential opioid use is not confounded by age or injury characteristics. When comparing alternative treatment patterns of AY2013 claims to AY2016 claims, year of injury was added to the matching process to ensure that the comparison takes into account the recent declines in opioid use in the workers' compensation system and that fewer newer claims involved high-risk opioid use.

Potential early indicators of high-risk opioid use were identified by comparing patterns of opioid use on high-risk use claims (before the claims met the threshold for high-risk opioid use) and lower-dose use claims that have similar distributions of age, type of surgery and type of pain. These patterns include number of dispensers, number and type of opioids prescribed and concurrent use of opioids and benzodiazepines, a class of drugs commonly used for treating anxiety. Similarly, potential alternative measures were identified by comparing the utilization of non-opioid drugs and physician services on high-risk use claims to lower-dose use claims with similar characteristics. The categories of alternative measures that were analyzed include non-narcotic pain medication, physical therapy, acupuncture, chiropractic care, pain and functional assessment, functional restoration program, counseling, durable medical equipment, addiction treatment and cognitive behavioral therapy (CBT).

Utilization was measured by the number of medical transactions (prescriptions or medical services) per claim and medical payments per claim during the first year of treatment. The study also examined the leading physical therapy modalities and procedures that contributed to the differential use between claims involving high-risk opioid use and those with lower-dose opioids. Similar methods were used to compare the utilization of different types of non-opioid pain medication between high-risk and lower-dose opioid use claims.

<sup>5</sup> The WCIRB collects medical transaction data from 50 WCIRB insurer groups and their vendors, representing 92 percent of the California insured market. This data includes medical payments by insurers for services provided to injured workers, but does not include payments made directly to any known third party who may be assigned medical management.

<sup>6</sup> The WCIRB's medical transaction data reported as of January 7, 2019.

<sup>7</sup> The WCIRB's USR data reported as of January 7, 2019.

<sup>8</sup> Dowell D, Haegerich TM, Chou R. *CDC Guideline for Prescribing Opioids for Chronic Pain —United States, 2016*. Centers for Disease Control and Prevention. MMWR Recomm Rep. 65(RR-1):1-49

<sup>9</sup> CDC compilation of benzodiazepines, muscle relaxants, stimulants, zolpidem and opioid analgesics with oral morphine milligram equivalent conversion factors, 2017 version.

<sup>10</sup> Global Surgery indicator derived from global surgery data field within National Physician Fee Schedule Relative Value File Calendar Year 2017.

<sup>11</sup> Based on surgery current procedure terminology (CPT) code sets.

<sup>12</sup> CDC: Quality Improvement and Care Coordination: Implementing the CDC Guideline for Prescribing Opioids for Chronic Pain.

<sup>13</sup> Austin, Peter C. *Statistical Criteria for Selecting the Optimal Number of Untreated Subjects Matched to Each Treated Subject When Using Many-to-One Matching on the Propensity Score*. American Journal of Epidemiology, Volume 172, Issue 9, pp. 1092-1097, 2010.

## Results

### Characteristics of Claims Involving High-Risk Opioid Use

About 2.5% (1,725 claims) of AY2013 claims with any opioid prescription involved high-risk opioid use within 12 months of the date of the injury as compared to 1.4% (531 claims) of AY2016 claims (Table 1). AY2013 high-risk opioid use claims took 5.6 months on average to achieve the high-risk opioid use status (taking 50 MME or more per day for at least 30 days), while AY2016 claims took less time (4.8 months) on average.

For both AY2013 and AY2016 claims, compared with lower-dose opioid use claims, high-risk use claims were more likely to involve older workers and significantly more likely to have acute pain and both chronic and acute pain (Table 1). They were also almost twice more likely to involve a major surgery and, in particular, three times more likely to involve surgical procedures on the spine, spinal cord and vertebral column. Given the sharply different demographic and injury characteristics between high-risk and lower-dose opioid use claims, matching claims on age and injury characteristics allows this analysis to remove the confounding effects of these factors on the differential opioid use. After matching, high-risk opioid use claims are not statistically different from lower-dose use claims in these characteristics (Table A2).

**Table 1. Demographic and Injury Characteristics of AY2013 and AY2016 Claims**

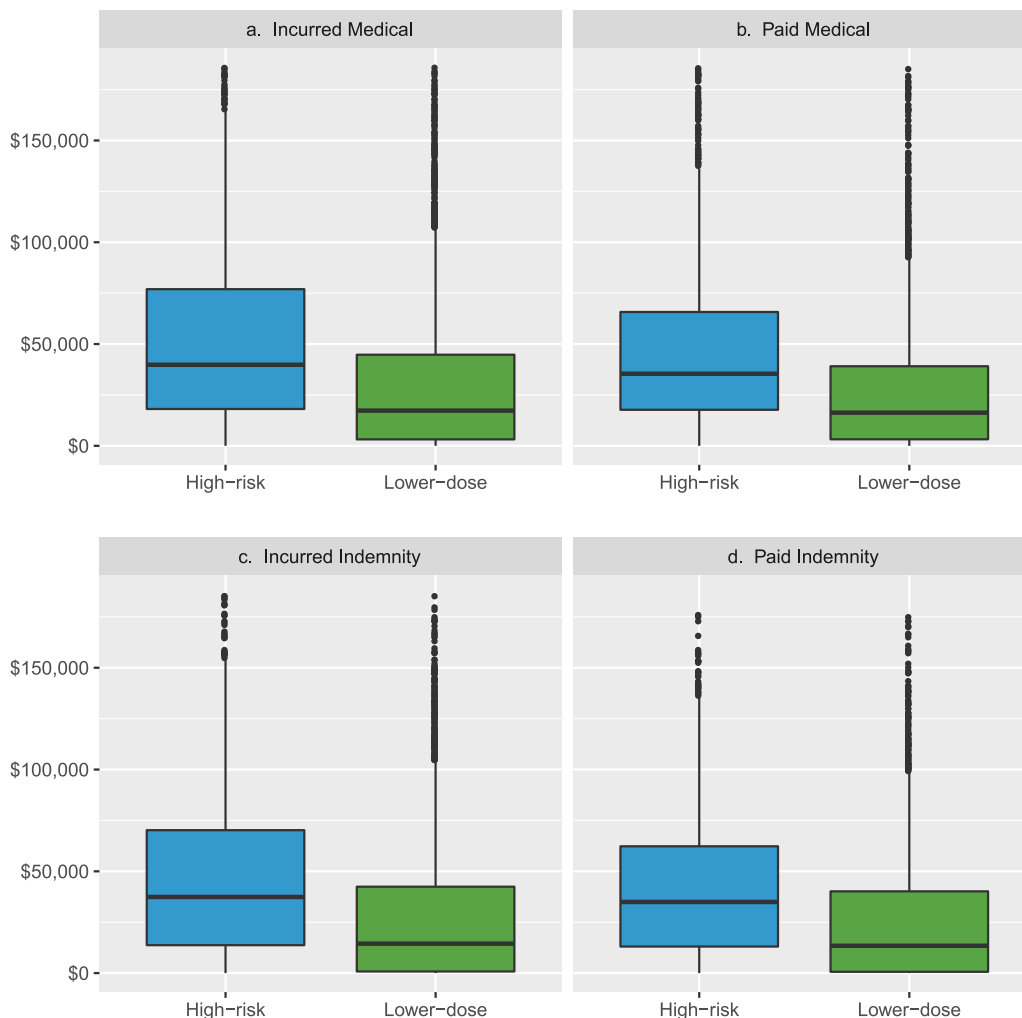
	AY2013 Claims			AY2016 Claims		
	Lower-dose opioid use	High-risk opioid use	P-value <sup>14</sup>	Lower-dose opioid use	High-risk opioid use	P-value
<b>Claim count</b>	67,787	1,725		37,408	531	
<b>Age at the time of injury, mean (SD)</b>	41.8 (12.4)	43.5 (11.7)	<0.001	43.2 (12.5)	44.5 (12.1)	0.014
<b>Pain Type (%)</b>						
None	63.8	48.8	<0.001	58.1	42.9	<0.001
Acute	7.9	10.5		10.7	14.7	
Chronic	7.4	8.1		5.7	4.3	
Both acute and chronic	20.9	32.6		25.4	38.0	
<b>Had a major surgery (%)</b>	21.4	46.0	<0.001	30.6	53.9	<0.001
<b>Type of first major surgery (leading six) (%)</b>						
Endoscopy/Arthroscopy Procedure on the Musculoskeletal System	39.3	32.6	<0.001	42.8	30.4	<0.001
Surgical Procedure on the Spine and Spinal Cord	3.3	11.5		2.6	7.6	
Surgical Procedure on the Shoulder	7.0	9.1		3.9	4.5	
Surgical Procedure on the Vertebral Column	0.9	6.3		1.3	4.5	
Surgical Procedure on the Leg and Ankle Joint	3.7	6.1		4.6	11.5	
Surgical Procedure on the Femur and Knee Joint	1.9	4.3		2.3	9.5	

Note: SD refers to standard deviation. % refers to claim share.

<sup>14</sup> P-value for the comparison of age was obtained from Wilcoxon sum rank test, Chi-square test for pain type, and Fisher's exact test for the leading six surgery types. The sample size for the surgery types following the top six was too small to include in the test.

High-risk opioid use claims also incurred significantly higher medical and indemnity costs than similar lower-dose use claims (Figure 1). For example, for AY2013 claims with a fourth USR report level (54 months from policy inception), both median incurred and paid medical losses on high-risk claims were more than twice the costs on otherwise similar claims involving lower-dose opioid use (incurred medical: \$45,475 vs. \$18,412; paid medical: \$37,889 vs. \$16,918).<sup>15</sup> The differences in median indemnity losses by the fourth year between the two claim groups were more pronounced, almost three times (incurred indemnity: \$39,301 vs. \$14,683; paid indemnity: \$35,344 vs. \$13,592).<sup>16</sup> The distributions of the medical and indemnity losses are presented in Table A3.

Figure 1. Patterns of Medical and Indemnity Costs Four Years After the Injury Comparing High-Risk to Similar Lower-Dose Opioid Use Claims, AY2013 Claims

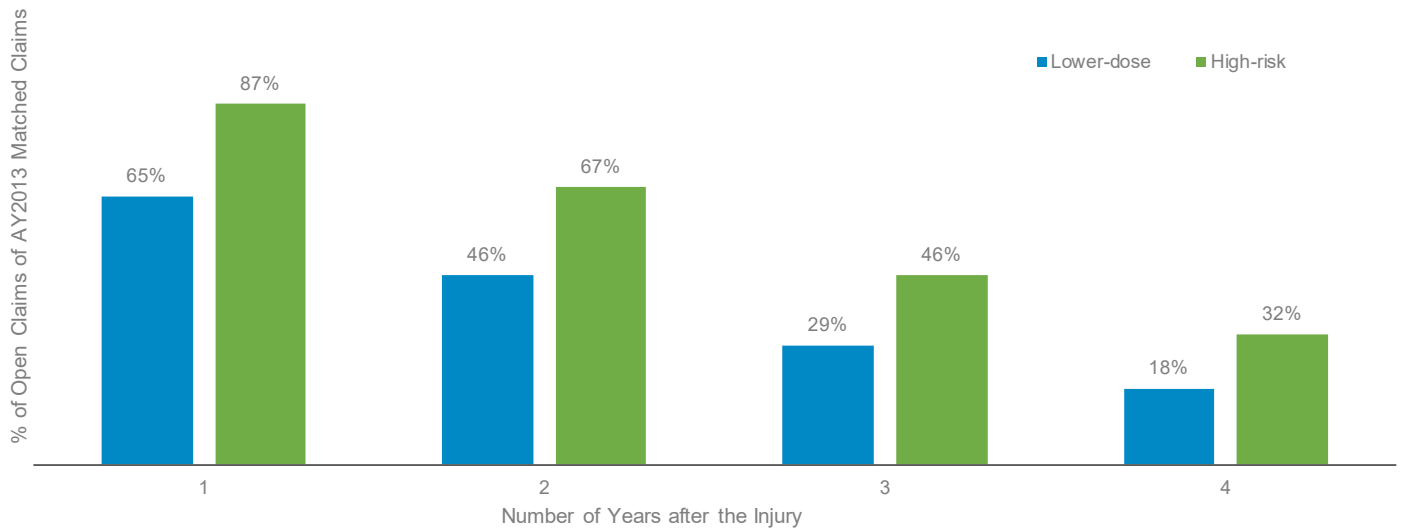


One potential reason for the higher costs on high-risk opioid use claims is that they are more likely to stay open longer. For AY2013 claims, about 87% of high-risk use claims were open one year after the injury as compared to 65% of similar lower-dose use claims (Figure 2). The difference in closing rate between high-risk and lower-dose claims becomes larger at later maturities. By approximately the fourth year after the date of injury (fourth USR report level), high-risk claims were almost twice more likely to remain open than similar lower-dose claims (32% vs. 18%).

<sup>15</sup> Wilcoxon sum rank test was conducted to compare the incurred and paid medical between high-risk and lower-dose opioid use claims. The differences were all highly significant.

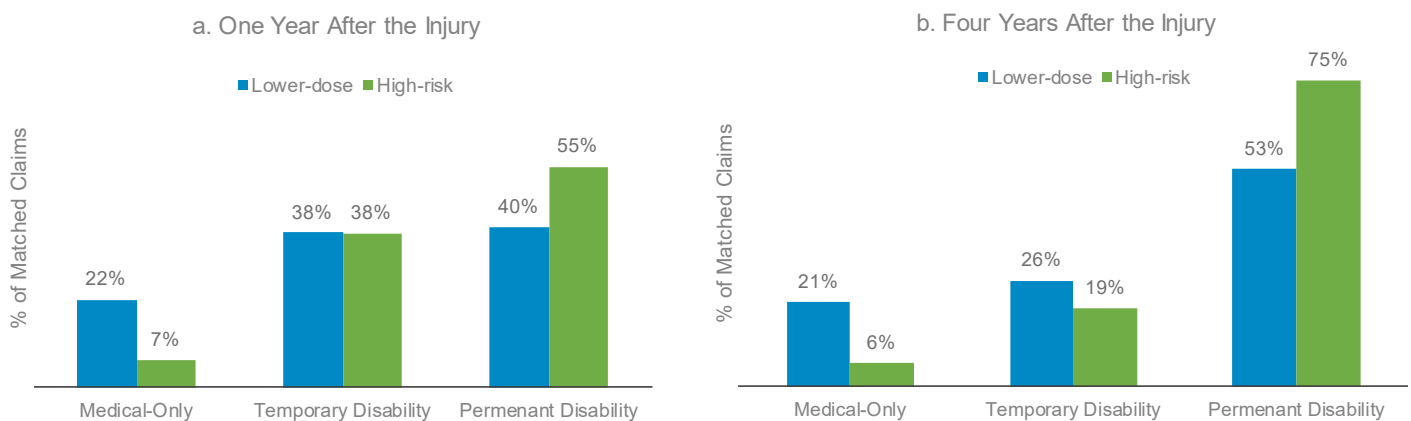
<sup>16</sup> Same test as indicated in footnote 15 was conducted on incurred and paid indemnity.

Figure 2. Share of Open Claims Over Time Comparing High-Risk to Similar Lower-Dose Opioid Use Claims, AY2013 Claims



High-risk opioid use claims were also more likely to receive permanent disability benefits and less likely to be medical-only claims. One year after the injury, about 55% of AY2013 high-risk opioid use claims involved permanent disability as compared to 40% of similar lower-dose use claims (Figure 3a). The higher proportion of permanent disability claims among high-risk claims persisted over time. By the fourth year after the injury, about 75% of all high-risk use claims involved permanent disability, while the proportion of similar lower-dose claims was only 53% (Figure 3b).

Figure 3. Disability Rating for High-Risk and Similar Lower-Dose Opioid Use Claims, AY2013 Claims



## Early Indicators of High-Risk Opioid Use

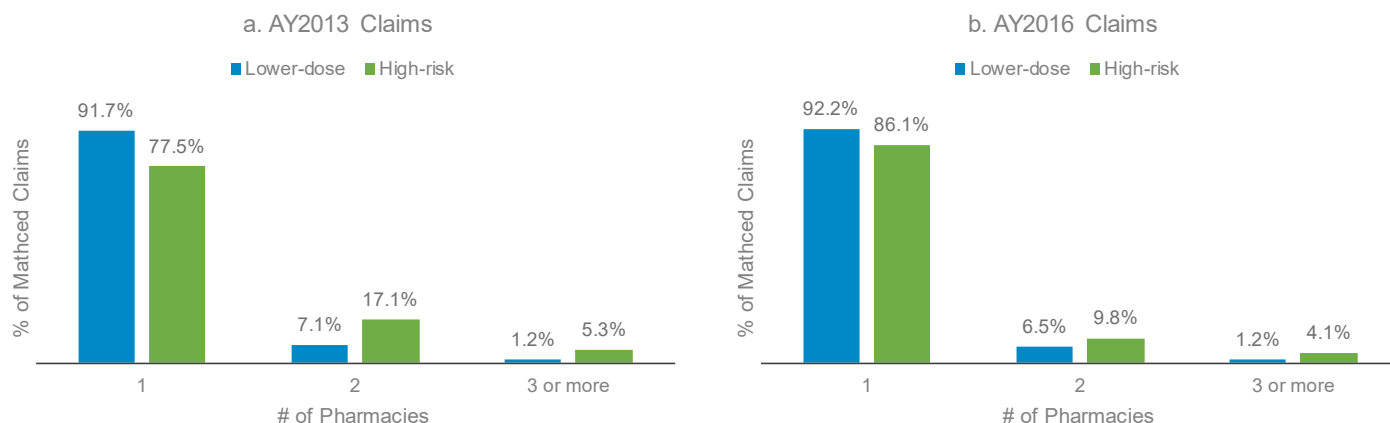
Claims that involved high-risk opioid use were matched to claims involving lower-dose opioid use with similar distributions of age, pain type and major surgery type to control for impacts of age and injury characteristics on opioid use. Patterns in opioid use were compared between these two groups of claims<sup>17</sup> to identify early indicators of high-risk opioid use. These comparisons used the WCIRB's medical transaction data within the first six months of treatment after the injury for both groups.

### Early Indicator #1: Obtaining Similar Opioids from Multiple Dispensers

Obtaining opioid prescriptions from multiple pharmacies or directly from physicians was shown to be associated with higher risks of prescription opioid overdose.<sup>18</sup> In particular, getting opioid prescriptions from three or more pharmacies in a six-month period would increase the odds of opioid overdose by more than threefold. This study analyzed the patterns of obtaining opioids from both pharmacies and non-pharmacy dispensers.

Among AY2013 claims, the majority of lower-dose use claims (92%) obtained similar opioids from only one pharmacy compared with 78% of high-risk opioid use claims (Figure 4a). The differences become more pronounced as the number of pharmacies increases. High-risk opioid use claims were twice more likely to get similar opioids from two pharmacies and almost four times more likely to involve three or more pharmacies. Compared with AY2013 claims, AY2016 high-risk opioid use claims were less likely to involve multiple pharmacies (Figure 4b). About 10% of high-risk use claims involved two pharmacies and about 4% involved three or more. As a result, the differences between lower-dose and high-risk use claims narrowed.

Figure 4. Number of Pharmacies for Similar Opioids Comparing High-Risk to Similar Lower-Dose Opioid Use Claims by Accident Year



Similar patterns were found for non-pharmacy dispensers<sup>19</sup>, yet overall high-risk opioid use claims were less likely to involve multiple non-pharmacy dispensers than pharmacies (Figure 5). For claims of both accident years, high-risk opioid use claims were about twice more likely to involve two non-pharmacy dispensers. The likelihood of involving three non-pharmacy dispensers or more was three times higher for AY2013 high-risk opioid use claims, while no claim had three or more dispensers in 2016.

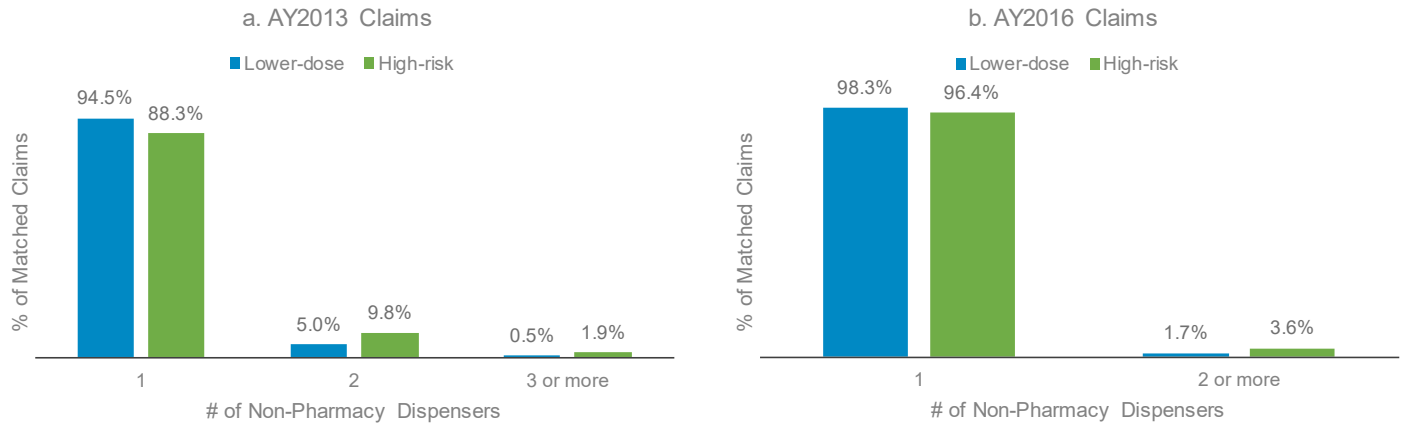
<sup>17</sup> The analysis focuses on the medical transactions of high-risk usage claims before they achieved the high-risk usage status.

<sup>18</sup> Yang, Zhuo et al. *Defining Risk of Prescription Opioid Overdose: Pharmacy Shopping and Overlapping Prescriptions Among Long-Term Opioid Users in Medicaid*. The Journal of Pain, Volume 16, Issue 5, pp 445-453, 2015; Wang, D., Thumula, V., and Liu, T. *Interstate Variation on Use of Opioids, 4th Edition*. Workers Compensation Research Institute, 2017.

<sup>19</sup> For the purpose of this study, non-pharmacy dispensers are defined as physicians, hospitals and managed care organizations.



Figure 5. Number of Non-Pharmacy Dispensers for Similar Opioids Comparing High-Risk to Similar Lower-Dose Opioid Use Claims by Accident Year



## Early Indicator #2: Overlapping Opioid Prescriptions

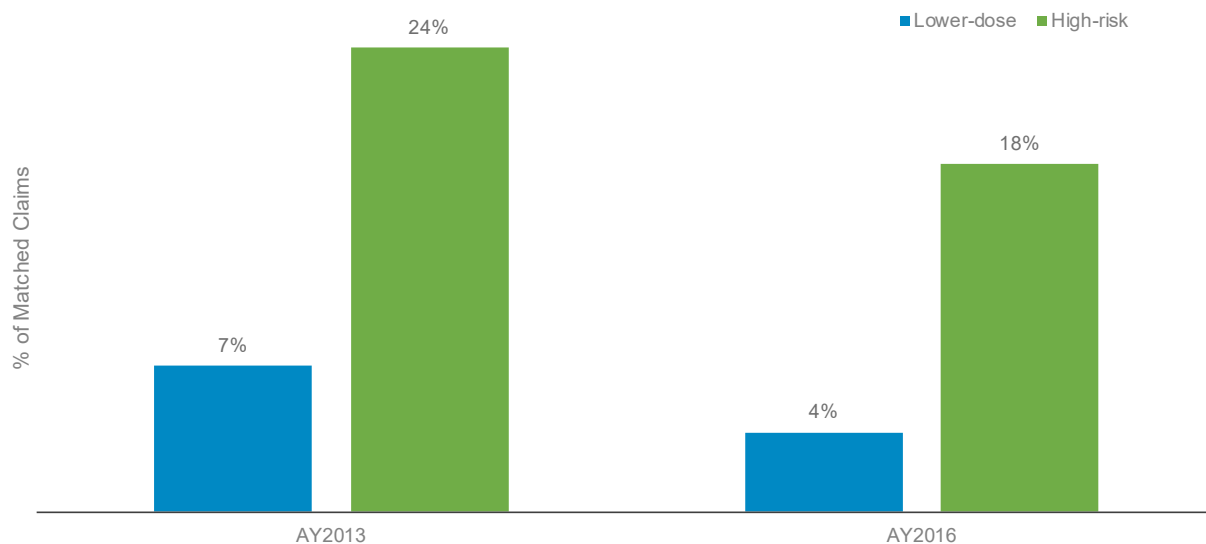
Getting overlapping prescriptions of similar opioids was shown to increase risk of opioid overdose by almost threefold.<sup>20</sup> Overlapping opioid prescriptions are defined, for the purpose of this study, as having more than one opioid prescription in a seven-day period. The analysis excluded prescriptions when the initial dispensed opioids had a supply time of five days or less so as to exclude opioids provided by emergency room providers who may have intended to bridge the gap between the emergency room visit and when a patient was seen by a primary treating physician.<sup>21</sup>

For both accident years, high-risk use claims were about four times more likely to have overlapping opioid prescriptions. The difference among the newer claims, in particular, was more striking despite fewer newer claims having overlapping opioid prescriptions (Figure 6).

<sup>20</sup> Yang, Zhuo et al. *Defining Risk of Prescription Opioid Overdose: Pharmacy Shopping and Overlapping Prescriptions Among Long-Term Opioid Users in Medicaid*. The Journal of Pain, Volume 16, Issue 5, 445–453, 2015.

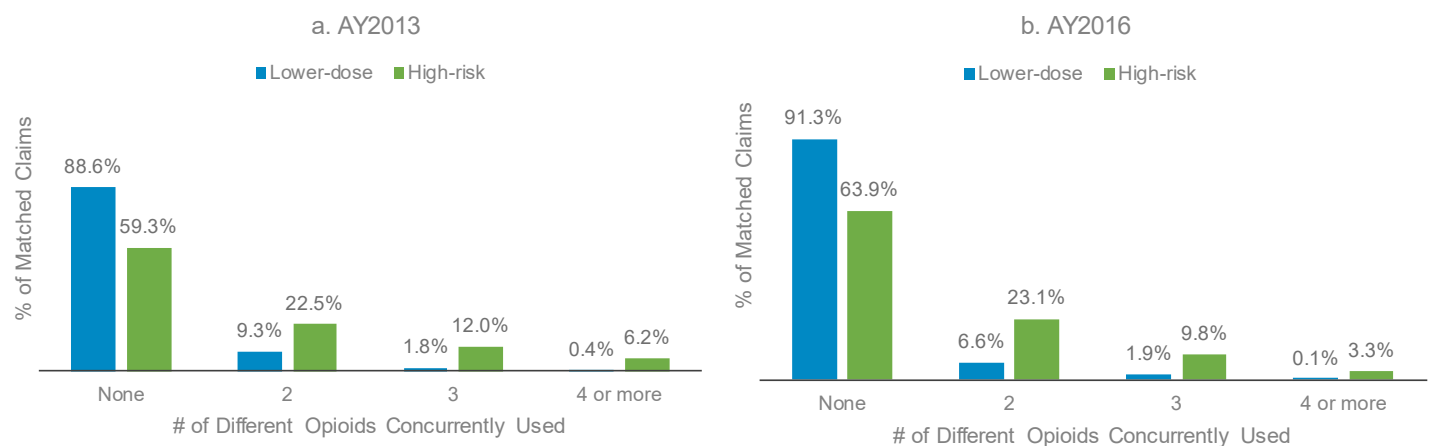
<sup>21</sup> Wilsey, Barth L. et al. *A qualitative study of the barriers to chronic pain management in the ED*. The American Journal of Emergency Medicine, Volume 26, Issue 3, 255–263, 2008.

Figure 6. Proportion of Claims with Overlapping Opioid Prescriptions Among High-Risk and Similar Lower-Dose Opioid Use Claims by Accident Year



In addition, this study analyzed overlapping prescriptions of different opioids, as available research has shown that opioids are one of the top two therapeutic drug groups in which three or more drugs are concurrently prescribed in the California workers' compensation system.<sup>22</sup> For both accident years, claims involving high-risk opioid use were about six times more likely to use three or more different opioids concurrently (Figure 7).

Figure 7. Number of Distinct Opioid Prescriptions on High-Risk Opioid Use Claims as Compared to Similar Lower-Dose Opioid Use Claims by Accident Year



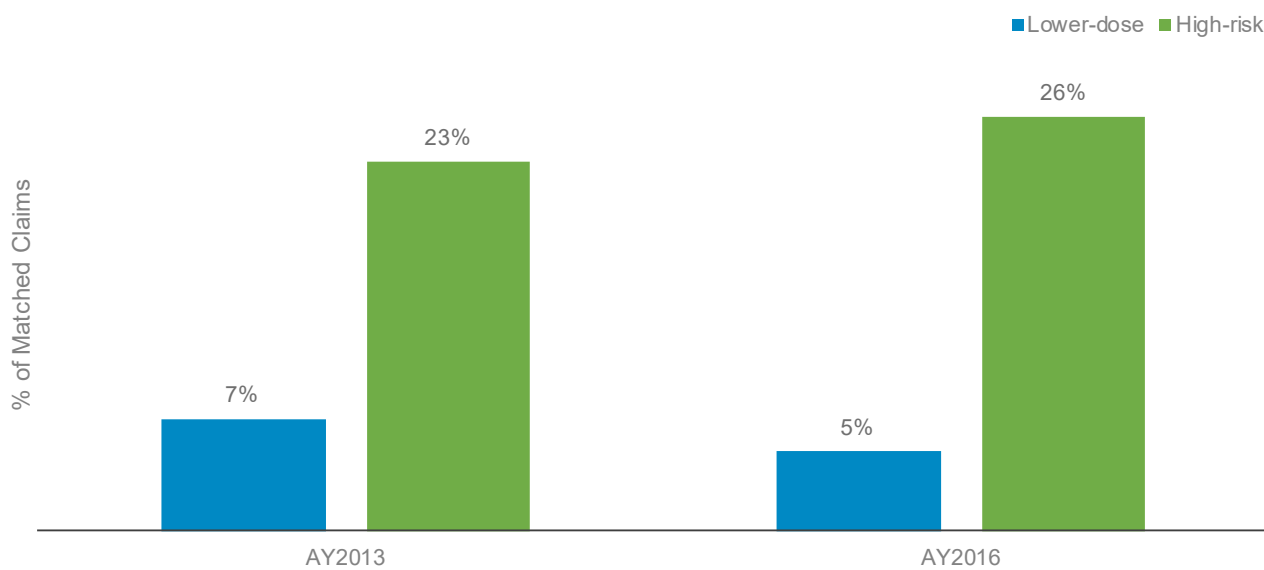
<sup>22</sup> Jones, S. and Bullis, R. *An Examination of Polypharmacy Claims in California Workers' Compensation*. California Workers' Compensation Institute. August 2018.

### Early Indicator #3: Use of Extended-Release/Long-Acting Opioids

The CDC's guidelines for opioid use recommend that physicians prescribe immediate-release opioids instead of extended-release (ER) or long-acting (LA) opioids to treat chronic pain. These guidelines are based on clinical evidence and research that have shown a higher risk for overdose among patients initiating treatment with ER/LA opioids than among those initiating treatment with immediate-release opioids.<sup>23</sup>

Overall, newer claims were slightly more likely to be prescribed ER/LA opioids than older claims (Figure 8). Among AY2013 claims, high-risk opioid use claims were three times more likely to involve prescriptions of ER/LA opioids than lower-dose use claims (23% vs. 7%). For AY2016 claims, the difference between high-risk opioid use claims and lower-dose use claims becomes more significant (26% vs. 5%).

Figure 8. Use of Extended-Release/Long-Acting Opioids Comparing High-Risk to Similar Lower-Dose Opioid Use Claims by Accident Year

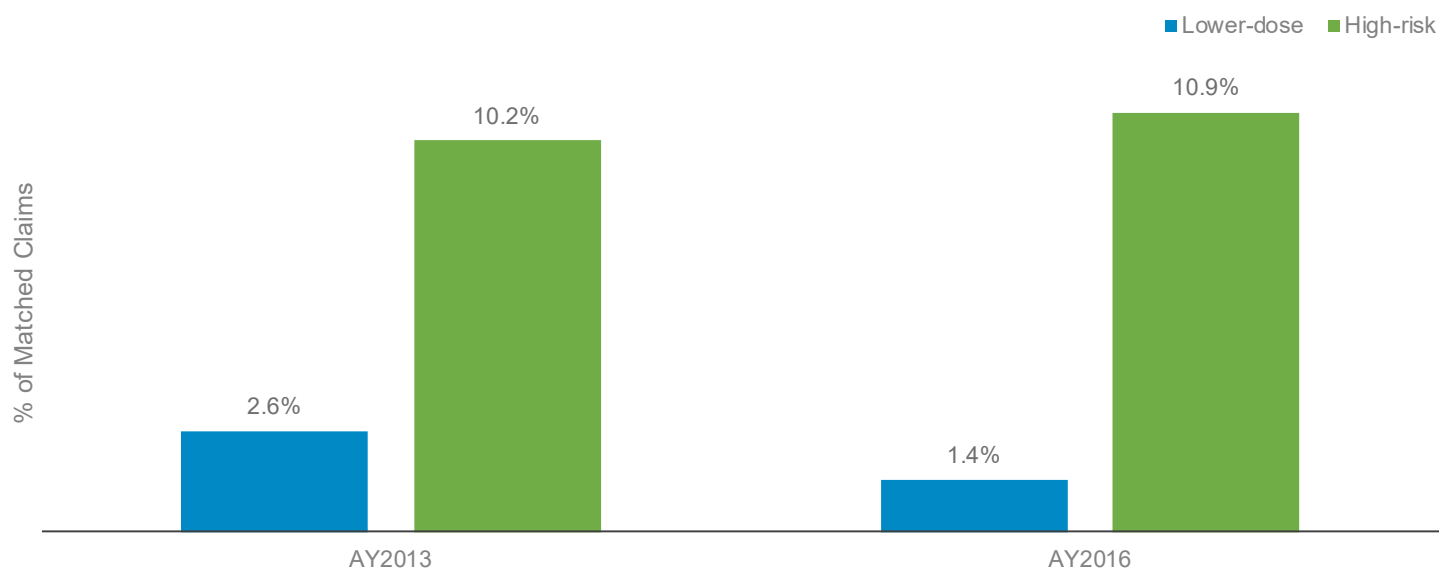


<sup>23</sup> Miller, M., et al. *Prescription Opioid Duration of Action and the Risk of Unintentional Overdose Among Patients Receiving Opioid Therapy*. JAMA Internal Medicine, Volume 175, Issue 9, pp. 608-615, 2015.

#### Early Indicator #4: Concurrent Use of Opioids and Benzodiazepines

Benzodiazepines are a class of drugs primarily used for treating anxiety. Concurrent use of opioids and benzodiazepines, however, was shown to increase the risk of fatal opioid overdose.<sup>24</sup> The CDC also recommends physicians avoid prescribing these two drugs concurrently whenever possible.<sup>25</sup> For AY2013, high-risk opioid use claims were almost five times more likely to involve taking opioids and benzodiazepines together (Figure 9). The differences between high-risk and lower-dose opioid use claims are even more stark (about seven times) for AY2016 claims.

Figure 9. Concurrent Use of Opioids and Benzodiazepines Comparing High-Risk to Similar Lower-Dose Opioid Use Claims by Accident Year



#### Alternative Non-Drug Treatments

During the first six months of treatment after the date of the injury, medical service utilization, measured by the number of medical transactions per claim, on lower-dose use claims was compared to that of high-risk opioid use claims before the claims achieved the high-risk use status (pre high-risk period) with similar distributions of age, pain type and type of surgery.

#### Lower-Dose Use Claims Compared to High-Risk Use Claims in the Pre High-Risk Period

Overall, use of physical therapy, acupuncture and chiropractic care was higher on lower-dose use claims, while use of other physician services (e.g., anesthesia and radiology) and other medical services (e.g., inpatient and outpatient care) was lower on these claims.

For AY2013 claims, the number of physical therapy treatments per claim was 49% higher on similar lower-dose use claims than on high-risk use claims (Figure 10a). The larger volume of physical therapy treatments was primarily driven by increased use of therapeutic exercise, electrical stimulation, myofascial release and soft tissue mobilization, infrared light treatment and manual therapy techniques such as mobilization and manipulation.

Lower-dose use claims in AY2013 also involved 14% more chiropractic care, mostly chiropractic manipulative treatment (CMT) on one to two spinal regions, and 38% more acupuncture treatments, primarily electroacupuncture. While relatively

<sup>24</sup> Wang, D., Thumula, V., and Liu, T. *Interstate Variation on Use of Opioids, 4th Edition*. Workers Compensation Research Institute, 2017.

<sup>25</sup> Dowell D, Haegerich TM, Chou R. *CDC Guideline for Prescribing Opioids for Chronic Pain —United States, 2016*. Centers for Disease Control and Prevention. MMWR Recomm Rep. 65(RR-1): pp. 1-49.

few claims included transactions for counseling services in the study population, lower-dose use claims involved 29% more counseling services than high-risk use claims, primarily biofeedback training.

Similar utilization patterns of physical therapy, chiropractic care and acupuncture were found on AY2016 claims, yet the differences in patterns between lower-dose and high-risk use claims grew (Figure 10b). Physical therapy treatments such as therapeutic exercise, manual therapy techniques, kinetic activities, neuromuscular re-education and self-care and home management training were found to be among the procedures and modalities utilized significantly more on lower-dose use claims. Also, AY2016 lower-dose use claims tended to use acupuncture and the same type of CMT as AY2013 claims. Lastly, AY2016 lower-dose use claims involved 72% more durable medical equipment, mostly lumbar orthosis and knee orthotics, than on similar high-risk use claims.

**Figure 10. Differences in Utilization of Medical Services Comparing Lower-Dose to Similar High-Risk Opioid Use Claims in the First Six-Month Treatment After Injury by Accident Year**



For both accident years, the remaining categories of alternative measures (including CBT, addiction treatment, pain and functional assessment and functional restoration program) were used less frequently than physician therapy, acupuncture and chiropractic care, and no significant differential in utilization was found between lower-dose and high-risk use claims.

### Treatment Patterns of High-Risk Use Claims in the Pre and Post High-Risk Periods

Use of potential alternative measures was also compared between high-risk use claims in the pre and post high-risk period, primarily to assess if medical treatments on high-risk use claims changed after the claim met the threshold for high-risk opioid use and, if there were changes, whether the treatments changed in a way that is similar to the treatment involved in lower-dose use claims. For the purpose of this study, the post high-risk period is defined as the time period after the claims met the threshold for high-risk opioid use.

Medical service utilization in the six months before and six months after the claim met the threshold were compared. AY2013 high-risk use claims involved 39% more physical therapies and 11% more acupuncture treatments per claim in the post high-risk period than in the pre high-risk period (Figure 11a). The increased utilization was for similar treatments frequently used on lower-dose use claims, including therapeutic exercise, myofascial release and soft tissue mobilization, manual therapy techniques, kinetic activities and electroacupuncture.

AY2016 high-risk use claims also involved 95% more physical therapy treatments and 66% more acupuncture treatments in the post high-risk period, with similar types of procedures and modalities to the analogous AY2013 claims (Figure 11b).

Figure 11. Differences in Utilization of Medical Services Comparing High-Risk Opioid Use Claims in the Post High-Risk Period to Pre High-Risk Period (Six Months Before and Six Months After Meeting the Threshold) by Accident Year





The relationship between major surgery and types of physician services was also analyzed. It was found that physical therapy was the only service type utilized significantly more after the first major surgery on the high-risk claims in the post high-risk period (twice more for AY2013 claims and five times more for AY2016 claims). This suggests that physical therapy may be being utilized to rehabilitate injured workers.

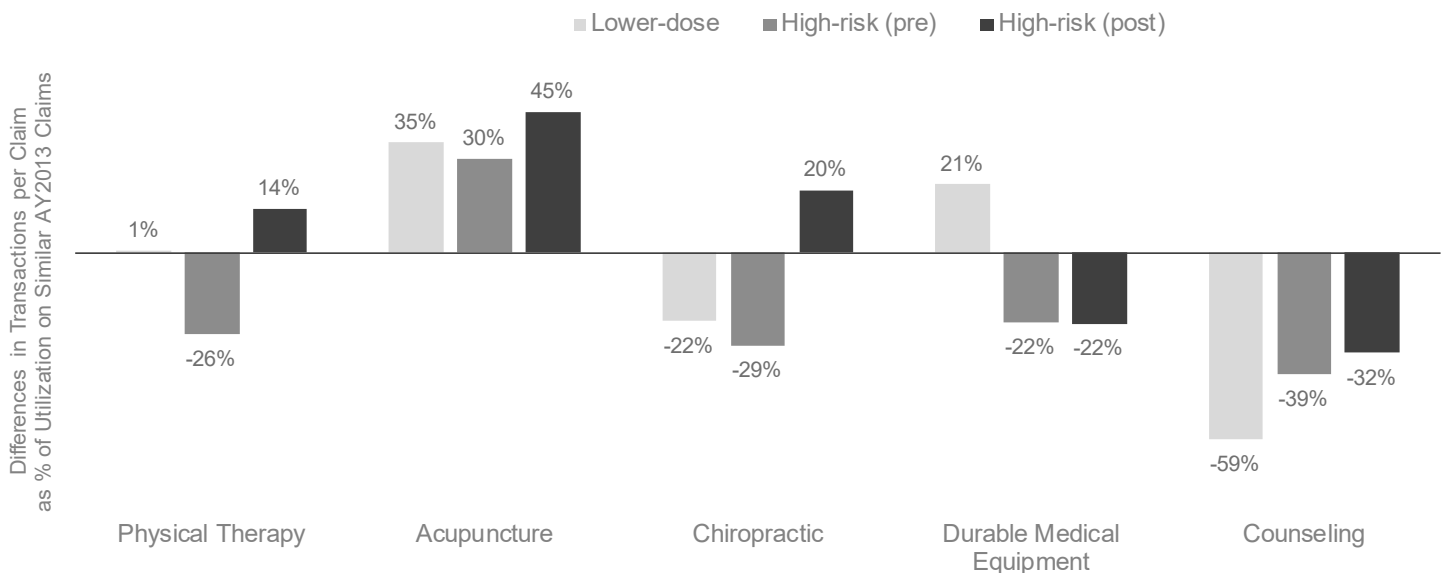
For both accident years, other physician services and other medical services were utilized much less in the post high-risk period. Similarly, other categories of alternative treatments, such as CBT, were used less frequently, limiting the ability to make meaningful inferences.

### Changes in Treatment Patterns over Time

To assess if treatment patterns have shifted, service utilization between newer claims (AY2016) and older claims (AY2013) was compared within each of the three claim groups (lower-dose use claims, high-risk use claims in the pre high-risk period and high-risk use claims in the post period).

Overall, AY2016 claims were more likely to use acupuncture treatments and less likely to use counseling services than AY2013 claims, regardless of the levels of opioid use (Figure 12). Lower-dose use claims, in particular, involved 35% more acupuncture and 59% less counseling in AY2016 than in AY2013. While a small number of claims used counseling services in both accident years, the downward trend was driven by a significant reduction in the use of biofeedback training partly offset by a slight increase in the use of psychotherapy.

Figure 12. Differences in Utilization of Selected Medical Services Comparing AY2016 Claims to Similar AY2013 Claims



In addition, AY2016 lower-dose use claims involved 21% more durable medical equipment but 22% less chiropractic care than comparable AY2013 claims. A surge in the use of miscellaneous durable medical equipment was observed; much of this additional medical equipment tended to be the newer and more complex equipment that did not have a defined procedure code. However, relatively few claims used durable medical equipment in both accident years. While utilization of physical therapy did not change over time, some changes in the patterns of specific procedures and modalities were found. For example, AY2016 claims used less electrical stimulation but more therapeutic exercise, kinetic activities and neuromuscular re-education.

For high-risk use claims in the pre high-risk period, AY2016 claims involved significantly less physical therapy, chiropractic care and durable medical equipment than AY2013 claims. In the post high-risk period, newer claims involved more chiropractic care (i.e., CMT on one to two spinal regions).

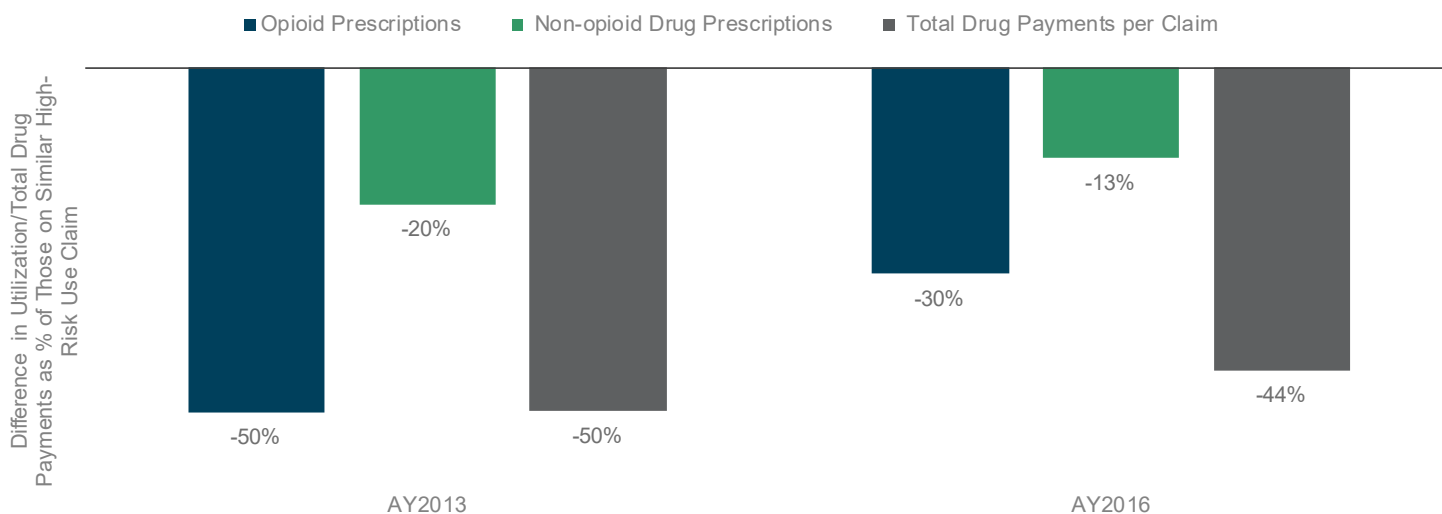
## Alternative Drug Treatments

Similar to the analysis of non-drug alternative treatments, the matched claims were analyzed to identify potential drug alternatives to high-risk opioid use. The leading groups of prescription drugs were compared between lower-dose and high-risk opioid use claims before those claims met the high-risk use threshold. The comparisons were based on drug prescriptions within the first six months of treatment after the injury.

### Lower-Dose Use Claims Compared to High-Risk Use Claims in the Pre High-Risk Period

For AY2013 claims, the number of opioid prescriptions per claim was 50% lower, and non-opioid prescriptions 20% lower on lower-dose use claims than on high-risk use claims, together contributing to 50% lower total drug payments per claim (Figure 13). The cost savings from lower levels of drug use were similarly significant on AY2016 claims.

Figure 13. Differences in Drug Utilization and Pharmaceutical Payments Comparing Lower-Dose to Similar High-Risk Opioid Use Claims by Accident Year

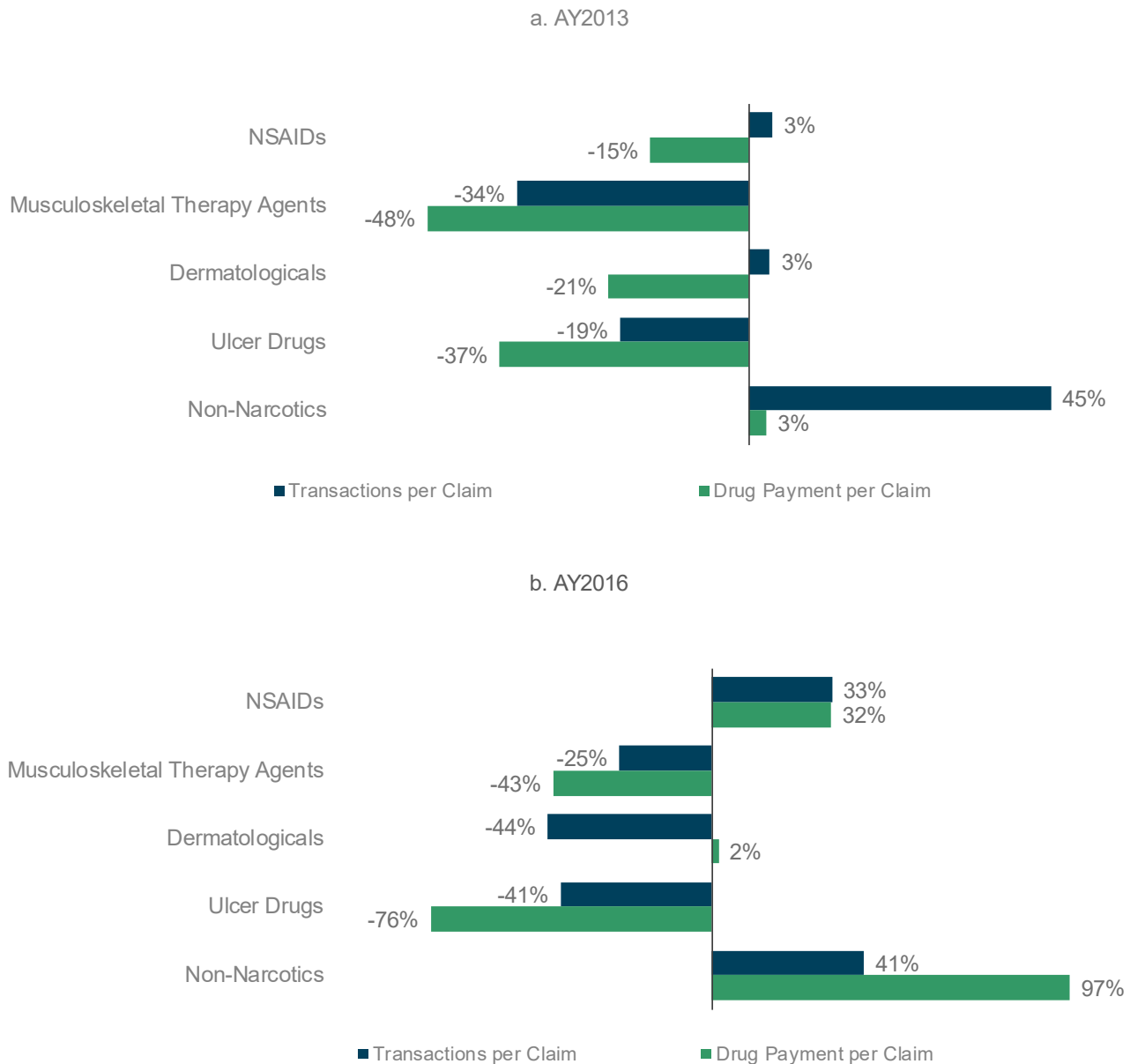


For both AY2013 and AY2016 claims, utilization of NSAIDs and non-narcotic analgesics were higher on lower-dose opioid use claims than on similar high-risk use claims (Figure 14). In fact, non-narcotic analgesics became the third leading drug group being prescribed on AY2016 lower-dose use claims, following NSAIDs and musculoskeletal therapy agents. This aligns with California's Medical Treatment Utilization Schedule (MTUS) guidelines<sup>26</sup> supporting the use of these drugs to treat chronic pain and may be suggestive of a substitution effect. In addition, extent of concurrent use of opioids and buprenorphine was analyzed as a recent development in drug treatments for opioid addiction. However, very few claims in the study period had used buprenorphine, limiting the ability to make meaningful inferences.

<sup>26</sup> Medical Treatment Utilization Schedule (MTUS) guidelines, California Division of Workers' Compensation.

For AY2013 claims, lower-dose use claims involved 3% more NSAIDs and 45% more non-narcotic analgesics per claim than otherwise similar high-risk opioid use claims; yet the increased utilization did not drive up the drug payment per claim, suggesting lower-dose claims also used cheaper NSAIDs and non-narcotics. Conversely, utilization of musculoskeletal therapy agents (-34%) and ulcer drugs (-19%) was much lower among lower-dose use claims, suggesting less adverse effects from opioid use (Figure 14a).

**Figure 14. Differences in Utilization and Payments to Non-Opioid Prescription Drugs Comparing Lower-Dose to Similar High-Risk Opioid Use Claims by Accident Year**



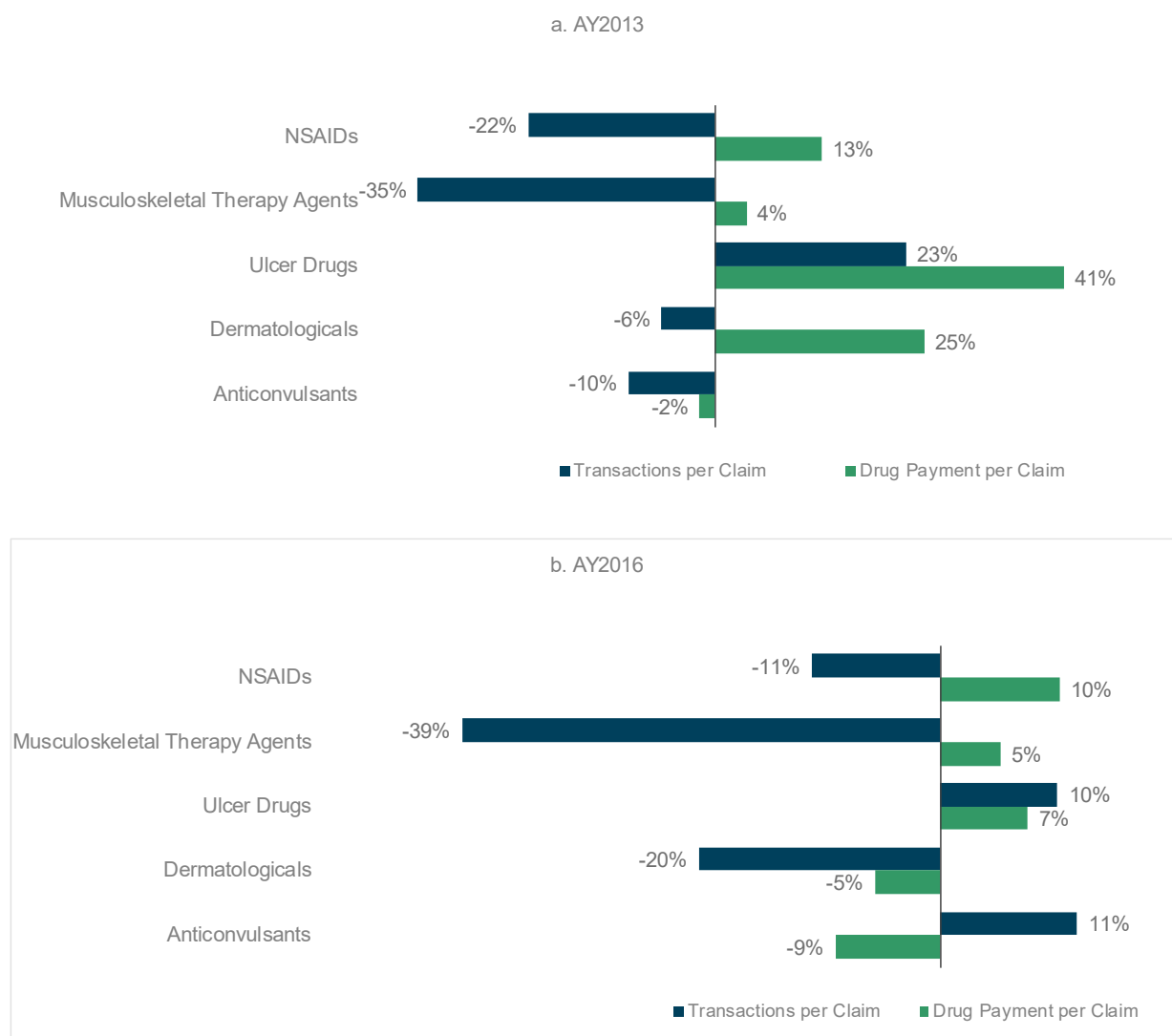
Similar trends but more pronounced differences were found among AY2016 claims (Figures 14b). Lower-dose use claims involved significantly more NSAIDs (by 33%) and non-narcotics (41%) than high-risk use claims, but involved much less musculoskeletal therapy agents, dermatologicals and ulcer drugs.

### Prescription Patterns of Claims with High-Risk Opioid Use Before and After High-Risk Period

Patterns of prescription drug utilization were also compared between high-risk use claims in the pre and post high-risk periods. Overall, for claims of both accident years, prescriptions of almost all drugs including opioids per claim went down on high-risk use claims after the opioid daily doses reached or exceeded 50 MME for at least 30 days. Use of opioids, in particular, decreased significantly for both AY2013 and AY2016 claims.

Conversely, ulcer drugs experienced an increase in utilization, most likely as a result from the adverse effects of the high-level opioid use (Figure 15). In addition, AY2016 claims started to involve more anticonvulsants, which are increasingly being used in the treatment for neuropathic pain (Figure 15b).

Figure 15. Differences in Utilization of Non-Opioid Prescription Drugs Comparing High-Risk Opioid Use Claims in the Post High-Risk Period to Pre High-Risk Period by Accident Year

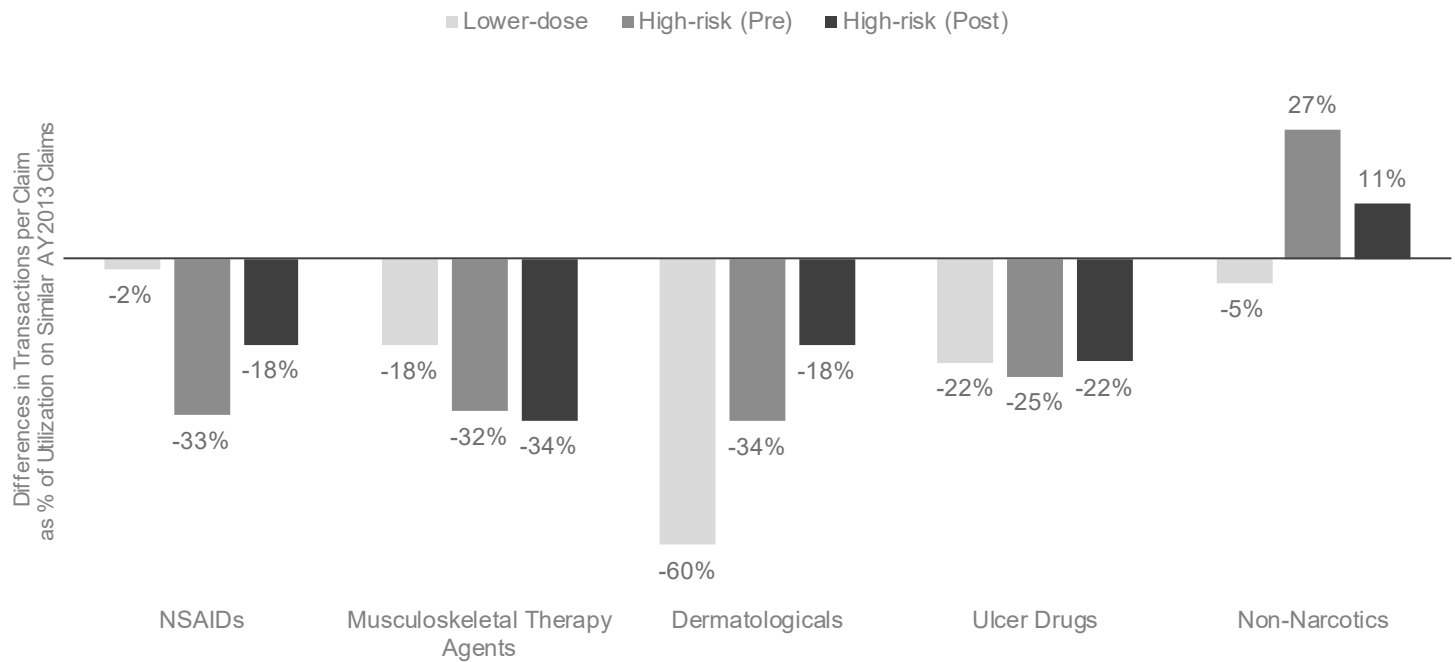


The relationship between major surgery and types of non-opioid prescription drugs was also analyzed. It was found that NSAIDs were utilized significantly more after the first major surgery on the high-risk claims after their opioid use reached or exceeded the threshold (by 1.4 times for AY2013 claims and 1.6 times for AY2016 claims). At the same time, opioids were used significantly less (down by 8% for AY2013 claims and up by only 4% for AY2016 claims). This suggests NSAIDs were increasingly used more for postoperative care and potentially a substitution for opioids.

### Changes in Prescription Patterns Over Time

Overall, utilization of pharmaceuticals declined for all claim groups over time (Figure 16). Among lower-dose use claims, AY2016 claims involved significantly less pharmaceuticals than AY2013 claims except for NSAIDs and non-narcotic drugs for which usage only declined modestly, by 2% and 5%, respectively. High-risk use claims, conversely, involved more non-narcotics in 2016 yet the number of non-narcotic prescriptions per claim was very small.

Figure 16. Differences in Utilization of Non-Opioid Prescription Drugs Comparing AY2016 Claims to Similar AY2013 Claims



## Conclusions

The share of newer claims with high-risk opioid use declined by almost half (from 2.5% of AY2013 claims to 1.4% of AY2016 claims), indicating good progress in addressing the opioid crisis in the California workers' compensation system. However, a small group of claims still involves high dosages and extended use of opioids. These high-risk opioid use claims were four times more likely to get similar opioids from three or more pharmacies, about four times more likely to have overlapping opioid prescriptions, five times more likely to use extended-release/long-acting opioids and seven times more likely to concurrently use opioids and benzodiazepines, all of which not only elevate the risk of opioid misuse and overdose, but also lead to significant costs (both medical and indemnity) to the workers' compensation system. Thus, early identification of this population of claims can help address the adverse impact of opioid overuse and misuse on the system.

Early identification of high-risk opioid use claims in the system could also facilitate early provision of alternative physician services and drug treatments to this group of injured workers. Physical therapy, acupuncture and chiropractic care were found to be utilized consistently and significantly more on lower-dose use claims than high-risk use claims, suggesting these alternative treatments could potentially be used in place of high levels of opioid prescriptions. In addition, NSAIDs and non-narcotic analgesics were also found to be used significantly more on lower-dose opioid use claims than high-risk use claims, which is consistent with clinical evidence and California's MTUS guidelines for treating chronic pain. Physical therapy and NSAIDs, in particular, were found to be used significantly more for postoperative care on high-risk use claims.

While the overall level of utilization of physical therapy remained essentially unchanged over the study period, some changes in the specific procedures and modalities were observed. Newer claims were more likely to use therapeutic exercise, kinetic activities and neuromuscular re-education. An increase in the use of acupuncture treatments was also identified. While utilization of almost all types of pharmaceuticals declined over time, relatively modest declines in the use of NSAIDs and non-narcotics suggest substitutions for opioids may have occurred.



## Conditions and Limitations

The WCIRB completed this study of high-risk opioid use and alternative measures using data from reported medical transactions for workplace injuries occurring in 2013 and 2016. Our data reflects approximately 92% of the insured employers in California. In reviewing this information, the following should be noted:

1. This report reflects a compilation of individual insurer submissions of medical transaction data to the WCIRB. While the individual insurer data submissions are regularly checked for consistency and comparability with other data submitted by the insurer as well as with data submitted by other insurers, the source information underlying each insurer's data submission is not verified by the WCIRB.
2. The study is based solely on the experience of insured employers. No self-insured employer experience is reflected in the study.
3. The WCIRB's medical transaction data does not include information on the length of each prescription. As a result, the calculation of MME per claim was partly based on two assumptions related to the days of opioid supply for each claim. The research team consulted medical providers and other researchers in the workers' compensation system and validated the assumptions using different accident years of medical transaction data.
4. The claim information used in this study reflects claims information limited to services rendered within 12 months after the accident date. Evaluations of patterns over a longer duration of treatment may provide further information on alternative treatments that are often being provided later in the life of a claim.

## Appendices

Table A1. Surgery Types Controlled in the Analysis

Procedure Code	Description <sup>27</sup>
10030-19499	Surgical Procedures on the Integumentary System
20005-20999	General Surgical Procedures on the Musculoskeletal System
21010-21499	Surgical Procedures on the Head
22010-22899	Surgical Procedures on the Spine (Vertebral Column) Cervical, Thoracic and Lumbar Spine
23000-23929	Surgical Procedures on the Shoulder
23930-24999	Surgical Procedures on the Humerus (Upper Arm) and Elbow
25000-25999	Surgical Procedures on the Forearm and Wrist
26010-26989	Surgical Procedures on the Hand and Fingers
26990-27299	Surgical Procedures on the Pelvis and Hip Joint
27301-27599	Surgical Procedures on the Femur (Thigh Region) and Knee Joint
27600-27899	Surgical Procedures on the Leg (Tibia and Fibula) and Ankle Joint
28001-28899	Surgical Procedures on the Foot and Toes
29800-29999	Endoscopy/Arthroscopy Procedures on the Musculoskeletal System
30000-32999	Surgical Procedures on the Respiratory System
33010-37799	Surgical Procedures on the Cardiovascular System
39000-39599	Surgical Procedures on the Mediastinum and Diaphragm
40490-49999	Surgical Procedures on the Digestive System
50010-53899	Surgical Procedures on the Urinary System
60000-60699	Surgical Procedures on the Endocrine System
62263-63746	Surgical Procedures on the Spine and Spinal Cord
64400-64999	Surgical Procedures on the Extracranial Nerves, Peripheral Nerves and Autonomic Nervous System
65091-68899	Surgical Procedures on the Eye and Ocular Adnexa

<sup>27</sup> Based on the surgery current procedural terminology code sets.

Table A2. Demographic and Injury Characteristics of Matched Claims

	AY2013 Claims			AY2016 Claims		
	Lower-dose opioid use	High-risk opioid use	P-value <sup>28</sup>	Lower-dose opioid use	High-risk opioid use	P-value
<b>Claim count</b>	3,450	1,725		1,062	531	
<b>Age at the time of injury, mean (SD)</b>	43.7 (11.6)	43.5 (11.7)	0.646	44.8 (12.0)	44.5 (12.1)	0.712
<b>Pain Type (%)</b>						
None	48.8	48.8	0.982	43.1	42.9	0.853
Acute	10.2	10.5		13.5	14.7	
Chronic	8.0	8.1		3.9	4.3	
Both acute and chronic	33.1	32.6		39.5	38.0	
<b>Had a major surgery (%)</b>	45.9	46.0	0.937	53.7	53.9	0.943
<b>Type of first major surgery (leading six) (%)</b>						
Endoscopy/Arthroscopy Procedure on the Musculoskeletal System	33.3	32.6	0.931	31.5	30.4	0.820
Surgical Procedure on the Spine and Spinal Cord	12.2	11.5		7.4	7.6	
Surgical Procedure on the Shoulder	10.9	9.1		4.5	4.5	
Surgical Procedure on the Vertebral Column	5.9	6.3		4.5	4.5	
Surgical Procedure on the Leg and Ankle Joint	6.1	6.1		14.3	11.5	
Surgical Procedure on the Femur and Knee Joint	3.9	4.3		10.4	9.5	

Note: SD refers to standard deviation. % refers to claim share.

<sup>28</sup> P-value for the comparison of age was obtained from Wilcoxon sum rank test, Chi-square test for pain type and Fisher's exact test for the leading six surgery types. The sample size for the surgery types following the top six was too small to include in the test.

Table A3. Medical and Indemnity Costs Approximately Four Years After the Date of Injury Comparing High-Risk with Similar Lower-Dose Opioid Use Claims

	Mean	25th Percentile	Median	75th Percentile	Wilcoxon Test P-value
Incurred Medical					
Lower-Dose	\$ 45,927	\$ 3,402	\$ 18,412	\$ 48,564	<0.001
High-risk	\$ 102,193	\$ 19,987	\$ 45,475	\$ 96,300	
Paid Medical					
Lower-Dose	\$ 33,676	\$ 3,334	\$ 16,918	\$ 40,595	<0.001
High-risk	\$ 71,356	\$ 18,394	\$ 37,889	\$ 74,479	
Incurred Indemnity					
Lower-Dose	\$ 32,362	\$ 824	\$ 14,683	\$ 43,640	<0.001
High-risk	\$ 63,221	\$ 14,267	\$ 39,301	\$ 73,455	
Paid Indemnity					
Lower-Dose	\$ 26,532	\$ 642	\$ 13,592	\$ 40,372	<0.001
High-risk	\$ 48,420	\$ 13,341	\$ 35,344	\$ 64,810	

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